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D E C I S I O N
of 5 April 2006

Case Number: T 0366/03 - 3.2.01

Application Number: 96930563.0

Publication Number: 0847362

IPC: B64C 27/02

Language of the proceedings: EN

Title of invention:
GYROPLANE

Applicant:
Cartercopters L.L.C.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56, 84

Keyword:
"Claims - clarity (yes)"
"Inventive step - (no) bonus effect"

Decisions cited:
T 0021/81, T 0365/86, T 0350/87, T 0226/88

Catchword:
-

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Case Number: T 0366/03 - 3.2.01

D E C I S I O N
of the Technical Board of Appeal 3.2.01
of 5 April 2006

Appellant: Cartercopters L.L.C.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 18 October 2002 refusing European application No. 96930563.0 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: S. Crane
Members: J. Osborne
S. Hoffmann

Summary of Facts and Submissions

I. The appeal is directed against the decision posted 18 October 2002 to refuse European patent application No. 96 93 0563.0 (EP-A-0 847 362) due to lack of clarity of the independent claims.

II. In a communication pursuant to Article 110(2) EPC the board indicated its provisional opinion that the claims according to the main request then on file were clear. The board further indicated that, in view of the appellant's request to grant a patent, it intended to exercise its discretion in accordance with Article 111(1) EPC to continue examination of the case.

III. The following state of the art played a role during the further examination of the appeal:

D1: US-A-2 068 616

D2: US-A-5 301 900

D3: US-A-3 310 117.

IV. During oral proceedings held 5 April 2006 the appellant requested that a patent be granted on the basis of claims 1 to 7 (main request) or in the alternative claims 1 to 5 (auxiliary request), all filed with a letter dated 21 December 2004.

V. The independent claims 1 and 4 according to the main request read as follows:

"1. A gyroplane (11) having a variable pitch rotor blade (31), a propeller (33), a wing (19,21), a horizontal stabilizer (43), an engine (101) and an engine prerotator clutch (105) to engage or disengage the rotor blade, and wherein:
the engine is adapted to rotate the rotor blade at a first speed while the engine prerotator clutch is engaged;
flight control apparatus (201-225) is provided to set the rotor blade pitch to zero (a minimum lift condition) while the engine prerotator clutch is engaged;
an engine speed controller is provided to increase engine, propeller speed and thrust to achieve an increasing horizontal velocity necessary to maintain altitude, first with the rotor blade providing most of the lift and until the wing provides all the lift; and
said flight control apparatus is also adapted to reduce the pitch and angle of attack of the rotor blade to essentially zero lift to decrease the rotor blade rotational speed to minimize drag during horizontal flight;
characterised in that:
the rotor blade has a construction and a weight to enable rotation at said first speed to store a minimum of 299 Joules per Kg (100 foot pounds of kinetic energy per pound) of gross weight, said rotor blade comprising rotor blade tip weights (321) to achieve said kinetic energy; and
said flight control apparatus being adapted for changing the rotor blade pitch to a lift condition to

climb to an altitude of at least 15.24 metres (fifty feet) after the prerotator clutch is disengaged."

"4. A method of flying a gyroplane (11) having a variable pitch rotor blade (31), a propeller (33), a wing (19,21), a horizontal stabilizer (43), an engine (101) and a clutch (105) to engage or disengage the rotor blade, comprising the steps of:
rotating the rotor blade at a first speed to describe a rotor disc, while the engine prerotator clutch is engaged and the rotor blade pitch is set to zero (a minimum lift condition);
disengaging the prerotator clutch and changing the rotor blade pitch to a lift condition;
increasing the speed and thrust of the propeller to achieve an increasing horizontal velocity necessary to maintain a selected altitude, first with the rotor blades providing most of the lift and until the wings provide all the lift;
reducing the angle of attack of the rotor blade disc and the pitch of the rotor blade to essentially zero lift to decrease the rotor blade rotational speed to minimize drag during horizontal flight;
characterised in that:
said rotor blade is so constructed and has a weight to enable rotation at said first speed to store a minimum of 299 Joules per Kg (100 foot pounds of kinetic energy per pound) of gross weight, said rotor blade comprising rotor blade tip weights (321) to achieve said kinetic energy; and
disengagement of the prerotator clutch when said rotor blade is rotating at said first speed and changing the rotor blade pitch to a lift condition causes said

gyroplane to climb to an altitude of at least 15.24 metres (fifty feet)."

