(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 October 2019 (24.10.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/203673 A1

(51) International Patent Classification:
B64C 29/00 (2006.01) *B64C 39/00* (2006.01)
B64C 9/14 (2006.01) *B64C 39/08* (2006.01)
B64C 21/04 (2006.01) *B64C 11/00* (2006.01)

(21) International Application Number:
PCT/RO2019/000011

(22) International Filing Date:
11 April 2019 (11.04.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
a 2018 00268 17 April 2018 (17.04.2018) RO

(72) Inventor; and
(71) Applicant: SABIE, Razvan [RO/RO]; Str. Radna nr. 40, sector 6, Bucharest (RO).

(74) Agent: CABINET D. NICOLAESCU; Str. Turda No. 102, Bl. 30A, et. 7, ap. 28, sector 1, 011334 Bucharest (RO).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(54) Title: PERSONAL FLIGHT APPARATUS WITH VERTICAL TAKE-OFF AND LANDING

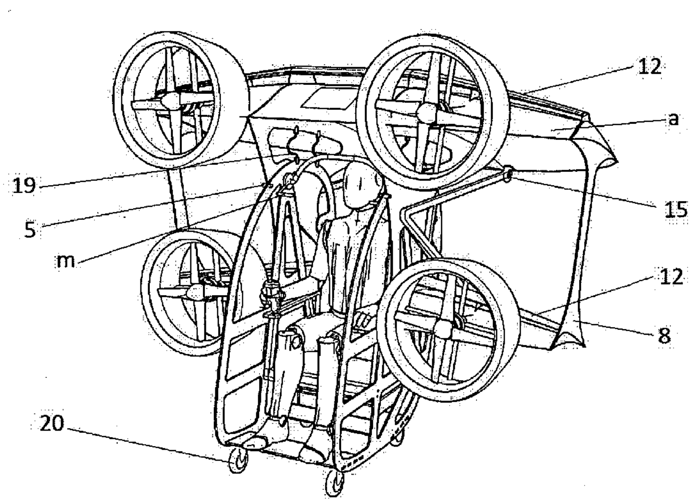

Fig. 2

(57) Abstract: A personal flight apparatus with vertical take-off and landing conceived as a biplane apparatus constituted by two distinct parts articulated there between, the first distinct part consisting of the cockpit (1), which is hinged to the second part of the latter, which is formed of the wings assembly (6),the cockpit 1 being attached to the wings assembly (6) by two hinges (3) fixed in the upright central vertical supports (7) of the wings, and in this way the cockpit having a limited swing possibility inside of the wings support structure which in turn they are provided with four propellers (9), of ducted type and driven by electric engines (20) disposed two on the top wing and two on the bottom wing, thus forming a kind of quadcopter, the duct (10) of each propeller being provided on the inlet lip with an annular ejection slit (11), and the electrical energy required to operate the apparatus is provided by the batteries (14) placed under the pilot's seat which through the speed regulators transmit the electric energy to the engines, the entire operation of

[Continued on next page]

WO 2019/203673 A1

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *of inventorship (Rule 4.17(iv))*

Published:
- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

the apparatus being managed by means of a flight computer (17) disposed in the central part of the upper wing of the biplane, and the taking off being made with the wings and the engines vertically oriented, the flight apparatus being laid on the ground by means of a landing gear (15) fixed in the wing extremities, the flight apparatus taking off as a quadcopter, and the transition to the cruise flight is made by reducing the angle of incidence of the wings, this angle decreasing naturally due to the increased resistance to advancement of the wings concurrently with the speed of translation of the flight apparatus, and in the meantime the cockpit (1) remains in a vertical position due to its lower center of gravity and due to the joints (3) which allow it to rotate relative to the wings assembly (6) and the landing is made similarly to a quadcopter, slowing down the speed leading to increasing the incidence angle of the wings until they return to the vertical plane required for landing.

