

## SPECIFICATION

### BOTH-END SUPPORTING WING AIRCRAFT

#### TECHNICAL FIELD

[0001]

The present invention relates to a both-end supporting wing aircraft, and particularly to a both-end supporting wing aircraft that does not comprise a cantilever wing, the aircraft flying by relevant stream or positive pressure flowing along the lower surface of the aircraft.

#### BACKGROUND OF THE INVENTION

[0002]

An aircraft provides lift by negative pressure along the upper surface of a wing because of difference in velocity of air stream flowing on the upper and lower surfaces.

[0003]

JP2004-106784A discloses a kite-type aircraft that flies by air stream or positive pressure.

[0004]

In the kite-type aircraft, the angle of attack gets greater to about 60 degrees in low-speed flight or landing, which is similar to a kite. In the aircraft, thrust and lift are generated by a jet engine for discharging a gas obliquely downward like an ordinary airplane. Lift is not generated by air stream.

[0005]

In low-speed flight and landing, the angle of attack of the whole aircraft has to be made very large and it is very difficult to run on the ground with the very large angle of attack.

## DISCLOSURE OF THE INVENTION

### SUMMARY OF INVENTION

[0006]

The present invention provides a both-end supporting wing aircraft that does not comprise a cantilever wing having a free end, the aircraft flying by relative air stream, assuring stable flight in landing/takeoff or at low speed.

[0007]

The inventor found that aircraft weight is supported by a component force of reaction force obtained by air stream generated on the upper and lower surface of the aircraft by going forward by a thrusting device, the aircraft being raised by a component force of thrust by the thrusting device and flying while its posture is kept at optimum.

[0008]

In one aspect of the invention there is provided a both-end supporting wing aircraft comprising: a main body having a front end; a right body disposed at one side of the main body and having a front end; a left body disposed at the other side of the main body and having a front end, the front ends of the right and left bodies being behind the front end of the main body; a wing supported by the main body, the right body and the left body and having a front end that is behind the front ends of the right and left bodies, an air path being defined longitudinally of the aircraft by a bottom surface of the wing and inner side surfaces of the right and left bodies; a horizontal stabilizer wherein the wing has an upper flat surface and a lower positive camber, while the horizontal stabilizer has an upper positive

camber and a lower flat surface, the wing gradually getting thinner rearward from a maximum thickness portion, a gap being formed between the wing and the horizontal stabilizer; a thrusting device in the gap; a vertical fin in the middle of the horizontal stabilizer; a rudder at the rear end of the vertical fin; and an elevator at the rear end of the horizontal stabilizer.

[0009]

As used herein, except where the context requires otherwise, the term "comprise" and variations of the term, such as "comprising", "comprises" and "comprised", are not intended to exclude other additives, components, integers or steps.

[0010]

Reference to any prior art in the specification is not, and should not be taken as, an acknowledgment, or any form of suggestion, that this prior art forms part of the common general knowledge in Australia or any other jurisdiction or that this prior art could reasonably be expected to be ascertained, understood and regarded as relevant by a person skilled in the art.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

[Fig. 1] A top plan view of an embodiment of an aircraft according to the present invention.

[Fig. 2] A bottom plan view thereof.

[Fig. 3] A cross sectional view taken along the line III-III in Fig.

1.

[Fig. 4] A front elevational view thereof.

#### BEST MODE FOR CARRYING OUT THE INVENTION

[0018]

An embodiment of the present invention will be described with respect to the drawings.

[0019]

In Figs. 1 and 2, different from a conventional aircraft, a both-end supporting wing aircraft in this embodiment is characterized in that the aircraft that is different from a conventional aircraft has not a long wing extending transversely.

[0020]

The aircraft comprises a main body 2 in the middle; a wing 3 projecting transversely from the lower part of the main body 3; a right body 4A and a left body 4B fixed to each side of the main body 3; a horizontal stabilizer 5 at the rear ends of the right and left bodies 4A, 4B; and a propeller 6 at the upper and rear ends of the main body 2. On the horizontal stabilizer 5, a vertical fin 7 and an elevator 8 are provided, while a rudder 9 is provided on the vertical fin 7.

[0021]

Between the front edge of the horizontal stabilizer 5 and the rear edge of the wing 3, there is formed a gap 10 in which a propeller 6 is disposed.

[0022]

The vertical fin 7 is disposed in the middle of the horizontal stabilizer 5, and the rudder 9 is mounted at the rear part of the vertical fin 7. The elevator 8 is mounted to the rear end of the horizontal stabilizer 5.

[0023]

In Fig. 1, the right body 4A and the left body 4B have a

hemispherical front end and the inner side surface is almost linear. Each of the right and left bodies 4A,4B have an outer side 4C.

