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(54) Title: AIRCRAFT HYBRID PROPULSION

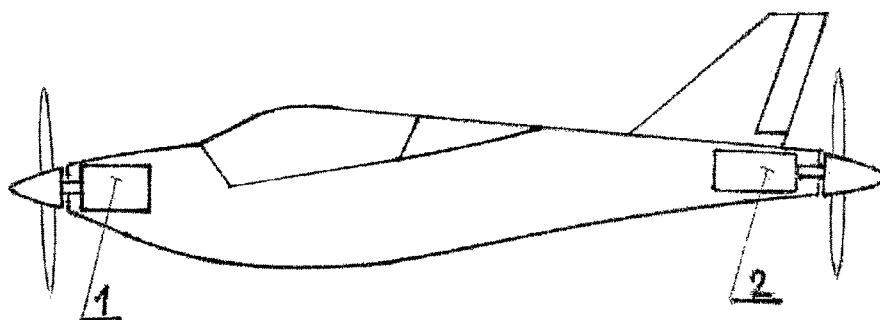


Fig. 1

(57) Abstract: The invention relates to the aircraft hybrid propulsion, consisting of two propeller propulsion units, one of which is based on the principle of an internal combustion engine (1), with a propeller and the second one on the principle of an electric motor (2) with a propeller characterized in that the propulsion units are installed without an interdependent mechanical coupling in the push-pull configuration in the direction of flight on the aircraft fuselage, so that one of the propulsion units (1, 2) is located in the forward fuselage and generates a propulsion effect using a tractor propeller and the second one of the propulsion units (1, 2) is located in the rear fuselage and generates a propulsion effect using a pusher propeller and the batteries supplying the energy to the electric motor are rechargeable by recuperation during flight. From the electric motor with a propeller (2) and/or from a generator installed on the internal combustion engine (1).

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## Aircraft Hybrid Propulsion

### Technical Field

The invention relates to an aircraft propulsion system, applying the electric motor and internal combustion engine principles.

### Background Art

At present, most of the practically usable aircraft are powered by propulsion units, creating the propulsion by converting the chemical energy contained in the fuel to the thermal energy and then by the expansion to the mechanical energy. This energy is used for accelerating the air flow by the propeller and based on the momentum conservation principle the thrust necessary for the aircraft motion is generated. Besides this basic principle of the energy conversion used for the propulsion, attempts to utilize for the propulsion the electrical energy by its conversion to the mechanical energy in the electric motor are emerging recently. These electric motors are able, because of the limited capacity of the batteries, to power only lighter aircraft, mostly aircraft models. There appear also experiments attempting to overcome the limitations of the capacity of the batteries by the application of a hybrid propulsion (a combination of an internal combustion engine and an electric motor), which are conceived as an analogy to the hybrid automobiles drive systems. In the frame of the this concept, there exists either a mechanical coupling between the combustion engine and the electric motor, constituting a coupled drive train to a single propeller only and this way both propulsion units are interdependent, or the combustion engine is only a source of energy for the battery charging. These designs have disadvantages, from the point of view of the aircraft applications, mainly with regard to their complexity, weight and reliability. The propulsion of heavier aircraft used for the passenger or cargo transport is in the experimental phase. Because of the future limited availability of the hydrocarbon fossil fuels on the crude oil bases, the trend of the electrical energy utilization for the aircraft propulsion gains increasing importance.

### Disclosure of the Invention

The disadvantages and limited capabilities of a purely electrically powered aircraft are eliminated by the proposed hybrid propulsion, which simply combines two independent propeller propulsion units, comprising an internal combustion engine with a propeller and an electric motor with a propeller.

The basis of the conceptual arrangement according to the invention is the push-pull configuration of both kinds of propeller propulsion units on the aircraft fuselage. One propeller propulsion unit is installed in the forward fuselage in the tractor configuration and the other propeller propulsion unit is located in the rear fuselage in the pusher configuration. This propulsion units arrangement has no internal mechanical coupling and allows either a combined operation of both propulsion units, when both units generate maximum propulsive effect or, coincidentally, this arrangement allows independent operation of one of the propulsion units only, e.g. during the cruise flight, when the energy of the second propulsion unit is saved. At the same time, another advantage of this concept presents the alignment of both propulsion units / propeller axes with the main longitudinal fuselage / aircraft axis so that the propulsion units axes may be located either in the proximity of the main aircraft/ fuselage axis or may be identical with the main aircraft / fuselage axis and this way is eliminated the yawing moment, which is otherwise important during the one engine inoperative flight of the aircraft with a conventional configuration of engines installed on the wings.