PERSONAL FLIGHT APPARATUS WITH VERTICAL TAKE-OFF AND LANDING

The invention refers to a vertical take-off and landing flight apparatus capable of carrying at least one person and flying, in carrying capacity, in a cruise mode.

During the last time, the vertical take-off and landing flight apparatuss have experienced a great development because to the crowded road traffic in big cities, as well as in their surroundings, it is more than ever necessary to find some air transport solutions to replace the passenger car.

Several types of vertical take-off and landing flight apparatus are known to have advantages and disadvantages and are disclosed in patents and patent applications such as RU152807U1, US8800912B2 or WO20171584171 (A1).

The purpose of the present invention is to provide a flight apparatus suitable to the above stated requirements.

The flight apparatus with vertical take-off and landing is characterized in that it is a biplane apparatus constituted by two distinct parts articulated there between, the first distinct part consisting of the cockpit, which is hinged to the second part of the latter, which is formed of the solid support of the wings, the cockpit being attached to the wings assembly by two hinges fixed to the central vertical support pillars of the wings, the cockpit can swing inside of the wing support structure, which in turn is provided with four electric motors with ducted propellers disposed two on the top wing and two on the bottom wing forming a quadcopter assembly, the duct of each propeller being provided on the inlet lip with an annular ejection slit, and the electrical energy required for the operation of the flight apparatus is provided by battery accumulators placed under the pilot's seat, which transmit the power to the engines, the entire operation of the flight apparatus being managed by a flight computer disposed in the central part of the upper wing of the biplane and the take-off takes place with vertically oriented wings and motors, the flight apparatus lands on the ground by means of a landing gear fixed to the wings extremities, the flight apparatus taking off as a quadcopter, and the transition to the cruise is made by decreasing the angle of incidence of the wings, this angle decreasing naturally due to the increase of wing-forwarding resistance while increasing the translation speed of the flight apparatus and meanwhile, the cockpit remains in a vertical position due to its low center of gravity and the hinges that allow it to rotate in the interior of the wings assembly and the landing procedure is similar to a quadcopter, slowing down the speed leading to an increase of the angle the incidence of wings until they return to the vertical plane required for landing.

In order to make the flight more efficient, the flight apparatus can be additionally fitted both on wings and on propellers' ducts, with Coanda ejectors.

The advantages of the flight apparatus with take-off and landing according to the invention are as follows: it is capable of taking off and landing vertically, can carry a person (the concept can be extended for the transport of 4-5 persons), ensures a flight of several dozen kilometers, shows low noise, shows good energy efficiency on all flight regimes, has a high degree of safety and low size.

The following is a detailed description of the flight apparatus according to the invention, also with reference to the figures 1-17, which are:

- Fig. 1, an overview of the two distinct parts of the flight apparatus in the constructive variant with wing ejectors;
- Fig. 2, overview of the flight apparatus in cruise mode;
- Fig. 3, a general view of a flight apparatus in the construction version with wing ejectors on cruise position;
- Fig. 4 is an overview of the flight apparatus in the construction version with wing ejectors in the take-off / landing position;
- Fig. 5 is a side view in perspective with the flight apparatus in the construction version with wing ejectors in the take-off / landing position;
- Fig. 6 is a lateral perspective view of the flight apparatus in the construction version with wing ejectors in the take-off / landing position;
- Fig. 7 is a lateral view of the the flight apparatus in the construction version with wing ejectors in the transition mode;
- Fig. 8, lateral view of the the flight apparatus in the construction version with wing ejectors in the cruise mode;
- Fig. 9, front view of the flight apparatus in the construction version with wing ejectors in the take-off / landing position;

