

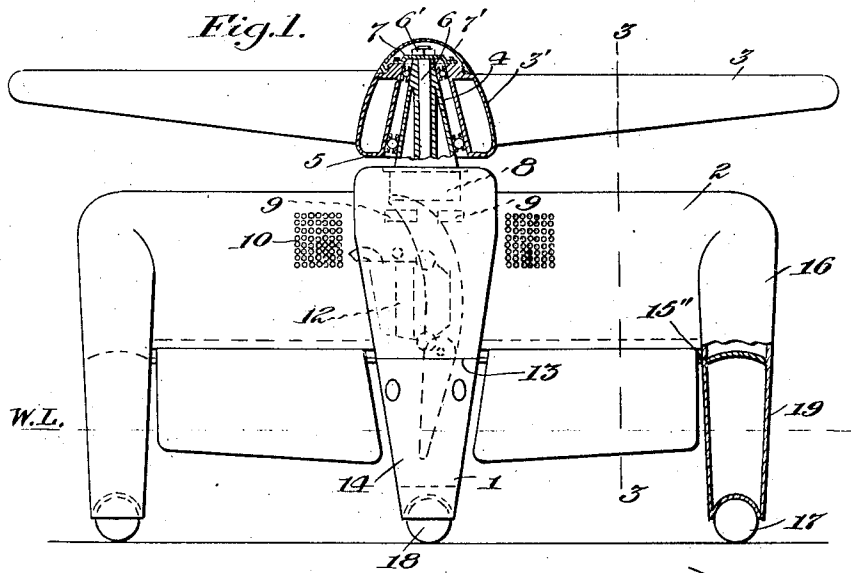
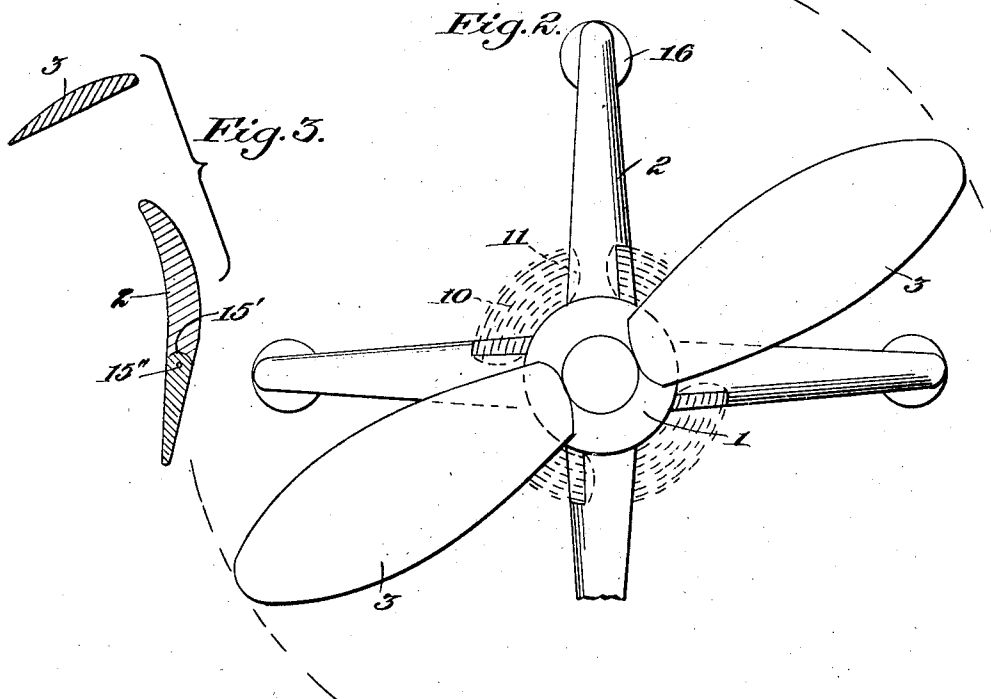
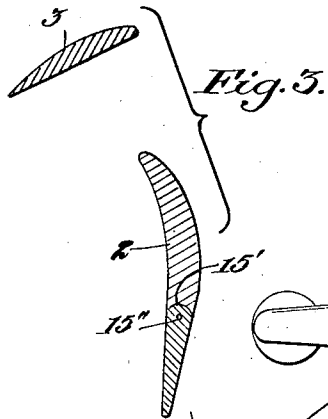
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R. WAGNER

HELICOPTER

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Inventor:
R. Wagner,

by Langner, Perry Card & Langner

Att'ys.

