Feb. 7, 1967 M. LAZAREFF 3,302,908

UNMANNED FLYING MACHINE

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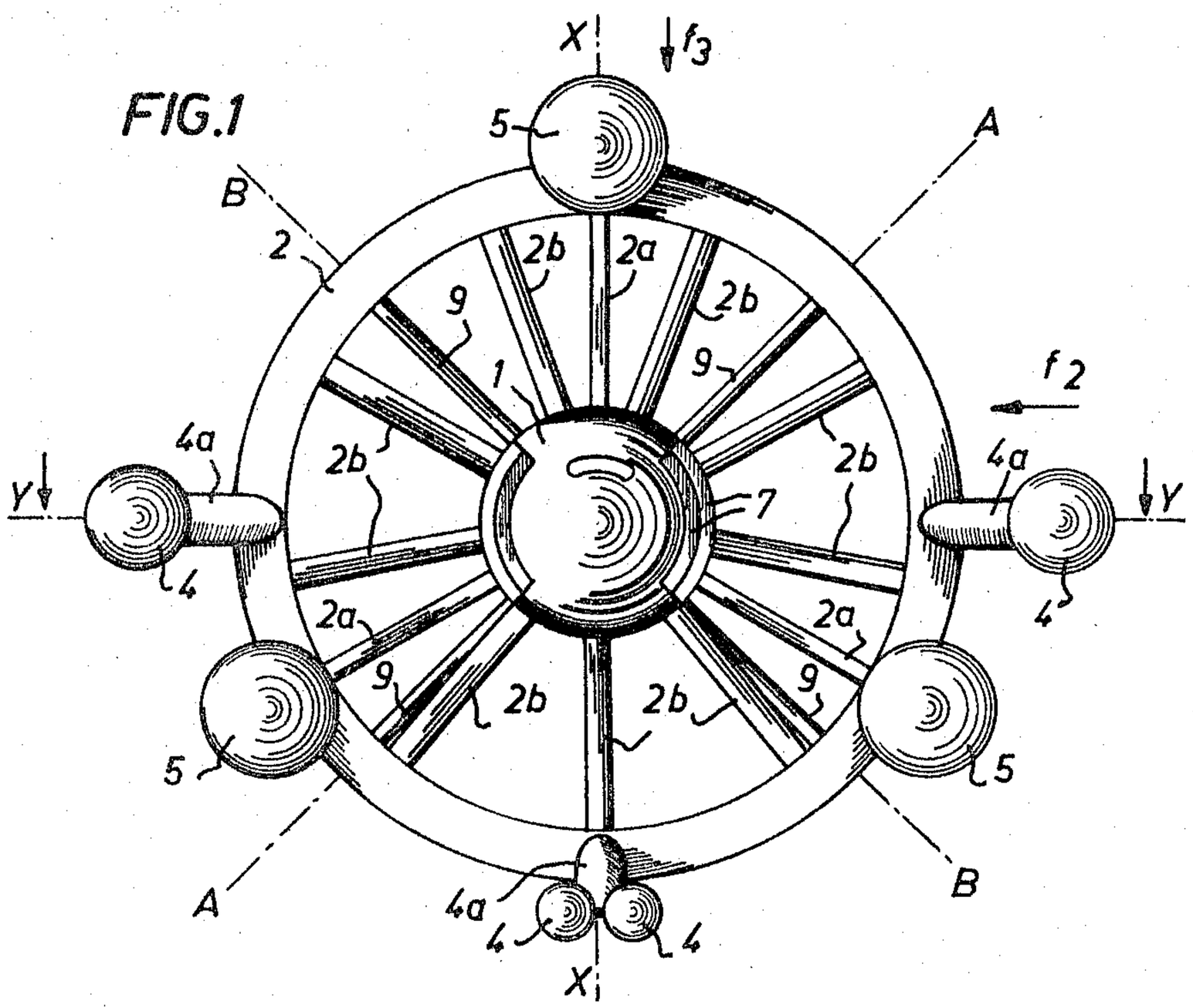
FIG.1



