VTOL WITH FRAME EXTENDING THROUGH THE ROTOR

BACKGROUND ART

The closest prior art is the US patent application publication US20090050733 (titled: SIMPLE VTOL FLYING MACHINE) disclosing a Portable Flyer powered by an opposed piston engine driving two counter-rotating intermeshing rotors.

Close prior art is the GB2,515,369 patent disclosing an unconventional two-stroke opposed-piston engine suitable for Portable Flyers.

In a conventional helicopter, Fig 1, as the big diameter main rotor rotates it divides the space into an area above the main rotor and an area underneath the main rotor wherein the fuselage is. Only the area underneath the main rotor is reachable / accessible at operation. The fuselage has a tail boom, at the end of which the tail rotor is mounted.

In a conventional helicopter with a pair of contra rotating “coaxial” rotors of big diameter, Fig 4, the top rotor divides the space into an area towards the fuselage and a separated area above the top rotor. The top rotor is mounted at the top of a shaft passing through another long and holed shaft that holds and drives the bottom rotor.

While many small airplanes are now equipped with a rescue parachute for emergency landing, a rescue parachute is problematic for helicopters (with the main obstacle / risk being the rotating rotor above the fuselage and above the cage wherein the rescue parachute is housed).

The tail rotor, which is a main cause of fatal accidents in helicopters, can be arranged differently.

SUMMARY OF THE INVENTION

This invention is about a Vertical Take Off / Landing (VTOL) vehicle comprising at least a frame bearing a load and a rotor providing lift, the rotor is dividing the space in an area above the rotor and an area underneath the rotor wherein the load is arranged, the rotor has a hollowed center hub, through the hollowed center hub of the rotor the frame extends upwards, providing room and support for keeping a rescue parachute in the area above the rotor, so that in case of emergency the deployment of the rescue parachute has not the obstacle of a rotating rotor above it.

This invention is also about different design approaches resulting from the new architecture wherein the frame passes above the top main rotor of the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig 1 shows the arrangement of a conventional helicopter of the prior art. There is a main rotor providing the lift and a tail rotor providing the necessary reaction torque.

Fig 2 shows a fist embodiment of the present invention. The arrangement provides room and support above the rotating main rotor, wherein a rescue parachute can be stored. In this arrangement the frame of the helicopter, passing through the hollowed hub of the main rotor, forms a tail boom above the main rotor, with a tail rotor at its end.

Fig 3 shows the first embodiment with the rescue parachute deployed. The deployment of the rescue parachute can happen with the main rotor rotating, or auto-rotating, or at stall.

Fig 4 shows a conventional helicopter having two contra-rotating big diameter rotors.

Fig 5 shows a second embodiment of the present invention wherein the frame of the helicopter passes through the holed hubs of the two contra-rotating rotors, with a rescue parachute housed at the top end of the frame, above the top rotor.
Fig 6 shows a third embodiment of the present invention. The frame of the VTOL vehicle is actually a long mast / pipe with several main rotors (each powered by its own engine and transmission) rotatably mounted on the frame / mast to provide the required lift. At the top of the frame / mast a rescue parachute is stored in a cage, above all main rotors. In the basket at the bottom of the pipe there is room for several people, or for water for fire fighting, or for cargo etc.
Fig 7 shows a fourth embodiment. Two Opposed Piston engines (GB2,515,369 patent) are mounted on a frame, the one above the other. Each engine drives, by means of sprockets and toothed belts, two counter-rotating rotors. The rotors have hollowed hubs and are supported by bearings on the two perpendicular beams of the frame. These beams extend above the top rotors, providing support for a cage wherein a rescue parachute is stored. The fuel for the top engine and the control of the top engine (like the gas cable, the electrical cables etc) pass through passageways and holes made in the frame beams. With two independent propulsion units (each comprising an engine and two counter-rotating rotors driven by the engine) and a rescue parachute instantly deployable, the safety of this Flyer is improved.
Fig 8 shows the fourth embodiment from a side viewpoint.
Fig 9 shows the fourth embodiment secured on the shoulders of a pilot / rider. At the top of the frame beams they are secured two cones wherein rescue parachutes are stored. Besides housing

rescue parachutes, the cones are improving the aerodynamic behavior of the rotors below them.