UNITED STATES PATENT OFFICE.

RUDOLF WAGNER, OF HAMBURG, GERMANY.

HELICOPTER.

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The present invention deals with helicopters and provides an arrangement which increases the reliability, simplifies the construction, increases the efficiency, and lessens the cost of production, of such devices.

In the usual form of helicopter, the effect of the turning moment of the power plant on the machine is taken up or compensated by the use, in general, of two or more counter-running propellers arranged either coaxially one above the other or side by side with parallel axes, such propellers being positively interconnected in order as far as possible to produce similar and equal working or lifting forces for each propeller. In such constructions, however, there is much danger that when one propeller becomes inoperative, the entire machine is set in circular movement. This of course, results in the propeller still in operation generating insufficient lifting force to sustain the apparatus. Aside from this danger, a construction wherein propeller shafts penetrate each other presents certain constructional difficulties.

In the present invention for the purpose of simplifying the construction and increasing the security of operation of these devices, use is made of but a single revolving propeller. The turning moment of the engine in this case is equalized by a stationary, so-called counterpropeller mounted below the main propeller and having curved or bendable blades.

This counterpropeller takes up or compensates without shock, the greater part of the swirl of the main propeller stream which has arisen as a reaction of the rotation of the main propeller, and directs and carries off the air streams in an axially downward direction.

With a construction as contemplated by this invention a rotation of the body on its vertical axis is prevented and at the same time an additional lifting force is produced whereby the efficiency of the drive is very substantially increased. The additional lifting force is a result of the changing of direction of the air streams coming from the main propeller, by coacting with the blades of the counterpropeller.

The arrangement of stationary counterpropeller blades according to this invention provides an additional advantage in that the entire apparatus is stabilized in the direction of vertical movement and furthermore, the blades may serve, even though somewhat im-

perfectly, as gliding surfaces for a gliding flight of the craft in the event the power plant should break down.

Thus with the contemplated construction greater security is provided as compared with other constructions wherein such gliding surfaces are wholly absent.

The invention can also be applied to aircraft having several adjacently positioned supporting propellers wherein each propeller has its own counterpropeller and any desired direction of rotation. As compared with other constructions the advantage of the present form consists in that the swirl of the air stream from each individual supporting propeller is neutralized by its own counterpropeller so that no free turning moment can arise should one of the supporting propellers cease to properly function.

In order to equalize or compensate for any residual turning moment on the body of the device, according to this invention, the counterpropeller blades, either wholly or in part, may have all or a part of their blade surface arranged to swing about a horizontal axis. This mobility of the blades can serve to produce a certain inclined position of the vertical axis of the aircraft, and thereby a lateral movement of the craft in any desired direction.

The number of counterpropeller blades according to the present invention is not limited but may be varied according to requirements or as experience dictates to be equal to more or less than the usual number of four or six as generally used with water craft. A most advantageous number is an arrangement using only four and having opposed crossed blades. It is also advantageous at times to use only two blades in oppositely positioned arrangement.

Merely by way of example a form of this invention using a counterpropeller having four blades is shown in the accompanying drawings wherein like reference characters designate like parts throughout, and wherein:

Fig. 1 is an elevational view of the entire craft partly shown in section.

Fig. 2 is a top plan view of the craft with parts broken away.

Fig. 3 is a section on line 3—3 of Fig. 1.

With reference to the drawings a helicopter is shown wherein a light weight high

pressure steam turbine is used for the drive. It is of course immaterial as regards this invention just what particular type of power plant is used. However, as compared with an internal combustion engine drive, this particular drive is of advantage in that the turbine, or turbines, if several be used, can operate in any position such as with a vertical shaft, and thus avoid the wasteful consumption of energy and the complicated angle or bevel drive such as is necessary when internal combustion engine drive be used.

Another advantage of the steam drive is that it is equally efficient at various heights so that greater altitudes can be attained than is the case with the internal combustion engine drive.

The steam drive has also been found to have certain constructional advantages when several lifting propellers are arranged on a very large craft. In such craft, for example, the boiler with the auxiliary engines can be placed in a central main body, while each lifting propeller can be driven by a separate turbine, so that except for the propellers lying outside of the center, only a small part of the weight of the power plant is situated away from the center.

In the figures of drawing the body 1 of the aircraft serves as the hub or attaching means for the counterpropeller 2 which in the present case, as shown in Figure 2, has four crossed blades. The main or lifting propeller 3 is shown as having two blades and as having a hub 3' fitting onto a pivot or supporting member 4 projecting from the body 1 and carried thereon by roller bearings 5. A drive shaft 6 for the main propeller is received centrally by the member 4 and is connected to the main propeller by means of a plate 7 and a nut 6'. The connecting means just described is enclosed by means of a cap 7' which fastens over the hub 3' and gives a smooth outline.