Inventor:
Michel Lazareff
By
Lon W. Flocks
Attorney

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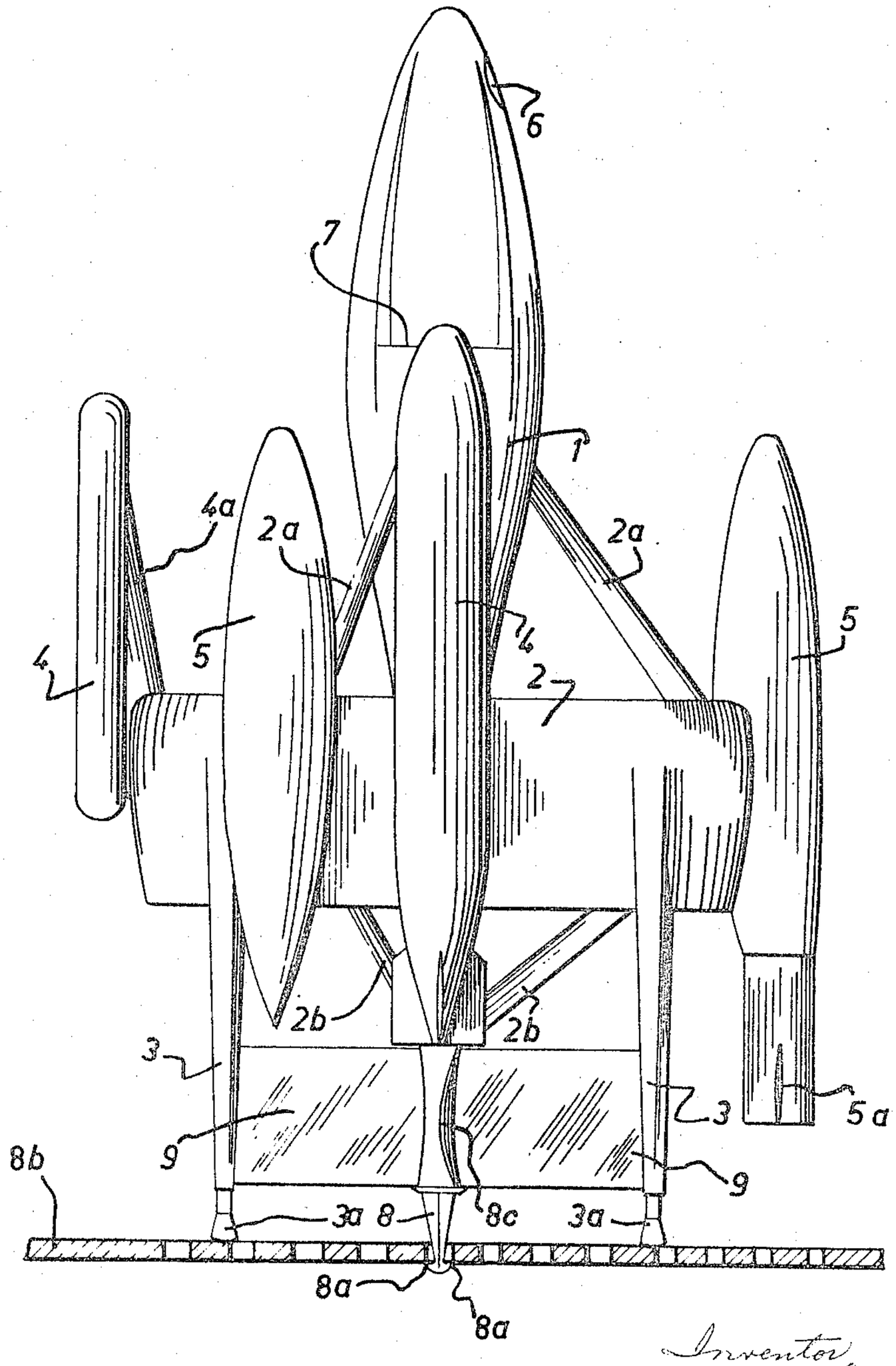
FIG. 2



