June 14, 1932. H. M. GRAF 1,862,789

AEROPLANE PROPELLING MEANS

Filed March 24, 1930

Fig. 1.

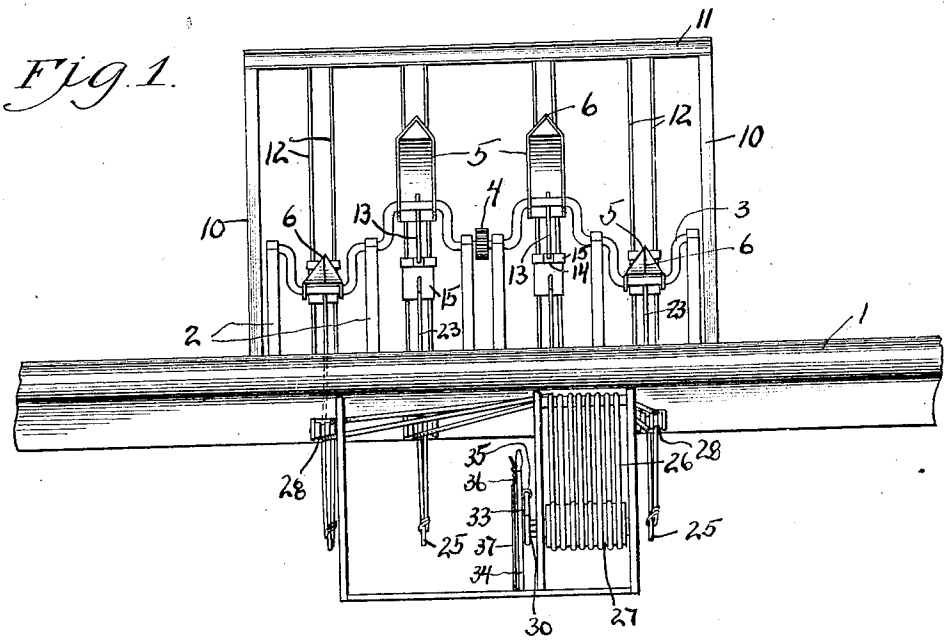



Fig. 2.

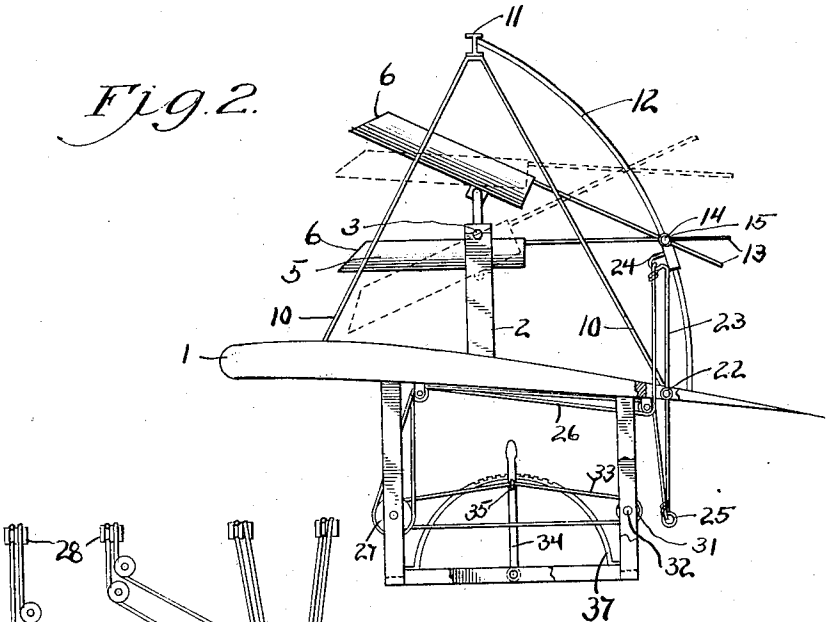
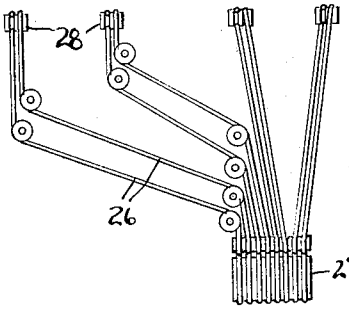



Fig. 3.




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# UNITED STATES PATENT OFFICE

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## AEROPLANE PROPELLING MEANS

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This invention relates to lifting and propelling apparatus for aeroplanes, the device being of such nature that the propelling vanes may be positioned in flight to produce a substantially vertical lift with very little forward movement or may be positioned so that practically their entire force is utilized to propel the aeroplane in a forward direction.

A still further object of the invention is to provide propelling vanes which, although having a circular path or course of travel, constantly change their angle of attack as regards the air so that in their down stroke their angle will automatically vary so that the maximum energy may always be secured for the purpose in view, either a practically upward vertical lift or a forward movement.

Another object of the invention is to provide automatic control means of the character mentioned, which while also positioning the vanes for maximum output at the same time positions them on their upward or non-power stroke at such an angle as to reduce back pressure in this part of their operating cycle.

Another object is to provide lifting and propelling means for aeroplanes of such nature that as long as the engine is operating it shall be impossible for the plane to go into a tail spin, a nose dive, or to side slip in either direction, the propelling mechanism being so arranged that the forces tending to move the plane are always in balance on the opposite sides of the fore and aft center, the object being also accomplished by having the vanes above the center of gravity and acting to lift the aeroplane.