- Fig.10 is a cross-sectional view of a ducted propeller with ejection slit and a wing fitted with a Coanda type ejector and the airflow in the take-off and transition mode;
- Fig. 11 is a cross-sectional view of a ducted propeller with inlet ejection slit, a wing fitted with a Coanda type ejector and the airflow in the cruise mode ;
-Fig. 12 is a cross-sectional view of a double-flow ducted propeller with inlet ejector;
- Fig. 13 is a cross-sectional view of a double-flow ducted propeller with inlet ejector and an evacuation ejector;
- Fig. 14 is a sectional view of a triple-flow jet engine;
- Fig. 15, rear view of the flight apparatus,
-Fig. 16 is an overall view of a flight apparatus with usual propellers without wing ejectors;
- Fig. 17 is a perspective view of the apparatus with an open salvage parachute;

Figure 1 shows the two distinct and articulated parts of the flight apparatus. The first distinct part is made up of the **cockpit 1**. This is made up of a rigid frame, preferably a truss to give it strength and stiffness, and which includes the flight deck which must be large enough to accommodate a comfortable position for a **pilot 2**. The armrests of the pilot seat incorporate the **controls panels 13** on the ends. If necessary, the controls can also be ordered in the pedestrian legs or levers. The cockpit is open, but it can be partially closed by a front door with a lateral opening or can be completely closed to deviate airflow for pilot's comfort. Under the pilot's seat are the **electric batteries 14**, as well as the speed controllers of the motors.
The **cockpit 1** has at its bottom a **four-wheel assembly 20** that can rotate 360 degrees, so that the flight apparatus can be easily operated on the ground and with the wings in the position for cruise flight. On the lateral structures of the **cockpit 1**, is disposed a **stopper bolt 5** which has the role of limiting the swing of the cockpit within the wings assembly during the cruise flight and it coming into contact with the wings assembly and, from a certain angle of the wings' incidence, to make that the two distinct parts of the apparatus to move jointly together. The **cockpit 1** which constitutes the second distinct part of the apparatus is attached to the **assembly of the wings 6**, by means of the **bar 4** which enter through common holes both of the **cockpit 1** and of the

wings assembly 6, thus forming the **joints 3**. In order to prevent uncontrolled swinging of the **cockpit 1** due to its inertia, the **joints 3** will have a controlled friction, allowing a smooth balancing of the cockpit to maintain its verticality to the ground but, without allowing its uncontrolled pivoting. The **joints 3** are provided on both sides of the **pilot 2** with a **lever m,** which by means of some gears, allows the pilot to manually adjust the wings angle when the pilot wishes or considers that is necessary for a particular maneuver.

The second distinct part of the flight apparatus is the **wings assembly 6** which consists of two **wings a and b** having a high lift airfoil, forming a biplane assembly, with the **upper wing a** disposed more advanced than the **lower wing b**. The assembly is stiffened by two **central vertical supports 7** which also have the role of supporting the cockpit and by two **lateral vertical supports 8** that join the ends of the wings. The wings assembly can also be reinforced with spikes (wires). The wings have embedded in them the **landing gear 15**. The airfoil must generate high lift at low speeds and at high angles of incidence, and the drag must be low. In this regard, it is preferable to use the profiles described in patent no. EP0772731B1. In the central area of the upper wing, are disposed the **flight computer 17** and the **survival parachute 18** of the apparatus. The two wings are provided with four electric ducted **propellers 9**, two for each wing, and they are arranged symmetrically with respect to the vertical axis of symmetry in a quadcopter specific manner. For reasons of efficiency, noise and safety the propellers are fitted with **ducts10**. For greater take-off efficiency, in order to increase the volume of the air intake, the lips of the propellers' **ducts 10** will be provided with **ejection slits 11**. Also, in order to increase the mass of air absorbed during the take-off and during the transition phase, the wings may be provided alongside them with bi-dimensional Coanda type **ejectors 12**. An overview of a flight apparatus in cruise mode provided with such wing ejectors is illustrated in Fig. 2, and Fig. 3 shows an apparatus not provided with wing ejectors. Fig. 4 shows an overview of the apparatus in a take-off / landing position, and in Fig. 5 is a side view showing the **landing gear 15** which is located in the wings extensions. The four wheels of the landing gear 15 can be rotated 360 degrees and are disposed at the ends of the second **A-shaped resistance structures 16** which are integral with the central vertical supports 7. To balance the forces developed during the take-off , the axes of the motors may be slightly inclined forward to the perpendicular to the ground, which can be obtained from the corresponding adjustment of the arms of the **resistance structure 16**.

