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ROTOR EQUIPPED AERIAL DEVICE

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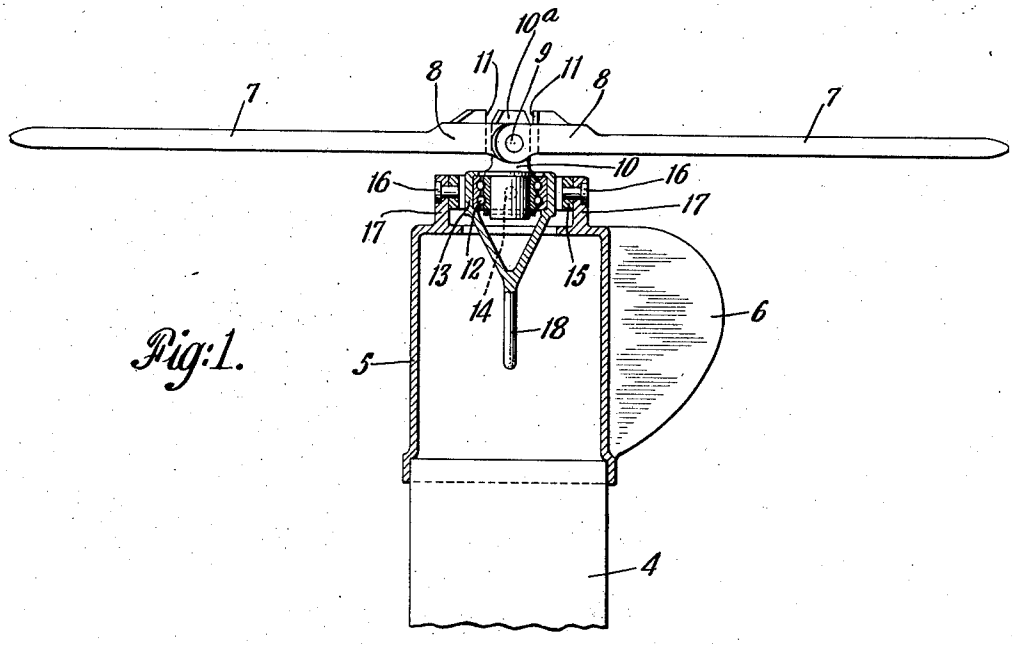


Fig. 1.

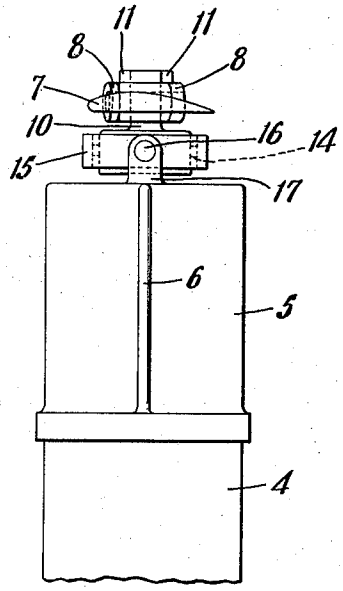


Fig. 2.

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ROTOR EQUIPPED AERIAL DEVICE

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2 Claims. (Cl. 244—138)

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This invention relates to aerial devices and is especially concerned with an aerial device equipped with a bladed rotor constructed to provide for retarded descent of the device when released or launched at an elevation, for instance, from a bomber-type airplane.

Although a number of features of the invention are capable of adaptation to a wide variety of specific uses, the invention is particularly advantageous when adapted to an aerial bomb, especially of the high explosive type. It should be mentioned, however, that the device may be used for dropping cargo of various types from aircraft, and even for carrying an occupant.

In the preferred construction, the device includes a body portion of elongated form, with the bladed rotor rotatively mounted at one end of the body on an axis approximately coinciding with the longitudinal axis of the body. The body portion may comprise a bomb or may constitute a housing for carrying cargo or an occupant.

Another important feature of the invention is the provision of controllable means whereby at least limited control of the flight path of the device is afforded. In the event of a device constructed to carry an occupant, the controllable means may be manually operated, and in the event of a bomb, or a cargo-carrying device, the controllable means may be actuated by remote control mechanism, for instance, radio control equipment of known type.

Still another feature of the invention is the provision of stabilizing means, desirably in the form of a fixed fin located adjacent the upper end of the body portion. Such a fin preferably lies in a substantially vertical plane and is located toward one side of the body portion near its upper end, so that when launched from an aircraft the stabilizing fin will contribute "weathercock" stability and act to prevent rotation of the body portion about its own axis.

How the foregoing and other objects and advantages are attained will appear more fully from the following description referring to the accompanying drawing in which—

Figure 1 is a side view of an aerial device constructed according to the present invention, with certain parts of the rotor mounting and rotor control mechanism shown in vertical section; and

Figure 2 is a view at right angles to Figure 1.

Referring first to Figure 1, the body portion proper is indicated in outline at 4. This body portion, in one preferred form comprises a bomb,

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for instance, a high explosive bomb. The body portion is preferably cylindrical, having a hollow upper portion 5. This portion serves to mount the rotor and carries the stabilizing fin 6.