[0024]

In Fig. 2, an inner side 4D is formed on the right body 4A and the left body 4B at the bottom of the aircraft. The bottom surface of the wing 3 is continuous with the bottom surface of the main body 2.

[0025]

In Fig. 4, the front faces of the right and left bodies 4A,4B are elliptical and the rear ends thereof are curved upward.

[0026]

The front end of the wing 3 is behind the front ends of the right and left bodies 4A,4B. A concave 3B is formed on the front edge of the wing 3.

[0027]

In Fig. 3, the wing 3 has a hemispherical front end and the upper surface of the wing 3 is flat. A positive camber 3A is formed on the lower surface of the wing 3. The wing 3 gradually gets thinner rearward from the maximum thickness portion of the wing 3.

[0028]

The front end of the wing 3 is formed as a concave 3B having a horizontal circular cross section. Owing to such shape of the concave 3B, air stream is unlikely to leave the wing 3.

[0029]

The maximum thickness portion of the wing 3 is provided at a position of  $2/10$  to  $3/10$  of the chord length from the leading edge of the wing 3. Thickness of the maximum thickness portion is  $3/10$  to  $4/10$ , preferably  $35/100$  of the chord length.

[0030]

If thickness of the maximum thickness portion was less than  $3/10$  of the chord length, the thickness of the wing 3 would not be enough and adequate lift would not be generated. If it was over  $4/10$ , air resistance would be too large. If the leading edge of the wing 3 was thicker than the maximum thickness portion, turbulence would occur.

[0031]

The wing 3 is thinner than the right body 4A and the left body 4B. The lower halves of the right body 4A and the left body 4B project from the lower surface of the wing 3.

[0032]

The wing 3, the right body 4A and the left body 4B make a gate-like frame as a whole in a vertical cross section. The bottom surface of the wing 3, the right body 4A and the left body 4B define an air path 11 extending from the leading edge to the trailing edge of the wing 3.

[0033]

In Fig. 2, a distance between the inner side 4D of the right body 4A and the inner side 4D of the left body 4B is shorter than those between the leading edges and between the trailing edges of the right body 4A and the left body 4B.

[0034]

During flight of the aircraft 1, air stream that passes in the air path 11 is accelerated by the Coanda Effect between the inner sides 4D and 4D and passes rearward.

[0035]

The main body 3 tapers rearward.

[0036]

The elevator 8 is hinged at the rear end of the horizontal stabilizer 5. The lower surface of the elevator 8 is convex, and the upper surface is flat. The side edges 5B of the horizontal stabilizer 5 project from the right and left bodies 4 outward, and the rear end of the wing 3 is close to the front end of the side edge 5B.

[0037]

The horizontal stabilizer 5 has a vertical cross section inverse to that of the wing 3 in a vertical cross section. In this embodiment, the wing 3 has an upper flat surface and a lower positive camber 3A, while the horizontal stabilizer 5 has an upper positive camber and a lower flat surface. The upper surface of the wing 3 is not limited to the shape in Fig. 3. If a positive camber is formed on the upper surface of the wing 3, the upper surface of the horizontal stabilizer 5 will be flat.

[0038]

The horizontal stabilizer 5 is higher than the rear end of the wing 3 in Fig. 3, enabling the aircraft to fly stably.

[0039]

Instead of the propeller 6, a jet engine or a rocket engine may be employed to generate thrust. If the aircraft 1 is a small plane, an unmanned plane or a model plane, a propeller may be combined with a motor driven by an electric source such as battery.

[0041]

In the aircraft 1, if necessary, a wheel (not shown) for running on the ground may be provided. The wheel is disposed on the front

of the lower surfaces of the right body 4A and the left body 4B and in the middle of the lower surface of the horizontal stabilizer 5. If the aircraft 1 is used as a flying boat, the right body 4A and the left body 4B may be used as float.

[0041]

When the aircraft 1 in this embodiment is accelerated by the propeller 6 from a rest on the ground or water, relevant stream flows into the air path 11 from the front end of the wing 3.

[0042]

Air stream passes rearward through the air path 11 along the right body 4A and the left body 4B at high speed without flowing out of the aircraft 1 transversely. The high-speed air stream pushes lower air downward. Owing to reaction of pushed air, the wing 3 is pushed up, so that the aircraft 1 gets lift.

[0043]

Flight of the aircraft 1 will be described compared with a Japanese kite.

[0044]

A tilted front face of the Japanese kite is pushed and tension is applied to a kite string for supporting the Japanese kite. With or without wind, the kite string is pulled down and air stream hits the front face. The kite floats up by reaction force and will rise to a position having a balancing angle of attack. The rising force is a component force of the reaction force so far as the kite string is not extended. When the kite string is extended, the rising force will be a resultant force of the above component force and a component force perpendicular to the front face of the kite.