Inventor
Michel Lazareff
By
Karl O. Flocks
Attorney

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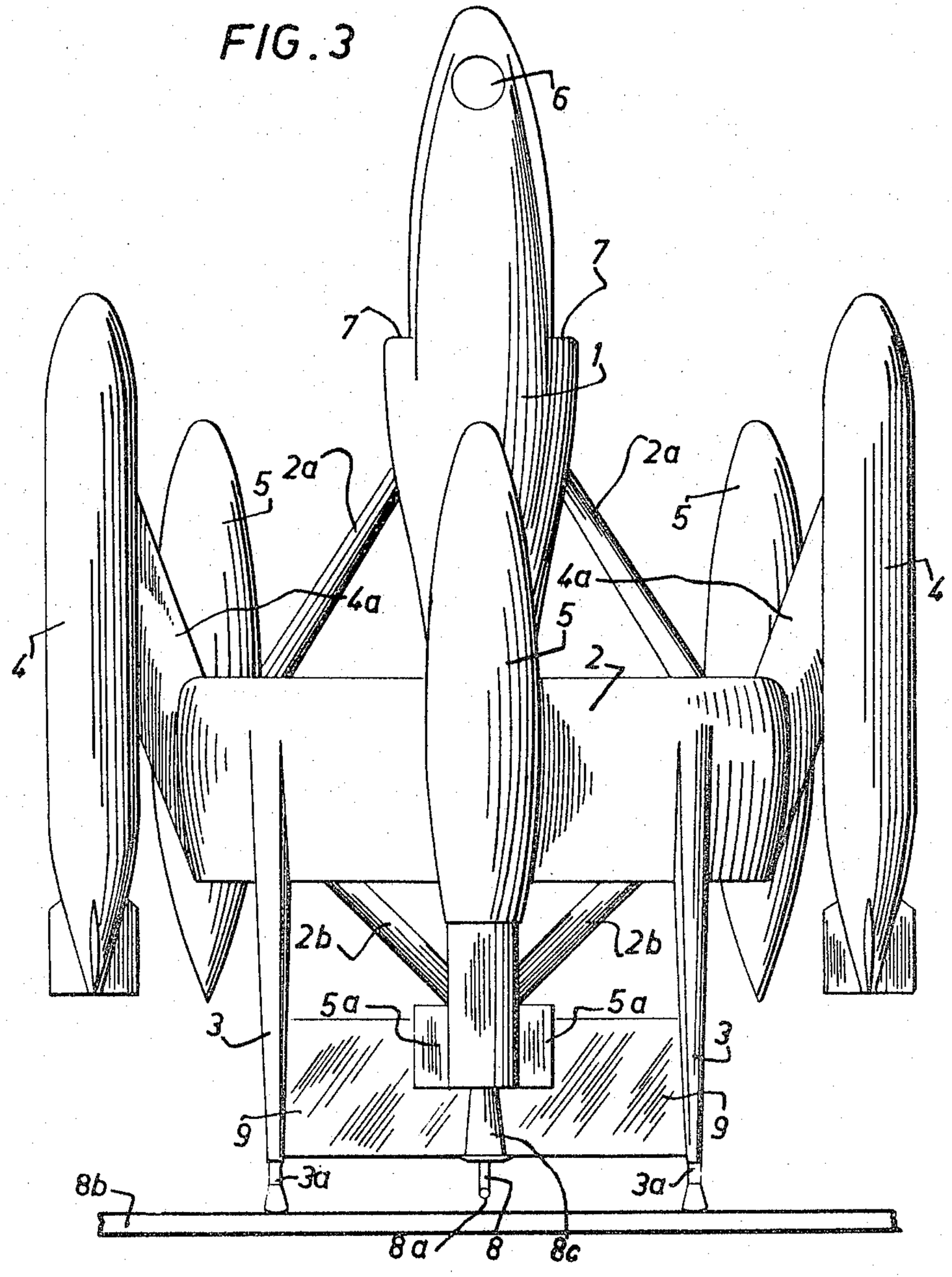
FIG. 3