Fig 10 shows the fourth embodiment with the engines and the rotors removed.

Fig 11 shows a fifth embodiment.

Fig 12 shows the fifth embodiment from another viewpoint.

Fig 13 shows the fifth embodiment from another viewpoint.

Fig 14 shows the fifth embodiment from a side viewpoint. The main rotor is rotatably mounted on a frame extending upwards from the fuselage. The outmost parts of the rotor wings provide the required lift. A wing having a pair of propellers at its ends is secured on the frame in the area above the rotor.

PREFERRED EMBODIMENTS

In a first embodiment, Figs 2 and 3, the frame of a helicopter extends above the fuselage and passes, through the hollowed hub of the main rotor, above the main rotor, with a tail boom (extension of the frame above the main rotor) extending backwards and bearing the tail rotor. The engine(s) of the helicopter can be mounted either above the main rotor, or below it (because there is frame at both sides of the main rotor). Through passageways in the frame, fuel and control cables can pass from the space above the main rotor to the space underneath the main rotor and vice versa.

The space in the cone above the main rotor houses a rescue parachute.

Either the main rotor rotates, or it auto-rotates, or it is stopped, the rescue parachute (preferably a ballistic parachute) can be deployed instantly.

In a second embodiment, Fig 5, two contra-rotating rotors, each having a hollowed hub, are rotatably mounted on the frame of the helicopter that extends upwards like a pipe or mast. At the top of the pipe / frame it is housed / stored a rescue parachute in a cage secured onto the frame above the top rotor that provides substantial lift. The engine or engines can be mounted either above the top rotor, or bellow the lower rotor, or in the space between the rotors, with fuel tubes and control cables passing through the pipe / frame.

In a third embodiment, Fig 6, the VTOL (Vertical Take Off and Landing vehicle) is actually a pipe / a mast whereon several rotors, having hollowed hubs, are rotatably mounted. Each “horizontal” rotor is powered by its own motor – transmission, with fuel and / or control and / or power (like electric power, for instance) provided through passageways in the pipe / mast. At the top of the pipe a rescue parachute is housed in a cage. At the top of the pipe is shown another engine / propeller for the propulsion of the VTOL at the desirable direction in a way similar to that in the airships (the “horizontal” rotors are providing the required lift).

The structure is quite simple, robust, lightweight and safe, and fits for air-cranes, for fire fighting, for evacuation of hazardous areas etc.

In a fourth embodiment, Fig 7 to 10, the VTOL is a Portable Flyer. Its frame passes through the rotors providing support for a cage above the top propeller, wherein a rescue parachute is housed. With the two independent propulsion units (each comprising an opposed piston engine, two rotors and the transmission from the crankshafts to the rotors) and one (or two) rescue parachutes instantly deployable, the safety improves above current standards.

The two counter rotating crankshafts of each engine “share” the same combustion chamber keeping the basis perfectly rid of inertia vibrations and of combustion vibrations.
The basis (i.e. the rider / pilot) needs not to provide any reaction torque (not even at extreme changes of revs and load).
With the symmetric counter-rotating rotors (and crankshafts), the total "gyroscopic rigidity" is zero, i.e. the rider can "instantly" (as instantly as with the rotors stopped) vector the thrust to the desirable direction.
The above make "a true neutral propulsion unit": neither vibrations, nor reaction torque, nor gyroscopic rigidity; only a force that can "instantly" and effortlessly be vectored towards the desirable direction.
As aerodynamic "controls" the rider / pilot can use his legs, hands and body, just like the wing-suiters do. A wing-suit fits with the Portable Flyer, especially for long flights and fast aerobatics.
With 1m diameter rotors and 100Kp (220lb) total (including the rider and the fuel) take-off weight, the rotor "disk loading" is only half of the rotor "disk loading" of the Osprey (Bell Boeing V22).
And this is with the one only propulsion unit in action.
As the Osprey, the Portable Flyer is capable for "vertical take-off / landing (like a helicopter) and for long distance flights at high speed and low fuel consumption (like an airplane).
In the Osprey the malfunction of both engines, or the collapse of the one rotor, or the failure of the transmission may turn out fatal, especially during a vertical take-off or landing.
In comparison, the Portable Flyer of the fourth embodiment is safer, as explained in the following.