The subject-matter of the corresponding independent claims according to the auxiliary request differs from the above by the addition of the following feature:

– the rotor blade has an edgewise stiffness of at least 506 $N.m^2$ per Kg (80,000 pounds $inch^2$ per pound) of aircraft gross weight.

VI. The arguments of the appellant may be summarized as follows:

As regards clarity, the independent claims have been amended to more precisely define the minimum lift condition as one in which the rotor blade pitch is zero. The remaining wording which the examining division considered as being functional language defining results to be achieved concerns parameters which are readily determinable by the skilled person without undue burden.

As regards inventive step of claim 1 according to the main request, the closest prior art is that disclosed by D1. This relates to a gyroplane which permits efficient high speed flight by unloading the rotor. It particularly relates to synchronizing wing and rotor controls. Lift is controlled by adjusting the attitude of the aircraft relative to the airflow. However, it is silent regarding take-off and there is no disclosure of pre-rotation or indeed of any powered rotation of the rotor. The subject-matter of present claim 1 differs from the disclosure of D1 by the features relating to

the pre-rotator clutch, the construction of the rotor blade including blade tip weights to enable storage of the stated quantity of kinetic energy, the flight control apparatus being adapted to adjust the rotor blade pitch for take-off and the engine speed controller. The present independent claims solve the problem of improving the performance at high speed and altitude. In particular, the blade tip weights enable the blades to remain stable whilst the rotor is unloaded during high speed flight. D2 relates to an autogiro which is suitable only for low speed flight in which there is no significant transfer of load to fixed wings and the blades would become unstable if operated at higher speeds. It therefore contains no solution to the present problem. D3 relates to helicopter blades which operate differently from those in gyroplanes and autogiros and so are subject to different design considerations. In particular, D3 relates to a design for easily varying the longitudinal distribution of weight and stiffness. Blade tip weights are provided in helicopters to increase inertia to help during an unpowered landing and the weights presently claimed would be much heavier. Corresponding argumentation applies to claim 4.

As regards inventive step of the claims according to the auxiliary request, the additional feature and the blade tip weights have the combined effect of further improving stability of the blades when unloaded during high speed flight. The claimed value is not disclosed in the cited state of the art and D1 gives no hint towards it.

Reasons for the Decision

1. The application relates to an aircraft hereafter termed a gyroplane which derives its lift from both a fixed wing and from a rotor, the degree of lift provided by each depending on the forward speed of the craft. At low speeds the craft is driven forwards and the rotor axis is inclined relative to the direction of movement so that air passing through the rotor causes it to rotate and provide lift. At these low speeds lift is provided only by the rotor. At higher speeds lift is provided only by the fixed wing and the rotor disc inclination and blade pitch are adjusted to provide a low drag condition. The term "autogiro" is used hereinafter to designate an aircraft which operates in essentially the same way as a gyroplane at low speed, its rotor being the only source of lift. D2 relates to an autogiro which has an additional "jump-start" facility which permits vertical take-offs. With the craft stationary a motor drives the rotor in a no-lift condition, the drive is disconnected and the rotor blade pitch is set to provide lift whereupon the craft leaves the ground. The craft is then propelled forwards and the inclination of the rotor axis and blade pitch are set to cause the movement through the air to drive the rotor and provide lift as in a conventional autogiro.