Inventor:
Michel Lazareff
By
Kenneth W. Rocks
Attorney

Feb. 7, 1967 M. LAZAREFF 3,302,908

UNMANNED FLYING MACHINE

Filed Dec. 29, 1964 4 Sheets-Sheet 4

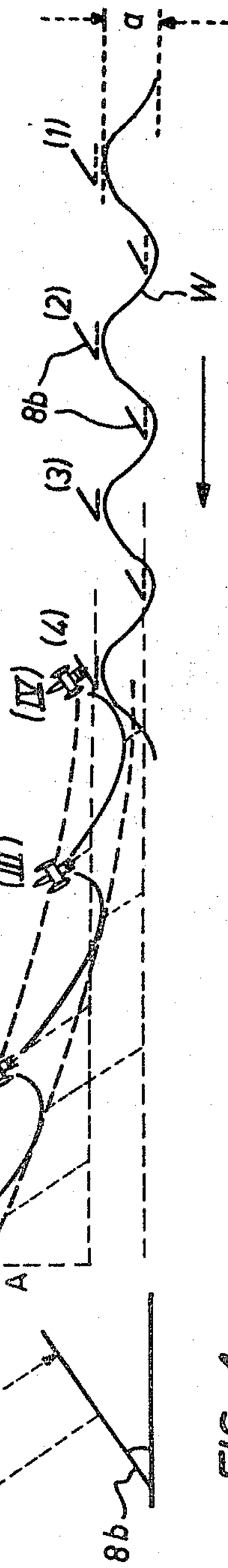


FIG. 4

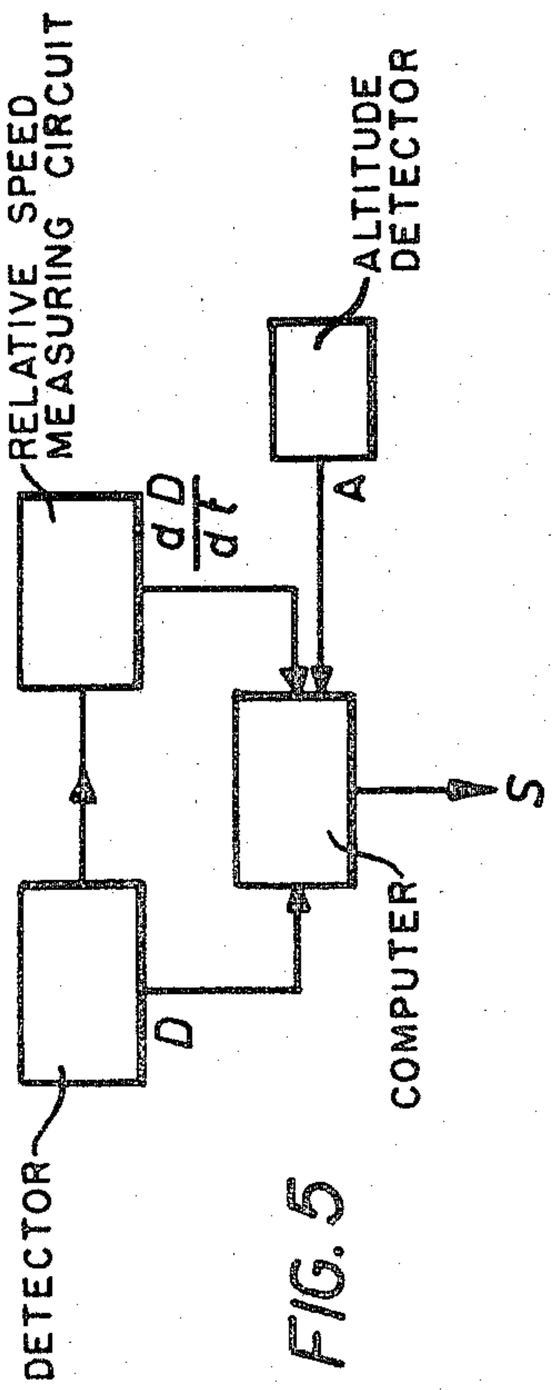


FIG. 5

FIG. 6

Inventor:
Michel Lazareff
By
Karl W. Flocks
Attorney

United States Patent Office

3,302,908

Patented Feb. 7, 1967

3,302,908

UNMANNED FLYING MACHINE

Michel Lazareff, Paris, France, assignor to Nord-Aviation Societe Nationale de Constructions Aeronautiques, Paris, France, a joint-stock company of France

Filed Dec. 29, 1964, Ser. No. 421,801
Claims priority, application France, Jan. 9, 1964, 959,849, Patent 1,389,617
2 Claims. (Cl. 244—77)

The present invention relates to an improved unmanned flying machine capable of carrying out aerial missions at high speed without the presence of a pilot.

At the present time helicopters are known which permit flights to be effected at high speed together with stationary flights, but these helicopters are vulnerable and bulky and a human pilot is necessary.

Flying platforms are also known which are either captive, that is to say attached to the ground, or free. However, the latter are unable to return to the ground without the aid of a pilot.

The present invention has therefore for its object an unmanned flying machine permitting, in the absence of a pilot, to take-off and land vertically and more particularly to take-off from a platform subjected to the movements of the sea and which is capable of returning to this platform under any atmospheric conditions whatever.

