Jan. 15, 1924. **1,481,024**

F. R. PORTER

FLYING MACHINE

Filed Sept. 19, 1916 2 Sheets-Sheet 1

Fig. 1.

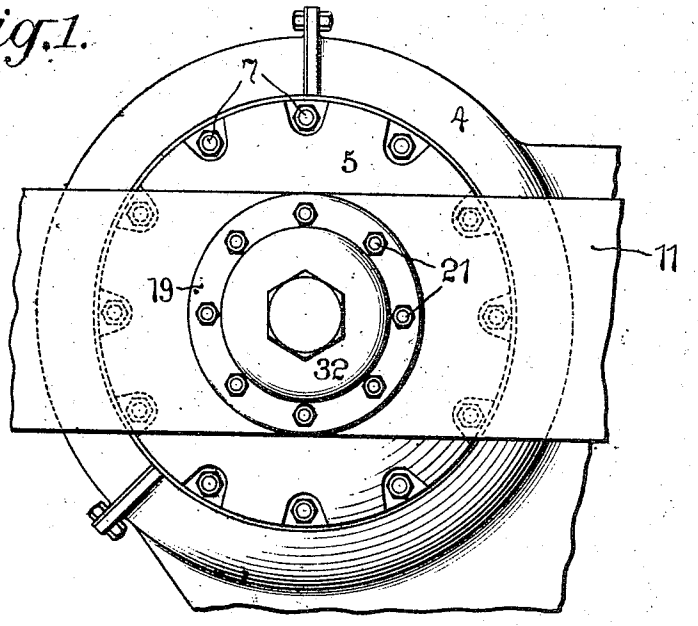
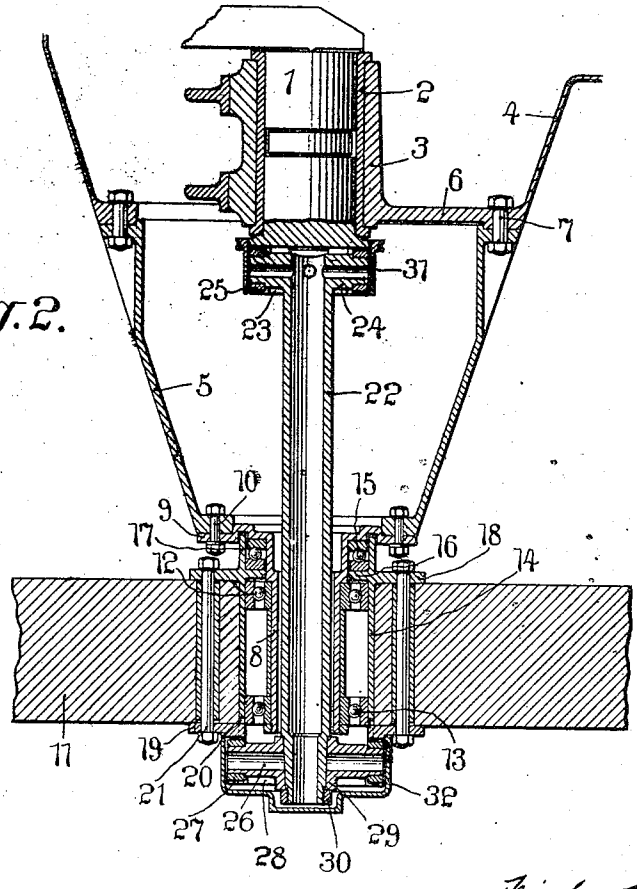


Fig. 2.



Inventor:
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Fig. 3.

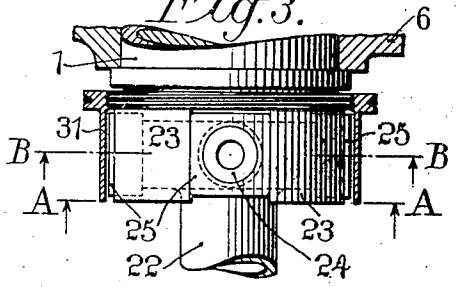


Fig. 6.