[0045]

In this embodiment, instead of tension of the kite string, the aircraft is accelerated with the wing by the propeller, the above two forces will be obtained as reaction.

[0046]

While air is pushed by the propeller with the wing 3, the elevator is slightly tilted downward. A floating force applied to the wing is restricted, so that the aircraft flies slightly above the ground.

[0047]

With increase in thrust of the propeller 6, the elevator 8 is tilted upward, and the front of the aircraft 1 is raised. Furthermore, in proportion with increase in thrust of the propeller, the aircraft 1 gets a large reaction force and is accelerated to rise.

[0048]

The angle of attack of the wing 3 increases remarkably. However, the front ends of the wing 3, the right body 4A and the left body 4B are hemispherical, so that air does not leave the leading edge of the wing 3. Thus, the aircraft does not go into a stall or does not crash.

[0049]

Air passes through the air path 11 rearward and is restricted by the camber 3A at the front part of the wing 3 and a sectional area of the air path 11 increases rearward. By the Coanda Effect, high-viscosity slow stream is generated along the bottom surface, the inner side surface of the right body 4A and the inner side surface of the left body 4B.

[0050]

High-speed air stream is produced, and large thrust can be applied to the wing by the high-speed air stream.

[0051]

In low-speed flight where output of the propeller 6 is small, a force of the aircraft 1 for pushing lower air downward is weak. The angle of attack of the whole aircraft 1 increases and a forward component force of thrust by the propeller 6 is small.

[0052]

With increase in power of the propeller 5, a force for limiting air by the wing 3 gets stronger, and the angle of attack gets smaller. The component force of thrust by the propeller 6 gets greater in a forward direction, enabling the aircraft to fly at high speed.

[0053]

Depending on thrust of the propeller 6, the angle of attack of the aircraft 1 can be changed, assuring stable flight. If wind speed is equal to the forward component force of the aircraft 1, the aircraft 1 will hover.

[0054]

The vertical cross section of the horizontal stabilizer 5 is in inverse relationship with the vertical cross section of the wing 3. Lift is generated on the upper surface of the horizontal stabilizer 5 by negative pressure, and the lift opposes a moment for raising the whole wing 3 forward, making its flight posture more stable.

[0055]

In this embodiment, the air path 11 is single, but a plurality of air paths may be formed side by side. The ratio of the air path 11 to the wing 3 may be preferably at least  $1/2$ . If it was less than  $1/2$ ,

floating force of the aircraft would not be enough, so that it would be necessary to strengthen the power of the propeller 6. The depth of the air path 11 may be determined such that the aircraft does not slide sideward.

#### INDUSTRIAL APPLICABILITY OF THE INVENTION

[0056]

The aircraft can be widely used to fly stably even at low speed.

## CLAIMS:

1. A both-end supporting wing aircraft comprising:
  - a main body having a front end;
  - a right body disposed at one side of the main body and having a front end;
  - a left body disposed at the other side of the main body and having a front end, the front ends of the right and left bodies being behind the front end of the main body;
  - a wing supported by the main body, the right body and the left body and having a front end that is behind the front ends of the right and left bodies, an air path being defined longitudinally of the aircraft by a bottom surface of the wing and inner side surfaces of the right and left bodies;
  - a horizontal stabilizer wherein the wing has an upper flat surface and a lower positive camber, while the horizontal stabilizer has an upper positive camber and a lower flat surface, the wing gradually getting thinner rearward from a maximum thickness portion, a gap being formed between the wing and the horizontal stabilizer;
  - a thrusting device in the gap;
  - a vertical fin in the middle of the horizontal stabilizer;
  - a rudder at the rear end of the vertical fin; and
  - an elevator at the rear end of the horizontal stabilizer.
2. The aircraft of claim 1 wherein the maximum thickness portion has a thickness ranging from  $\frac{3}{10}$  to  $\frac{4}{10}$  of a chord length of the wing, the maximum thickness portion being formed at a position of  $\frac{2}{10}$  to

3/10 of the chord length from a leading edge of the wing.

3. The aircraft of claim 1 wherein the wing has a concave shape at the front end.

4. The aircraft of claim 2 wherein each of the right body and the left body have the maximum thickness portion at the same position as that of the wing.

5. The aircraft of claim 1 wherein the front end of each of the right body and the left body is formed as hemisphere.

6. The aircraft of claim 1 wherein the front end of the main body is formed as hemisphere.

7. The aircraft of claim 1 wherein the elevator is hinged to the rear end of the horizontal stabilizer, the elevator having an upper flat surface and a lower positive camber.

8. The aircraft of claim 1 wherein the thrusting device comprises a propeller.