The improved flying machine may comprise at least one faired propeller driven by a turbo-propulsion unit, the tractive pull of the propeller effecting simultaneously the lift and the propulsion; of controls placed in the air-stream of the propeller. According to the invention said machine also comprises a distant control device; a special altitude piloting device on board the machine for landing on a platform subjected to the movement of waves; and a gripping device released by the impact of the said improved machine.

The present machine can be controlled from a single station, in which all the data necessary for the execution of a predetermined mission is available.

Other characteristic features and advantages will become apparent from the description which follows below of two forms of embodiment of the invention, reference being made to the accompanying diagrammatic drawings, in which:

FIG. 1 is a plan view looking on the top of a first form of embodiment of the improved flying machine according to the invention;

FIGS. 2 and 3 are views in elevation, taken respectively in the direction of the arrows f_2 and f_3 of FIG. 1;

FIG. 4 is an explanatory diagram showing the inclination of the machine and a landing platform;

FIG. 5 shows diagrammatically an altitude piloting device with which the machine is provided;

FIG. 6 is an explanatory diagram of the arrangements and devices for landing the machine on a platform subjected to the action of waves.

In FIGS. 1 to 3, the propulsion unit comprises a turbo-propulser **1**, driving a faired propeller (propeller not shown, fairing **2**) which provides simultaneously the lifting force and the lateral movement power of the flying machine. Its equilibrium about a given position and its control are obtained by means of controls located in the air-stream of the propeller. The stabilization in altitude is ensued by varying the pitch of the propeller.

The strong structure of the flying machine is essentially constituted by the fairing **2** and by a driving frame represented by stays or brackets **2***a* and **2***b*. This structure or machine can rest on the ground by means of four landing supports or legs **3**, arranged at the corners of

a square. It can be fixed on a platform or a deck by means of a harpoon **8** provided with hooks **8***a* which grip a grid **8***b* rigidly fixed to the platform or the deck. The machine can be held on the grid **8***b* by means of the harpoon and jacks **3***a* mounted on each of the supports **3**. The grid **8***b* can form part of the lift of a floating aircraft-carrier unit. The harpoon **8** is movable inside a cylinder **8***c*.

On the machine there is fixed the useful load composed preferably of streamlined bodies **4**, with or without tail-fins, and tanks **5** which may also be of streamlined shape. The positions of the bodies **4** and the tanks **5** are chosen so as to provide good accessibility. The bodies **4** which constitute the useful load are preferably carried on the extremities of arms or brackets **4***a*.

The propeller (not shown) is completed by an upstream corrector composed of blades with pitch controlled in dependence on the pitch of the propeller blades so as to eliminate all or part of the overturning couple; in the case of symmetrical loads, this corrector is controlled so as to eliminate the couple. In the case where there is an unbalanced rolling (after release of a load) the corrector is controlled so that the resulting engine torque acts in opposition to this unbalance.

The rudders **9** are arranged in two perpendicular planes A—A and B—B. The two half-rudders of each plane can carry out differential movements about each symmetrical rudder position, so that the four half-rudders contribute to the control of rolling (in addition to the corrector upstream of the propeller which plays the part of a trim control).

The rudders **9** are arranged between the support **3** in such manner that their planes A—A and B—B follow the diagonals of the quadrangle surface formed by the said supports and so that the harpoon **8** and its cylinder **8***c* located in the extension of the turbo-propulsion unit, occupy the intersection of the two planes.

It should be observed that one of the streamlined tanks is provided with stabilizing fins **5***a*.

By reason of an essential question of centering with respect to the line of action of the resultant of the internal aero-dynamic forces, the propeller turbine **1** is arranged upside down in front of the intake plane of the fairing **2**. The ejection of the propeller turbine is thus located at the extreme front; in order to avoid the undesirable component of the residual thrust, the discharge nozzle is composed of one or split into a number of branches, the outlet orifices of which can be seen at **6**, arranged at right angles, to a vertical plane XX. The supply of air to the propeller turbine is effected through two inlets **7**, arranged in a plane YY perpendicular to the plane XX of the discharge nozzle, so as to prevent any risk of recycling of the combustion gases (FIG. 1).