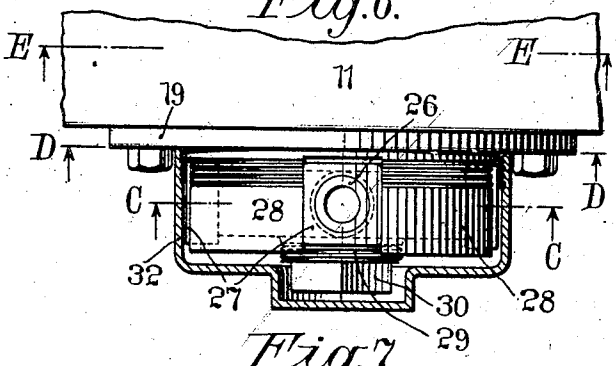


Fig. 4.

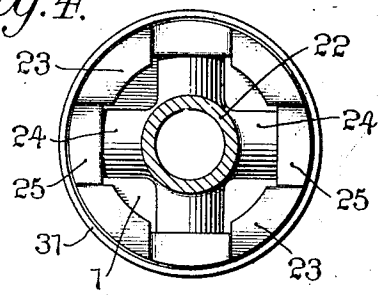


Fig. 7.

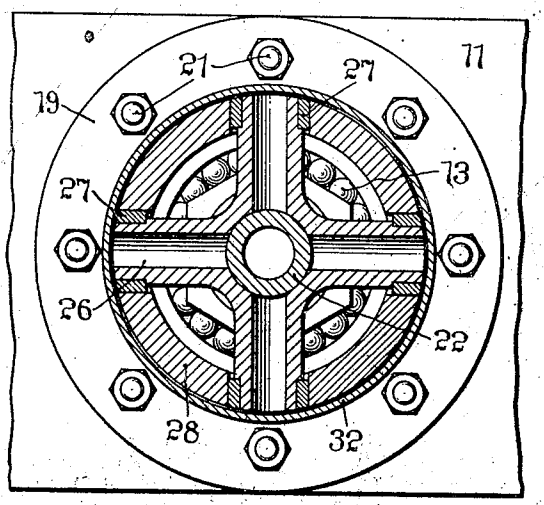


Fig. 5.

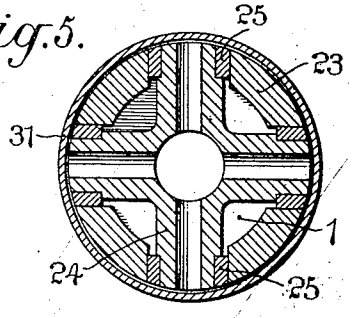


Fig. 9.

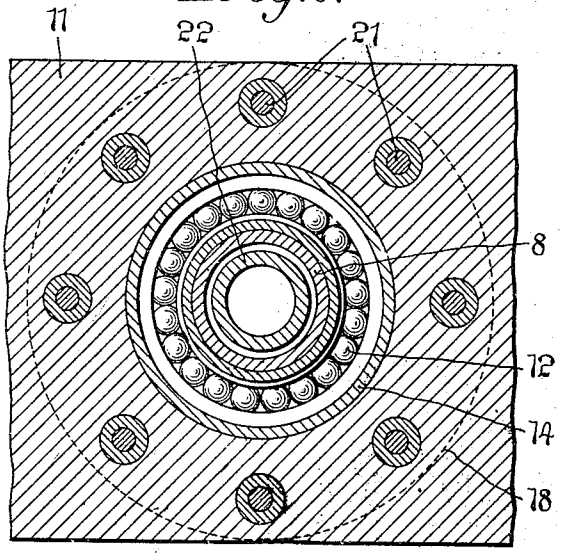
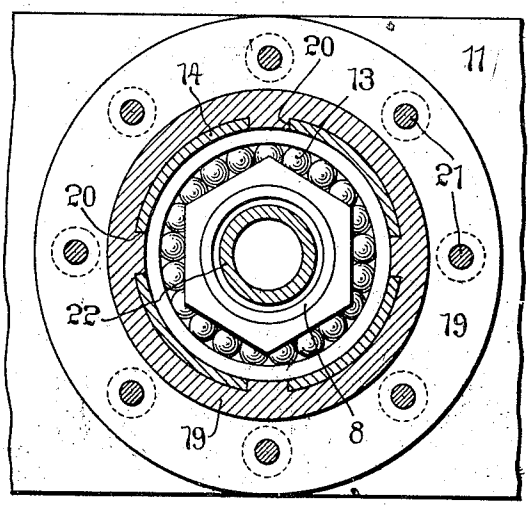


Fig. 8.