The rotor may incorporate any desired number of blades, a pair of blades 7—7 being employed in the form illustrated, which blades are provided with fork ends 8 pivotally connected by a common pivot 9 with a hub spindle 10. The blades also have stops 11 adapted to engage the upward extension 10a of the hub and thus restrict upward swinging movement of the blades about the pivot 9.

With respect to pivot 9, it is preferable to employ a pivot positioned with its axis oblique to the longitudinal axes of the blades, the obliquity being such that, when viewed in plan, the pivot axis forms an acute angle with the axis of each blade at the leading side of the blade axis and the outboard side of the pivot axis. This causes the blade pitch to decrease upon upward swinging of the blades and thereby facilitates initiation of rotation.

The hub is journalled by bearing 12 in the inner ring 13 of a gimbal ring assembly. Diametrically opposite pivot pins, one of which appears at 14, serve to pivotally mount the rings 13 in another ring 15 which in turn is mounted by trunnions 16 in the supporting lugs 17.

The rotor spindle 10 is adapted to be tilted in all directions by means of a control member 18 which is connected with the inner ring 13 of the gimbal ring assembly. In the case of a man-carrying device the control 18 may be manually operated, and in the case of a remotely controlled cargo-carrying device or aerial bomb, member 18 may be coupled with the servo or other actuating motor device of the remotely controlled mechanism.

When the device is first released or launched the air flow across the blades of the rotor acts to swing them upwardly on the pivot 9 to reduced pitch position. The blade stops 11, however, prevent the blades from excessive upward swinging movement and thus ensure that the blades occupy appropriate positions for initiation of rotation under the influence of the air flow. The stops are desirably positioned to remain out of engagement after rotation is established, so as not to interfere with blade movements which accompany adjustments of the rotor control or which result from aerodynamic forces in descent. Moreover, the stops 11 and the angle of the pivot 9 should be arranged so that the permitted upward swinging movement of the blades

will reduce the blade pitch angle to a negative value, which is of importance for the purpose of initiating rotation. For this purpose a considerably larger angle may be needed than that shown in the drawings, the showing in the drawings not being intended to indicate any exact value.

The action of the rotor control and of the stabilizing fin is as follows:

When the device is launched from an airplane, as is contemplated, the initial portion of the path of descent will, of course, be inclined rather than truly vertical because of the forward motion of the airplane at the time of launching. This sets up air flow over the stabilizing fin 6 acting to prevent rotation of the body portion about its vertical axis. Actuation of the rotor control will then enable continuance of the same flight path or any desired change in the direction of drifting, and if the control is actuated to change the direction the stabilizing fin will cause the body portion to turn about its vertical axis through a corresponding angle until the fin is again in a trailing position.

In addition to the foregoing, although various features of the invention are adapted to a driven rotor, preferably the rotor is arranged to provide for aerodynamic or autorotative actuation thereof, under the influence of the relative air flow set up by the descent of the device.

In devices adapted to different purposes the required or desired rate of descent may be different, and this can readily be taken care of by appropriate design of the rotor, especially the blades thereof, for instance, by varying the length of the rotor blades, the pitch setting thereof, etc.

With respect to the blade pitch angle to be employed, it may be said that appreciable variation is permissible. An appropriate autorotative setting found suitable for the purpose is about 4 or 5 degrees above the no-lift setting calculated with reference to a plane perpendicular to the axis of rotation, when the blades are perpendicular to the rotational axis.

In an embodiment of the invention taking the form of a remotely controlled explosive bomb adapted to be launched from a bomber-type airplane, it is of advantage that the rotor characteristics and especially the length of the blades be selected so as to retard the rate of descent not appreciably more than that required to secure accuracy in operation of the remote control mechanism, since, in this way, at least some penetrating force will be retained.

With appropriate selection of rotor characteristics, the bombardier or other operator of the remote control mechanism may be provided with sufficient accuracy of control to enable direct striking even of a relatively small specific target.

We claim:

1. A motorless rotary wing device adapted to be dropped from a height with its rotor initially inoperative, said device comprising a relatively light rotor having at least one airfoil rotor blade, a body portion adapted to cooperate with a load so that the combined mass of said body portion and the load is relatively heavy compared with said rotor, and rotor mounting structure comprising a pivot adjacent the blade root securing the blade to the body portion in a manner to provide for blade swinging movement to a high coning position responsive to the downward motion of the device through the air, said structure being arranged to provide for decrease of blade pitch to a negative value when the blade is in said high coning position.

2. A motorless rotary wing device adapted to be dropped from a height with its rotor initially inoperative, said device comprising a relatively light rotor having at least one airfoil rotor blade, a body portion adapted to cooperate with a load so that the combined mass of said body portion and the load is relatively heavy compared with said rotor, and means for initiating rotation of the rotor comprising a pivot securing the blade to the body portion in a manner to provide for blade swinging movement to a high coning position responsive to the downward motion of the device through the air, said pivot having an axis oblique to the longitudinal axis of the blade and providing for decrease of blade pitch to a negative value when the blade is in said high coning position.

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