Clarity - both requests

2. Claim 1 is a product claim which defines certain parameters by results to be achieved:

– an engine speed controller is provided to increase engine, propeller speed and thrust to achieve an increasing horizontal velocity necessary to maintain a selected altitude;

– the rotor blade is so constructed and has a weight to enable rotation at the first speed to store a minimum of 299 Joules of kinetic energy per Kg of gross weight; and

– changing the rotor blade pitch to a lift condition causes the gyroplane to climb to an altitude of at least 15.24 metres.

The examining division found these definitions to offend the requirement of Article 84 EPC in respect of clarity. In the board's view it is clear for the skilled person from each of these definitions which essential parameters form the subject-matter of the claim. However, as set out below the subject-matter of the independent claims according to both requests does not involve an inventive step. For this reason it is not necessary to treat the matter of clarity in further detail.

Inventive step - main request

3. The appellant and the board are in agreement that the closest state of the art for consideration of inventive step is that disclosed by D1. D1 relates to a gyroplane having a variable pitch rotor blade, a propeller, a wing, a horizontal stabiliser and an engine. Flight control apparatus is provided to reduce the rotor blade pitch and the angle of attack of the rotor blade disc

to an essentially zero lift condition to decrease the rotor blade rotational speed and thus minimise drag during horizontal flight. It is implicit that an engine speed controller is provided to increase engine speed and propeller speed and thrust after lift-off to achieve an increasingly horizontal velocity necessary to maintain altitude, first with the rotor blade providing most of the lift and until the wing provides all of the lift. Whilst D1 concerns itself with details of operation during flight it contains no disclosure regarding take-off. Since no drive means for the rotor is disclosed it is implicit that the craft would perform take-off in the way which is conventional for this type of craft, namely by employing movement of air through the rotor during forward motion of the craft to cause the rotor to turn.

3.1 The subject-matter of claim 1 according to the main request differs from that of D1 in that:

(i) there is an engine prerotator clutch to engage or disengage the rotor blade;

(ii) the engine is adapted to rotate the rotor blade at a first speed while the engine prerotator clutch is engaged;

(iii) flight control apparatus is provided to set the rotor blade pitch to zero (a minimum lift condition) while the engine prerotator clutch is engaged;

(iv) the flight control apparatus is adapted for changing the rotor blade pitch to a lift

condition after the prerotator clutch is disengaged;

(v) to climb to an altitude of at least 15.24 metres;

(vi) the rotor blade has a construction and a weight to enable rotation at the first speed to store a minimum of 299 Joules of kinetic energy per Kg of gross weight;

(vii) the rotor blade comprises rotor blade tip weights to achieve the kinetic energy.

3.2 These differentiating features all relate to the craft's capability to perform a "jump-start", enabling it to take-off vertically. Features (i) to (iv) and (vii) relate to the construction of the aircraft, whilst (v) and (vi) specify parameters achievable by that construction. Accordingly, the problem solved by the subject-matter of present claim 1 may be seen as to modify the craft according to D1 in order to provide an improved take-off facility.

3.3 D2 discloses an autogiro which has the additional facility of being able to perform a "jump-start". This was not the first disclosure of the concept of a "jump-start" for autogiros and in column 1, lines 33 to 37 of D2 it is stated that "various autogyro devices in the past have provided some means to begin rotation of the rotary wing prior to takeoff …". Indeed, the appellant does not contest that the idea of a "jump-start" was already well known in the technical field of autogiros. The detail disclosure of D2 relates to control of the

pitch of the rotor blade and includes the above features (i) to (iv). In view of the essential equivalence in operation of a gyroplane and an autogiro at low speeds and since the concept of a "jump-start" on the latter was well known the provision of this facility on the gyroplane of D1 amounts to no more than a juxtaposition of known features. It would be within the normal ability of the skilled person to thereby provide the features (i) to (iv) in the craft according to D1. When putting this into practice the skilled person would inevitably select an appropriate height to which the craft should be "jumped", thereby arriving at feature (v) and also, as a consequence, feature (vi).