The failure of the transmission of the one propulsion unit of the Portable Flyer is not of vital importance because the other propulsion unit, alone, has its own transmission and is capable for the safe landing of the vehicle.

On the same reasoning, the malfunction of the one engine of the Portable Flyer is not of vital importance because there is another independent engine having its own rotors and transmission.

Even in the case wherein both engines fail, or in case the Portable Flyer runs out of fuel, the Portable Flyer can still, using the rescue parachute(s), land safely.

In a fifth embodiment, Figs 11 to 14, the main rotor provides lift with the ends (say the outmost 1/3) of its wings. The main rotor is rotatably mounted on a pipe comprising a part of the frame and extending, through the hollowed hub of the main rotor, above the main rotor wherein a wing is secured on the frame. The wing is having a pair of propellers at its ends. During a vertical take off, the propellers on the wing provide the necessary reaction torque. Later most of the power goes to the propellers on the wing to propel the vehicle forwards. As the horizontal speed of the vehicle increases, the main rotor is decelerating until stall. Then the main rotor is secured on the frame at a direction providing the minimum aerodynamic resistance and instability, and the vehicle flies like an airplane (in a way like the Osprey V22).

APPLICATIONS

In Portable Flyers.

In small, medium and big helicopters.

In air-cranes.

In rescue VTOL’s etc.

CLAIMS

What is claimed is:

1. A Vertical Take Off / Landing (VTOL) vehicle comprising at least a frame bearing a load and a rotor providing lift, the rotor is dividing the space in an area above the rotor and an area underneath the rotor wherein the load is arranged, the rotor has a hollowed center hub, through the hollowed center hub of the rotor the frame extends upwards providing room and support for equipment arranged above the rotor.

2. A Vertical Take Off / Landing (VTOL) vehicle according claim 1 wherein the frame extending above the hollowed hub of the rotor provides room and support for a rescue parachute in the area above the rotor, so that in case of emergency the deployment of the rescue parachute has not the obstacle of a rotating rotor above it.

3. A Vertical Take Off / Landing (VTOL) vehicle according claim 1 wherein the frame extending above the hollowed hub of the rotor forms a tail boom arranged above the rotor, the tail boom is having a tail rotor at its end.

4. A Vertical Take Off / Landing (VTOL) vehicle according claim 3 wherein the frame comprises passageways for the control required for the equipment above the rotor.

5. A Vertical Take Off / Landing (VTOL) vehicle according claim 1 wherein the frame extending above the hollowed hub of the rotor has the form of a mast, additional rotors are rotatably mounted on the mast above the rotor, fuel and / or control and / or power pass from the area underneath the rotor to the area above the rotor through passageways made in the mast.

6. A Vertical Take Off / Landing (VTOL) vehicle according claim 5 wherein one or more of the additional rotors is driven by a motor arranged above the rotor.

7. A Vertical Take Off / Landing (VTOL) vehicle according claim 1 wherein the frame extending above the hollowed hub of the rotor provides mounts for a wing, at high speeds of the vehicle the wing provides a substantial part, or all, of the required lift.

8. A Vertical Take Off / Landing (VTOL) vehicle according claim 7 wherein propellers rotatably mounted on the wing provide reaction torque during a vertical take off and thrust during a horizontal flight.

9. A Vertical Take Off / Landing (VTOL) vehicle according claim 1 wherein the “rotor providing lift” is the “top rotor providing substantial lift” of the vehicle.

10. A Vertical Take Off / Landing (VTOL) vehicle according claim 1 wherein the Vertical Take Off / Landing vehicle is portable and is carried on the shoulders of a pilot / rider.

11. A Vertical Take Off / Landing (VTOL) vehicle according claim 10 wherein the pilot / rider is a fuselage, and the steering controls are his hands, head and legs.

ABSTRACT

A Vertical Take Off / Landing vehicle having a frame bearing a load and a rotor providing lift, the rotor is dividing the space in an area above the rotor and an area underneath the rotor, the load is arranged in the underneath the rotor area, the rotor has a hollowed center hub, through the hollowed center hub of the rotor the frame extends upwards providing support and room for a rescue parachute in the area above the rotor, so that in case of emergency the deployment of the rescue parachute has not the obstacle of a rotating rotor above it.