The flying machine according to the invention comprises a conventional distant control system from the ground and, in addition, a special piloting device at a selected altitude from the ground, permitting the machine to be landed on a deck.

On the return journey, before landing on deck, the machine has a mean inclination to the vertical which is a function of its speed relative to the air. At 60 km. per hour, this inclination is of the order of 35°. The landing platform (the upper part of the storage lift for example) is pre-inclined at approximately the same angle to the horizontal, as shown in FIG. 4.

The piloting device shown diagrammaticaly in FIG. 5 comprises:

An appropriate detector (radar, infra-red detector) mounted on the flying machine, positioned so as to detect at every instant, the distance D which separates it from

the horizontally projected level of the landing platform on a normal to the platform;

An electronic measuring circuit associated with the detector, giving at every instant, with a certain approximation, a signal *dD/dt,* the relative vertical speed of the flying machine and the ship;

An appropriate electronic computer circuit receiving the signals D and *dD/dt* and the real altitude detected from the flying machine (with an altimeter) and permitting the preparation of an altitude order signal S to be given to the flying machine to operate its thrust and rudder controls.

This altitude order signal is such that the machine, in its attempt to follow this order, possesses a movement of its own approaching as close as possible to the upward and downward motion W of the ship when a deck landing is possible (see FIG. 6).

When the sea is rough and the height of the waves "*a*" is of large amplitude, the order signal is such that the machine descends at low speed when the ship is in the hollow of a wave, but it rises again when the ship is in the hollow of a wave, but it rises again when the ship tends to move upwards (trajectory C) thus permitting a correct deck landing when the ship is on the crest of the wave (position IV).

The deck landing is correct when the contact of the machine with the deck of the ship is effected at a low relative speed. In view of the limited power of the machine, the above-described process of deck-landing is necessary, otherwise a shock would be produced at the moment when the deck of the ship moves upwards.

The law which permits the calculation of the altitude order to be given to the flying machine as a function of D, *dD/dt* and of the altitude may be expressed in a strictly mathematical form which depends on the characteristics of the machine (power available, mass, etc.).

The last phase of the relative trajectory is normal to the flying machine thus inclined. The central harpoon **8**, is then released in order that by sliding in its cylinder, its spokes may engage in a grid **8***b*, of the deck-landing platform and prevent any subsequent separation. Immediately after this fixing, the jacks **3***a*, with which the supports **3**, of the machine are equipped, immobilize the machine by bracing themselves against the landing platform.

The release of the harpoon **8** is effected as soon as the supports **3**, come into contact with the platform, by the unlocking of a mechanical, pneumatic, hydraulic or other operating device.

It will of course be understood that the present invention has only been described and shown by way of explanation and not in any limitative sense, and that modifications of detail may be made thereto without thereby departing from its scope.

I claim:

1. Altitude piloting device provided in addition to a conventional distant control system mounted in an unmanned flying machine having an automatic pilot and capable of landing on a deck-landing platform subjected to the movements of the sea and including means for automatically anchoring said machine to the said platform upon contact of the machine therewith, said altitude piloting device comprising:

a detector detecting at each instant the distance D along the direction of flight of the machine separating the machine from the horizontally projected level of the deck-landing platform;

an electronic measuring circuit associated with the said detector and giving at each instant a signal *dD/dt* representing the relative speed of the machine with respect to the horizontally projected level of the deck-landing platform;

a second detector giving the altitude A of the machine;

an electronic computer receiving the signals D, *dD/dt* and A and giving an altitude order signal to the automatic pilot.

2. Altitude piloting device provided in addition to a conventional distant control system mounted in an unmanned flying machine having an automatic pilot and capable of landing on a deck-landing platform subjected to the movements of the sea and including means for automatically anchoring said machine to the said platform upon contact of the machine therewith, said altitude piloting device comprising:

a detector detecting at each instant the distance D along the direction of flight of the machine separating the machine from the horizontally projected level of the deck-landing platform;

an electronic measuring circuit associated with the said detector and giving at each instant a signal *dD/dt* representing the relative speed of the machine with respect to the horizontally projected level of the deck-landing platform which is inclined in accordance with the inclination to the vertical of the machine which is a function of its speed;

a second detector giving the altitude A of the machine;

an electronic computer receiving the signals D, *dD/dt* and A and giving an altitude order signal to the automatic pilot.

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FERGUS S. MIDDLETON, *Primary Examiner.*