3.4 A further practical consequence of providing the "jump-start" capability in the craft according to D1 is that the skilled person would need to store the specified quantity of kinetic energy in the rotor. As accepted by the appellant, it is conventional to provide weights in the tips of rotor blades of helicopters in order to increase inertia, as exemplified by D3. It would be an obvious measure for the skilled person to employ this known feature in order to achieve the same effect with the rotor of D1.

3.5 Contrary to the appellant's view, the board has not incorrectly redefined the problem to be solved and, in so doing, offended the principle that the statement of problem may not anticipate the solution. The original description begins on page 9 at line 16 to describe the features (i) to (vii) set out above as relating to vertical take-off capability. Improvement in high speed flight, which the appellant still states to be the problem, is achieved by other features (see page 8,

lines 15 to 21) which are, in fact, already known from D1.

3.6 The appellant argues that the feature of weights in the blade tips solves a problem of increasing stability of the rotor when it is unloaded during high speed flight and that this problem is not addressed by the cited state of the art. However, there is no support for this notion either as a disclosure in the original application or as evidence in the file. In the application the only reference to stability of the blades when in the unloaded condition relates to the avoidance of flutter by controlling the location of the centre of gravity in the blade cross-section and/or providing high torsional stiffness of the blades (beginning at page 11, line 11). There is no reference in this context to weights in the blade tips. The provision of such weights is disclosed, on the other hand, as being directly related to the need to store kinetic energy for "jump starts" (page 9, line 16 to page 10, line 11). Even if the asserted improvement in stability were present, it would be merely a fortuitous collateral advantage or so-called "bonus effect" which according to established jurisprudence of the boards cannot substantiate an inventive step (see T 21/81 (OJ EPO 1983, 15) or T 365/86, T 350/87 and T 226/88 (all not published in OJ EPO)).

3.7 The appellant furthermore argues that weights in the blade tips of helicopter rotors are provided in order to increase inertia and thereby help in maintaining rotation during an unpowered landing. As a result, they would be provided for a purpose and be of a size which would not render obvious feature (vii) in the present

case. The board disagrees. The skilled person would be aware that the use of such weights in helicopter blades is to increase stored kinetic energy by increasing the polar moment of inertia. Faced with the same problem in a closely related technical field it would be obvious for the skilled person to employ the same solution, adapting the size of the weights as necessary.

3.8 On the basis of the foregoing the board concludes that the subject-matter of claim 1 does not involve an inventive step (Article 56 EPC). Similar arguments and conclusions apply to the corresponding method claim 4. The request therefore must be refused.

Inventive step - auxiliary request

4. The subject-matter of the independent claims according to this request differs by the addition of the feature that the rotor blade has an edgewise stiffness of at least 506 $N.m^2$ per Kg of aircraft gross weight. As set out in the original application this feature aids the storage of kinetic energy in the rotor by permitting increased rotational speeds to be used during prerotation. It follows that this feature supplements those designated as (i) to (vii) in respect of claim 1 of the main request in solving the problem of modifying the craft according to D1 in order to provide an improved take-off facility.

4.1 It is within the general technical knowledge of the skilled person that the amount of kinetic energy stored by a rotating body is a function of both its speed of rotation and polar moment of inertia and that, moreover, one limitation in respect of rotational speed is the

structure of the rotor blades. The presently claimed edgewise stiffness accordingly is merely a value appropriate to achieving the required amount of stored energy and its determination would fall within the skilled person's normal activity. For reasons as set out under 3.6 above, any improvement in stability of the rotor blades when unloaded during high speed flight which may be achievable with this feature has no bearing on this assessment of inventive step.

4.2 The additional feature in claim 1 according to the present request therefore fails to establish inventive merit in claim 1. Similar considerations apply to the independent method claim.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Vottner S. Crane