Inventor: Finley R. Porter
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Brownell & Brownell

Patented Jan. 15, 1924. 1,481,024

UNITED STATES PATENT OFFICE.

FINLEY R. PORTER, OF PORT JEFFERSON, NEW YORK, ASSIGNOR TO KNIGHT AMERICAN PATENTS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

FLYING MACHINE.

Application filed September 19, 1916. Serial No. 121,053.

To all whom it may concern:

Be it known that I, FINLEY R. PORTER, a citizen of the United States, and resident of Port Jefferson, in the county of Suffolk and State of New York, have invented a new and useful Improvement in Flying Machines, of which the following is a specification.

Where propellers for flying machines are attached directly to their motor shafts, it has frequently happened that after a considerable use of the machine, the motor shaft breaks close up to the rear main or outer bearing of the motor, due to the propeller shaft being integral and rigid, with the motor shaft forming as it does an extension ten or twelve inches long, and being subjected to a variety of stresses acting in different directions, entirely due to its constructional features. The propeller is compelled to perform the fly wheel functions for the motor, with the result that the intermittent action of the inertia forces on the rear end of the motor must be dissipated through the length of the overhang or propeller shaft, which is resisted by the fly wheel effect of the propeller at the outer end of the extension which is held integral by some conventional form of antifriction bearing, which as a result of this construction is not subjected to any lateral load. The tremendous torsional strain, together with the bending movement as a result of the gyroscopic action of the propeller with the main forces at the motor end, and the resistance at the propeller end causes such excess of varying stresses that failure is imminent at all times. These rapidly varying stresses at certain critical speeds are apt to synchronize with the natural vibration frequency of the crank shaft, causing a rapid crystallization of this portion of the same and a consequent failure at this point where the full load of the motor is transmitted to the propeller. Crystallization of this portion of the crank shaft also arises from the rigid mounting of the propeller upon this part, vibration of the propeller blades being imparted to the crank shaft of the motor.

The object of the present invention is to overcome these vital defects by so mounting the propeller on a relatively fixed support and providing a flexible vibration dampening driving connection between the motor shaft and propeller, and by transmitting the driving effect of the motor shaft to the propeller, and retaining the torsional fly wheel effect of the propeller as an aid to the proper function of the motor, yet relieving the propeller shaft of the stress reversals due to the intermittent inertia forces of the motor and the gyroscopic results due to the dipping of the flying machine.

My invention includes novel means for carrying out the above objects.

A practical embodiment of my invention is represented in the accompanying drawings, in which,

Fig. 1 is a detail end view,

Fig. 2 is a detail view in longitudinal central section,

Fig. 3 is a detail view partly in plan and partly in section, showing the universal joint connection between the motor shaft and propeller shaft,

Fig. 4 is a transverse section taken in the plane of the line A—A of Fig. 3,

Fig. 5 is a section taken in the plane of the line B—B of Fig. 3,

Fig. 6 is a detail view partly in plan and partly in section, showing the universal joint connection between the propeller shaft and propeller,

Fig. 7 is a section taken in the plane of the line C—C of Fig. 6,

Fig. 8 is a section taken in the plane of the line D—D of Fig. 6, and

Fig. 9 is a section taken in the plane of the line E—E of Fig. 6.

The motor shaft 1 is rotatably mounted in the bearing bushing 2, carried by the hollow lug 3 of the crank shaft casing 4. A hollow extension 5 is secured to the end 6 of the casing 4, by an annular series of bolts 7. The hollow propeller axle 8 is provided with a flange 9 secured to the outer end of the extension casing 5, by an annular series of bolts 10. The propeller 11 is rotatably mounted on the hollow relatively fixed axle 8, antifriction bearings 12 and 13 being preferably interposed between the axle 8 and the hub 14 of the propeller. An antifriction thrust bearing 15 is preferably interposed between the flange 9 of the hollow axle and the flange 16 of the hub 14. A tubular extension 17 of the hub 14 serves to house the antifriction thrust bearing 15. The hub 14 is provided with an outwardly extended annular flange 18 for engaging the inner face of the propeller 11. A ring 19 engages the outer face of the propeller and

has an interlocked engagement, as shown at 20, with the outer end of the hub 14. An annular series of bolts 21 passes through the flange 18, ring 19 and the propeller 11, for rigidly assembling the parts.