The hub and cap are made sufficiently large so that they form, together with the body 1, a stream line contour whereby the air is caused to flow from one end to the other in an efficient manner. Due to this construction the counterpropeller 2 is capable of utilizing the core of the swirl from the main propeller in a substantially complete manner which results in the greatest possible increase of thrust.

The relative curvature of the counterpropeller blades 2 with respect to the main propeller, and the curvature of the main propeller blades, is clearly shown in the sectional view of Figure 3.

The main propeller can be made hollow and is preferably formed of duralumin and is constructed in accordance with approved practice in the formation of the usual air propellers.

The main propeller is driven by the shaft 6 which is supported throughout its length in the member 4 and, hence, is subject only to

torsional strain, and is entirely free from bending stresses.

The gearing of the turbine is designated at 8 while two turbines 9, 9 are provided for greater security. An air cooled condenser 10 in the form of a pipe system encompasses the entire body 1 between the blades 2 and receives the steam from the turbine by way of the chambers 11 formed within the blades 2. The air from the main propeller passes through this pipe system on its way to the lower end of the craft.

It is of course possible to use other types of condensers but the one described is very suitable.

The steam generator 12 is situated in the body 1 and is suitably provided with a superheater, air preheater, and if desired, a feed water preheater. An operator's platform 13 is provided in the body 1 together with other necessary accessories which it is not necessary to show. Below the platform 13 is a pilot cabin 14 which is located under the engine room, and from which the blades of the counterpropeller 2, having a construction to be described, can be operated.

As shown in Figure 1 the lower portion of each of the blades of the counterpropeller is hinged to the upper portion as at 15' so as to swing about horizontal axes 15".

Instead of having only a part of each of the counterpropeller blades movable, under certain conditions the entire blade may be rotatable as a whole on the body 1, in order to vary its position relative to the off-flow from the propeller stream.

As shown in the drawings the counterpropeller blades at their outer ends, are provided with enlarged portions 16 to the lower ends of which are attached air buffers 17 used for landing on solid ground. The body 1 as shown is also provided with a similar air buffer 18 for landing on solid ground.

In order to make the craft of more general use and to safeguard it in operation, the members 16 are provided with water-tight floats 19 so as to permit alighting on and arising from water surfaces. The position of the floats 19, remote from the center of the craft, provides great stability against tipping, and when resting on a water surface the water level would be as indicated by the line W. L. in Figure 1.

In addition to the embodiment of the invention as shown and described above it is of course possible to use many other types and arrangements of drive and other forms and numbers of blades and control surfaces without exceeding the contemplated scope of the invention.

Furthermore, under certain circumstances in order to provide for lateral movement of the craft, use can be made of auxiliary drive propellers having horizontal axes.

Again, when desired, the blades of the

counterpropeller can be interconnected at their outer ends by a circular collar for reinforcing the same.

5 Having now described a complete embodiment of my invention I now claim:

1. A helicopter comprising a main rotatable propeller and a stationary counter-propeller with curved blades mounted immediately below the main propeller for taking up and neutralizing the swirl of the fluid stream from the main propeller.

2. A helicopter comprising at least one main rotatable propeller, a stationary counter-propeller with curved blades mounted immediately below the main propeller for taking up and neutralizing the swirl of the fluid stream from the main propeller, and a chambered hub for the counter-propeller constituting the body of the helicopter.

3. A helicopter comprising at least one main rotatable propeller, and a stationary counter-propeller with curved blades mounted immediately below the main propeller for taking up and neutralizing the swirl of the

fluid stream from the main propeller, the counter-propeller having four blades spaced with equal angularity about said helicopter.

4. A helicopter comprising at least one main rotatable propeller and a stationary counter-propeller with curved blades mounted immediately below the main propeller for taking up and neutralizing the swirl of the fluid stream from the main propeller, said counter-propeller having supporting members extending downwardly from the blade ends, said blades being formed with hinged portions terminating above the lower ends of said supporting members.

5. A helicopter comprising at least one main rotatable propeller and a stationary counter-propeller with curved blades mounted below the main propeller for taking up and neutralizing the swirl of the fluid stream from the main propeller, portions of said blades being hinged about horizontal axes.

In testimony whereof I have signed my name to this specification.

RUDOLF WAGNER.