The flight phases that show how the **wings assembly 6** rotates relative to the flight position are as follows: Fig. 6 is a side view of the apparatus in the take-off / landing position; Fig. 7 is a side view of the apparatus in flight transition, and in Fig. 8 a side view with the apparatus during the cruise flight. During the cruise flight mode, the two distinct parts, the **cockpit 1** and **the wings assembly 6** come into contact by means of the **limiting bolt 5**, and at this moment, at any lower incidence angle, the two parts act as a unit, the **cockpit 1** tilting together with the **wings assembly 6**. The wings may have an elliptical shape with the straight ends as described in Fig. 9, but they may also have the trapezoidal or rectangular shape.

To take-off in an energy efficient way, it is necessary to drive down a large mass of air at a relatively low speed. In order to accomplish this, it is necessary to perform a synergistic operation of the ducted **propellers 9**, the **annular ejectors slits 11** and the bi-dimensional **ejectors 12** disposed on the wings. Figure 10 illustrates the synergistic operation of the ducted **propeller 9** provided with the **ejector slit 11** together with the wing **ejector 12** and outlines the air flow. In order for all the propulsion elements to function synergistically, the **electric motor 20** must transmits its motion not only to the propeller, but also to an air **compressor 22**, therefore it is preferred that the **electric motor 20** shaft has to cross the motor from one head to the other, so that the motor at one end to engage the propeller's **rotor 21**, and at the other to engage through a speed multiplier the air **compressor 22**. This air compressor may be axial in order to not have a large section, but also may be centrifugal or even of a Tesla type. The air compressor 22 absorbs the air through a **circular slit f** which surrounds the **electric motor 20**, and blows and supplies the compressed air via a **pipe 23** towards a **pressure annular chamber 24** disposed in the rim of the **duct 10**, and then from the annular chamber 24, the air is ejected under pressure through the **ejection slit 11**. Due to this ejection, a depression is formed on the upper part of the duct's lip and thus can draw larger masses of air through the interior of the **duct 10**. Simultaneously with this compressed air circuit, the **air compressor 22** supplies, through the **pipe 25**, compressed air to the bi-dimensional Coanda **ejector 12**, which is comprised of a **pressure chamber 26** disposed along each wing and which has the ejection **slit 30** and the **small wing 27** which is disposed all along each wing and which comprises a **pressure chamber 28** which has the **ejection slit 31**. The two **pressure chambers 26 and 28** have identical dimensions having a tronconic shape and have maximum cross sections in the central areas of the wings and their sections are shrunk to the wings extremities in order to maintain a pressure as uniform as possible uniform within them.

The two **ejection slits 30 and 31** are parallel to one another and the width of their opening is kept constant along them, thus achieving a relatively uniform ejection from one end of the wings to the other. On the length of the ejector, the curvature of the upper side wing is identical to the small wing 27 inner profile. The airfoil of the **small wing 27** airfoil has to be rounded on the leading edge this way generating an air depression and drawing a large mass of air. The airflow in the take-off mode is suggested by the arrows represented in Figure 10. It should also be noted that the **ejection slit 30** as well as the curved profile of the upper side of the wing contribute through the Coanda effect to maintain a uniform boundary layer along the upper side of the wing. In more complex constructive variants, the **small wing 27** can rotate at a certain angle so that the ejector **intake area A1** is diminishing and the **ejection area A2** increases and this way the pressure on the upper side can be controlled, thus can be mofified the wings' lift force without varying the flight speed of the flight apparatus or the wings' incidence angle.