The hollow propeller shaft 22 inherently possessing by reason of its structure a certain amount of resiliency, forms a flexible driving connection between the motor shaft 1 and the propeller 11, in the present instance a double universal driving connection, as follows: The outer end of the shaft 1 is provided with an annular series of projections 23, in the present instance four, and the inner end of the hollow propeller shaft 22 is provided with an annular series of radiating arms 24, in the present instance four, provided with blocks 25 interposed between the projections 23 of the motor shaft. These blocks 25 are swiveled on the arms 24, and have parallel faces which slidably engage the parallel faces of the projections 23, thus forming a universal joint driving connection between the motor shaft and propeller shaft at this point. The propeller shaft 22 projects through the hollow relatively fixed axle 8, and it is provided at its outer end with an annular series of radial arms 26, in the present instance four, having blocks 27 interposed between an annular series of projections 28, in the present instance four, on the ring 19. These blocks 27 are swiveled on the arms 26, and have parallel faces having a sliding engagement with the parallel faces 28, thus forming an outboard universal joint connection at this point between the propeller shaft and propeller. These arms 26 are herein shown as projecting outwardly from the hub 29, having a tapered bore fitted to the tapered end of the propeller shaft 22. A nut 30 engaging the screw-threaded end of the propeller shaft 22, serves to lock the arms 26 to the propeller shaft. By this construction the propeller shaft floats between the propeller and engine shaft, being relieved not only of the weight of the propeller, but being free to accommodate itself bodily to any stress due to gyroscopic action of the propeller of excessive vibration of the same.

A protective collar 31 is screwed onto the end of the motor shaft 1, and serves to retain the blocks 25 on their arms 24. A cap 32 has a screw-threaded engagement with the ring 19 and serves both to prevent the blocks 27 from coming off from the arms 26, and to prevent the propeller shaft from slipping out of its driving engagement. It also serves as a housing for the universal joint connection between the outer end of the propeller shaft and the propeller.

From the above description it will be seen that a flexible driving connection is provided between the propeller and motor shaft. The use of the short piece of hollow shafting 22 not only provides a resilient or flexible connection between the propeller and motor crank shaft, but also acts as a means to prevent the propeller vibrations from being imparted to the crank shaft of the motor as well as providing means whereby the propeller and associated parts may be quickly and easily assembled or removed. It will also be seen that by causing the ring 19 to be rigidly locked to the hub 14 and also to the flange 18 of the hub, the driving effect is transmitted to the propeller at different distances from its axis of rotation, and to both the front and rear faces of the hub, thus reducing materially the torsional effect thereon.

It is evident that various changes may be resorted to in the construction, form and arrangement of the several parts without departing from the spirit and scope of my invention, and hence I do not wish to limit myself strictly to the structure herein shown and described, but—

What I claim is:

1. In a flying machine, a motor shaft, a hollow axle, a propeller journaled on said hollow axle, a driven shaft within said hollow axle and connected to said propeller, and a flexible connection between said motor and driven shafts.

2. In a flying machine, a fixed axle, a propeller mounted thereon, a motor shaft, a fixed support for the axle and shaft, and a propeller shaft having a flexible driving connection with the motor shaft and propeller.

3. In a flying machine, a fixed axle, a propeller rotatably mounted thereon, a motor shaft, and a propeller shaft having flexible driving connections with both the motor shaft and propeller.

4. In a flying machine, a hollow axle, a propeller rotatably mounted thereon, a motor shaft, and a propeller shaft extending through the hollow axle and having a flexible driving connection with the outer end of the motor shaft and a flexible driving connection with the outer side of the propeller.

5. In a flying machine, a hollow axle, a propeller rotatably mounted thereon, a motor shaft, and a propeller shaft extending through the hollow axle and having a flexible driving connection with the outer end of the motor shaft and a flexible driving connection with the outer side of the propeller and an antifriction thrust bearing for the propeller.