Another advantage of the independent configuration of the propulsion units presents the possibility of a recuperation charging of batteries during flight using the electric motor in a generator mode, driven by the propeller. This system of charging during flight may be also combined with charging of the batteries from the generator on the internal combustion engine as well as from the ground source and the electricity distribution grid.

### Brief Description of Drawings

The invention will be further explained by the Figure 1, showing a side schematic view of the propeller propulsion units' installation in the aircraft fuselage.

### Best Mode for carrying out the Invention

The aircraft hybrid propulsion, according to the Figure 1, consists of two propeller propulsion units, independent of each other, in a push-pull configuration. The forward tractor propeller propulsion unit 1 may be either electric motor or internal combustion propulsion unit. The rear pusher propeller propulsion unit 2 is located on the rear of the fuselage and may be either electric or internal combustion propulsion unit depending on what kind of propeller propulsion unit is used as the forward unit. The propeller axes of both the propulsion units, the forward as well the rear, are arranged in parallel/ coaxial with the fuselage main longitudinal axis of symmetry.

The batteries supplying the electric motor 2 are rechargeable during flight by the recuperation from the electric propeller with a propeller 2 and/or from the generator installed on the internal combustion propulsion engine 1.

CLAIMS

1. The aircraft hybrid propulsion consisting of two propeller propulsion units, one of which is based on the principle of an internal combustion engine (1) with a propeller and the second one on the principle of an electric motor (2) with a propeller, characterized in that the propulsion units are installed without an interdependent mechanical coupling in the push-pull configuration in the direction of flight on the aircraft fuselage, so that one of the propulsion units (1, 2) is installed in the forward fuselage and generates a propulsion effect using a tractor propeller and the second one of the propulsion units (1, 2) is installed in the rear fuselage and generates a propulsion effect using a pusher propeller and the batteries supplying the energy to the electric motor are rechargeable during flight.
2. The aircraft hybrid propulsion according to the claim 1, characterized in that the batteries supplying the energy to the electric motor (2) are rechargeable during flight by recuperation using the electric motor with a propeller (2) and/or using a generator installed on the internal combustion engine (1).

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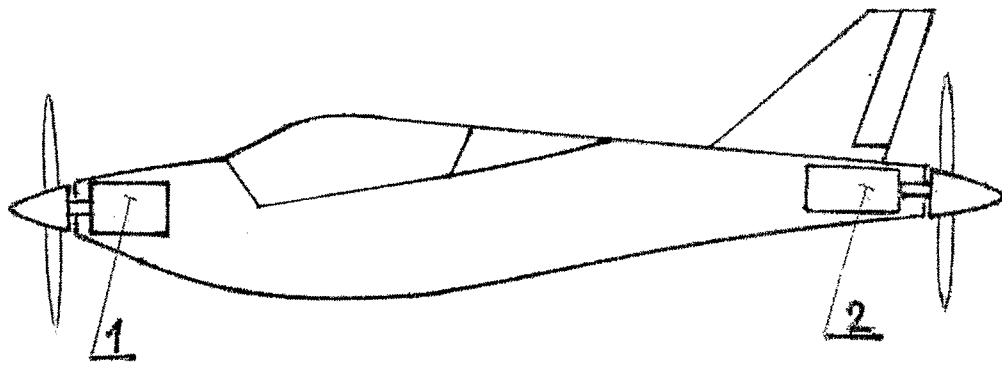


Fig. 1

## INTERNATIONAL SEARCH REPORT

International application No  
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INV. B64D27/08 B64D27/14 B64D27/24

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 089 493 A (PAULSON ALLEN E) 16 May 1978 (1978-05-16) abstract column 2, line 12 - column 2, line 14 figure 1	1-2
Y	US 2008/184906 A1 (KEJHA JOSEPH B [US]) 7 August 2008 (2008-08-07) paragraph [0053] - paragraph [0058] figure 2	1-2
A	US 5 782 427 A (HERMACH CARL J [US]) 21 July 1998 (1998-07-21) column 1, line 33 - column 1, line 42	1
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 728 044 C (DORNIER WERKE GMBH; E H CLAUDE DORNIER DR ING) 18 November 1942 (1942-11-18) figure 1 -----	1
A	US 1 851 857 A (ARTHUR MARNEY) 29 March 1932 (1932-03-29) the whole document -----	1-2
A	DE 101 56 868 A1 (SCHUMANN KURT [DE]) 28 May 2003 (2003-05-28) the whole document -----	1-2



**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No  
PCT/CZ2009/000102

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 2008184906	A1	07-08-2008	NONE
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DE 728044	C	18-11-1942	NONE
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