In order to have an efficient air circulation during the cruise flight, the supply of the compressed air through the **pipe 23** to the **slits 11** may be interrupted by means of the **valves 32** and the supply of compressed air to the **slit 28** can be interrupted by means of the **valve 33** and the compressed air is distributed only to the **slit 30**. Thus, through this operation, the air intake zone decreases, the dynamic thrust of the propeller increases as well as the air pressure in the **chamber 26**, and the masses of air are accelerated synergistically, and the air ejected under pressure through the **slit 30** contributes to achieving a uniform boundary layer on the upper side of the wing. In the constructive variant in which the **small wing 27** is mobile, it rotates as the **ejection area A2** decreases and consequently, the air accelerates inside the ejector contributing to the thrust. The air circulation during the cruise flight is showed by the arrows in Figure 11.

For longer flight distances, the **electric motors 20** can be replaced with heat engines. It is preferable that these motors are Wankel rotary, which have a high power / weight ratio and due to their low cross-section and low vibrations, they are suitable for being ducted. When using heat engines, one of the main drawbacks is the high level of noise. In order to reduce the noise level and at the same time to obtain increased efficiency in the take-off mode, it is possible to achieve a double-flow ducted propeller - Figure 12. In this case, the **duct 10** is doubled outward by another **duct 35**, which comprises an **annular chamber 36** and an **ejection slit 37**. The required compressed air is provided by an extension of the **pipe 23** to the annular **chamber 36**. The interior of the **duct 35** together with the outside part of the **duct 10** forms the profile required for a Coanda ejector through which the air is driven and accelerated inward by means of the **ejection slit 37**.

In order to have an energy-efficient take-off and landing, the propeller engine must driven large air masses at a relatively slow speed, which implies the need for a large propeller in diameter (as in the case of the helicopter). A solution that leads to a lower section of the propulsion unit, but which has a good take-off / landing efficiency is shown in Figure 13 which ilustrates a double-flow duct propeller that has both **ejection slits for intake 11 and 37** as well and for the evacuation, **the slits 38 and 39**. The corroborated action of the **ejection slits 38 and 39**, as well as the **rounded profiles of the rear parts 40** of the ducts, results in an air ejections also in the lateral sides, thereby increasing the evacuation area cone. Thus, a large mass of air is driven similar to a propeller of a much larger diameter. This concept, which implies the existence of a Coanda type ejector that surrounds the main engine, can be extended to the turbojet engines, and in the case that a Coanda ejector surrounds a turbofan it can be achieved even a triple flow jet engine - figure 14. In this case, the **pipe 23** takes the necessary compressed air from one stage of the **compressor 41** and supplies with it the **slits 11 and 37**. If necessary, the triple flow jet engine may also be provided with evacuation ejection slits. The advantages of a triple flow jet engine are as follows: it has a greater efficiency for vertical take-offs or classic take-off phases, a more reduced noise and a reduced thermal footprint.

Figure 15 shows a rear view of the flight apparatus in cruise flight, where we can see the arrangement of the batteries under the pilot's seat, which leads to a lower center of gravity and better stability of the flight apparatus. Also in the same place may be disposed the speed regulators of the electric motors.

For the construction variant of the flight apparatus that uses heat engines, instead of the batteries, can be placed the fuel tank.

Figure 16 shows a simpler and less expensive flight apparatus with simple propellers and no ejectors.

In the event that a fault occurs and this makes impossible to continue the flight, the flight apparatus is provided with the **rescue parachute 18** which is located in the upper wing of the flight apparatus. It is positioned so that when it is open, it will keep the wings of the flight apparatus at an optimal incidence angle for a landing this way. It is preferable that the parachute to be a rectangular wing type, because after the opening, the pilot can access the parachute controls and this way he can maneuver the flight apparatus in a suitable area for landing. Also, as a further safety measure, the pilot can be equipped with the individual parachute. In the case of a forced landing, the rounded shape of the cockpit's extremities favors the rolling of the flight apparatus which helps to dissipate this way the kinetic energy at the moment of impact with the ground. In the case of breaking one of the **joints 3**, the lateral frames of the **cockpit 1** are attached by **cables 19** to the **central vertical supports 7** of the wings assembly.