6. In a flying machine, a fixed axle, a propeller having its hub rotatably mounted thereon, said hub having a flange on one side of the propeller, a ring on the other side interlocked with the hub, and bolts passing through the propeller, a flange and ring for rigidly assembling them, and a

propeller shaft having a driving connection with said ring.

7. In a flying machine, a motor shaft, its casing, an extension secured thereto, a hollow axle fixedly secured to the extension, a propeller rotatably mounted on the axle, and a propeller shaft forming the driving connection between the motor shaft and propeller, said propeller shaft being located within said hollow axle.

8. In a flying machine, a motor shaft, a hollow axle, said shaft and axle being fixedly supported with respect to each other, a propeller, antifriction radial and thrust bearings on the axle for the propeller and a propeller shaft forming the driving connection between the motor shaft and propeller, said propeller shaft being located within said axle.

9. In a flying machine, a propeller, a propeller shaft therefor and an out board driving connection between the propeller and propeller shaft.

10. In a flying machine, a propeller, a propeller shaft therefor, and a flexible driving connection between said propeller and shaft arranged out board of the propeller.

11. In a flying machine, a propeller, a floating propeller shaft in axial alinement with said propeller and driving connections therebetween.

12. In a flying machine, a propeller, a propeller shaft therefor, and a universal driving connection arranged therebetween out board of the propeller.

13. In a flying machine, the combination with a fixed hollow axle, of a propeller rotatably mounted thereon, bearing surfaces for said propeller located exterior of and symmetrical to the plane of rotation of the propeller, and means for transmitting driving torque to both sides of the propeller.

14. In a flying machine, a frame, a motor shaft supported with respect to the frame, a hollow axle fixedly supported with respect to the frame, a propeller rotatably mounted thereon, and a propeller shaft extending through the hollow axle and flexibly connecting the motor shaft and the propeller.

15. In a flying machine, a frame, a motor shaft fixedly supported with respect to the frame, an axle supported with respect to the frame, a propeller rotatably mounted on the axle, and a hollow propeller shaft fixedly connecting the motor shaft and the propeller.

16. In a flying machine, a propeller, a floating propeller shaft therefor, and driving connections therebetween arranged out board of the propeller.

17. In a flying machine, a propeller, a floating propeller shaft therefor, and flexible driving connections therebetween arranged out board of the propeller.

18. In a flying machine, a propeller, a propeller shaft therefor, and a universal driving connection arranged therebetween out board of the propeller.

19. In a flying machine, an engine shaft, a propeller and a propeller shaft, driving connections between the propeller and propeller shaft and engine shaft and propeller shaft, said propeller being mounted intermediate said driving connections.

20. In a flying machine, a propeller shaft, a propeller mounted to rotate intermediate the ends of said shaft, and a driving connection between said propeller and one end of the propeller shaft.

21. In a flying machine, a fixed axle, a propeller rotatably mounted on said axle, a propeller shaft passing through said axle, and a driving connection between said propeller and axle arranged out board of said propeller.

22. In a flying machine, a fixed axle, a propeller rotatably mounted on said axle, a propeller shaft passing through said axle, and a flexible connection between said propeller and axle arranged out board of said propeller.

23. In a flying machine, a fixed axle, a propeller rotatably mounted on said axle, a propeller shaft passing through said axle, and a universal drive connection between said propeller and axle arranged out board of said propeller.

24. In a flying machine, a fixed axle, a propeller rotatably mounted on the axle, a driving shaft, a propeller shaft extending through said axle, and connected at its ends with said drive shaft and propeller respectively.

25. In a flying machine, a fixed axle, a propeller rotatably mounted on the axle, a drive shaft, a propeller shaft extending through said axle and flexibly connected at its ends with said drive shaft and propeller respectively.

26. In a flying machine, a fixed axle, a propeller rotatably mounted on the axle, a drive shaft, a propeller shaft extending through said axle and universally connected at its ends with said drive shaft and propeller respectively.

In testimony, that I claim the foregoing as my invention, I have signed my name this 13th day of September, 1916.

FINLEY R. PORTER.