Various efforts have been made in the art to provide circularly driven vanes as lifting and propelling means for aerial vessels, but as far as I am aware, although others have changed the angle of attack by manual means to position the vanes for a greater lift or for a greater forward movement, no one, as far as I am aware, has ever produced a mechanism of the general character outlined adapted to automatically position the vanes to always insure their greatest power output and to decrease the back pressure on the return or non-power stroke of each vane.

A still further object of the invention is to provide mechanism of the character set forth which is of strong, durable, efficient and comparatively inexpensive construction, and in order that it may be fully understood, reference is to be had to the accompanying drawing, in which:

Figure 1 is a front view of a portion of an aeroplane equipped with the devices of the invention.

Figure 2 is a side elevation of the same.

Figure 3 is a phantom view of the control mechanism for adjusting the vanes as it will appear in top plan view.

In the said drawing, where like reference characters identify corresponding parts in all of the figures, 1 indicates an aeroplane wing or a special platform, for example, at the tail of such aeroplane, and mounted on said base are a series of vertical standards 2, provided at their upper ends with bearings in which a crank shaft 3 is journaled, it being understood that the crank shaft may be of any suitable length and that the standards and bearings will be of such number as to accommodate the crank shaft. At a suitable point, preferably centrally of the crank shaft, is a driving gear 4 for connection to a source of power (not shown).

In the drawing four cranks are illustrated, said cranks being so arranged that the forces on opposite sides of the drive gear 4 are always in balance, and journaled on each crank are vanes 5, comprising relatively inverted buckets or pockets having a stream lined nose 6 and being open at their rear ends.

Securely mounted on the platform 1 and converging upwardly are a plurality of standards 10 which conjointly carry at their upper ends a cross beam or bar 11, said bar 11 providing an anchoring point for a plurality of arcuate guides or tracks 12 arranged in pairs, and having their lower ends anchored in the supporting platform 1.

As the construction for each vane is similar, I shall now proceed to describe the adjustment of a single vane, it being understood that such description applies equally to all vanes, regardless of their location on the aerial vessel. Projecting rearwardly

from the vane is a control stem or lever 13 having its rear end reciprocating through a bearing block 14 journaled in a slide or carrier 15, said carrier 15 being in turn slidably mounted on the guides or tracks 12. Secured to the carrier 15 and extending downwardly through the platform 1 and sliding through a journaled yoke 22 secured to said platform, is an operating stem 23 provided with a pair of upper and lower cable attaching loops 24 and 25 respectively.

The connection for effecting operation of the carrier along the tracks 12 comprises an endless cable 26 encircling a manually-operable drum 27, and guided by pulleys 28, the opposite ends of the cable being respectively attached to the loops 24 and 25, whereby upon rotation of the drum through the mechanism below described or by any other suitable operating mechanism, the carriers 15 may be operated upwardly or downwardly along the tracks 12 to effect manual change in the angle of attack of the operating vanes upon rotation of the crank shaft, as indicated in dotted lines, Figure 2.

It will be noted upon inspection of Figure 2, that by the mechanism above described, each vane is given what may be termed a "swimming stroke" as it is caused to rock around the crank shaft, the front or closed nose of the vane exerting the greatest force and travelling through a much greater arc than the rear portion of such vane, it being thus evident that the effective operating stroke is always greater than the diameter of the circle through which the crank travels.

As a convenient means of effecting operation of the drum 27, its shaft at one end is provided with a pulley 30 and in horizontal alinement with said pulley is a second pulley 31 journaled on a stud shaft 32 projecting from one of the rear uprights of the aeroplane frame. The pulleys 31 and 32 are encircled by an endless cable 33 permanently secured to the pulley 31. To effect operation of the cable 33 in either direction and consequently operate the drum 27 to effect adjustment of the vanes, an operating lever 34 is pivoted on one of the bottom cross members of the aeroplane frame, and at its upper end is provided with a split boss 35 permanently secured to the cable 33, said lever being equipped with a locking rod 36 in cooperative engagement with a locking quadrant 37 so that the cable 33 and consequently the drum 27 may be rigidly and positively held against rotation so that the vanes may be maintained in any desired position of adjustment.

From the above description, it will be apparent that I have produced a lifting and propelling apparatus for aeroplanes which embodies the features of advantage set forth as desirable in the statement of the object of the invention, and which may be modified in minor particulars within the principle of construction and mode of operation involved and the scope of the appended claims.

I claim:

1. The combination in an aeroplane of a supporting wing, a driven shaft extending longitudinally of the wing and being formed with a crank, a vane mounted on said crank and adapted to be driven thereby, and a carrier bearing a fixed relation to the wing and a slidable relation to the vane.

2. The combination in an aeroplane of a supporting wing, a driven shaft extending longitudinally of the wing and being formed with a crank, a vane mounted on said crank and adapted to be driven thereby, a carrier bearing a fixed relation to the wing and a slidable relation to the vane, and means operable to adjustably secure the carrier in different positions with respect to the supporting wing.

3. The combination in an aeroplane of a supporting wing, a driven shaft extending longitudinally of the wing and being formed with a crank, a vane mounted on said crank and adapted to be driven thereby, a guide carried by the wing, a carrier slidably mounted on said guide and having a slidable relation with the vane, and manually operable means for adjusting the carrier on the guide.

4. The combination with an aeroplane of a propelling and lifting device therefor, said device comprising a vane mounted to be driven in a relatively vertical plane and having a relatively reciprocating travel in such plane, and means whereby the angle of reciprocation of the vane may be altered at will to correspondingly shift the relationship of the forward and lifting forces of said vane.

In testimony whereof I affix my signature.

HUBERT M. GRAF.