The mode of operation of the flight apparatus is very simple, it flies in quadcopter mode for both take-off and landing mode, but also as well as in the transition and during the cruise flight, and the maneuvers and stabilization mode are known and compliant with this flight concept, thus the existence of other surfaces and additional means of controlling and stabilizing the apparatus is no longer necessary.

CLAIMS

1. Flight apparatus with vertical take-off and landing **characterized in that** it is a biplane apparatus constituted by two distinct parts articulated there between, the first distinct part consisting of the **cockpit 1**, which is hinged to the second part of the latter, which is formed of the **wings assembly 6**, the **cockpit 1** being attached to the **wings assembly 6** by two **hinges 3** fixed in the upright **central vertical supports 7** of the wings, and in this way the cockpit having a limited swing possibility inside of the wings support structure which in turn they are provided with four **propellers 9,** of ducted type and driven by **electric engines 20** disposed two on the top wing and two on the bottom wing, thus forming a kind of quadcopter, the **duct 10** of each propeller being provided on the inlet lip with an annular **ejection slit 11**, and the electrical energy required to operate the apparatus is provided by the **batteries 14** placed under the pilot's seat which through the speed regulators transmit the electric energy to the engines, the entire operation of the apparatus being managed by means of a **flight computer 17** disposed in the central part of the upper wing of the biplane, and the taking off being made with the wings and the engines vertically oriented, the flight apparatus being laid on the ground by means of a **landing gear 15** fixed in the wing extremities, the flight apparatus taking off as a quadcopter, and the transition to the cruise flight is made by reducing the angle of incidence of the wings, this angle decreasing naturally due to the increased resistance to advancement of the wings concurrently with the speed of translation of the flight apparatus, and in the meantime the **cockpit 1** remains in a vertical position due to its lower center of gravity and due to the **joints 3** which allow it to rotate relative to the **wings assembly 6** and the landing is made similarly to a quadcopter, slowing down the speed leading to increasing the incidence angle of the wings until they return to the vertical plane required for landing.

2. Flight apparatus with vertical take-off and landing according to claim 1, **characterized in that** the **propellers 9** are ducted, but without ejection slits.

3. Flight apparatus with vertical take-off and landing according to claim 1, **characterized in that** the **propellers 9** are simple, non-ducted.

4. Flight apparatus with vertical take-off and landing according to claim 1, **characterized in that** the **propellers 9** are double ducted and the **duct 10** and the **duct 35** are provided with **ejection slits 11 and 37**, thereby forming a double-flow ducted propeller, and the outside of the first duct together with the inner side of the second duct forms an annular Coanda ejector.

5. Flight apparatus with vertical take-off and landing according to claims 1 and 4, **characterized in that** the **duct 10** and the **duct 35** are provided with **ejection slits 38 and 39** in the rear side

6. Flight apparatus with vertical take-off and landing according to claims 1 to 5, **characterized in that** the longitudinal portion of the upper side of each wing forms with a parallel **small wing 27** a Coanda **ejector 12** and the compressed air required for operation is provided by an **air compressor 22** driven by the engine.

7. Flight apparatus according to claims 1 to 6, **characterized in that** both in the take-off / landing, transition as well as cruise mode, it flies and maneuvers in quadcopter configuration

8. Flight apparatus according to claims 1 and 6, **characterized in that the small wing 27** can rotate in such a way that it can increase or decrease the **intake area A1** and the **ejection area A2**.

9. Flight apparatus according to claims 1 and 4-8, **characterized in that** the anterior part of the **duct 10** is provided with an **annular chamber 24** from which the compressed air is ejected through the **slit 11** and the shaft of the **electric motor 20** drives directly or via a speed multiplier an **air compressor 22** which provides compressed air through **pipes 23** to **annular chamber 24**.

10. Flight apparatus according to 1 and 4, **characterized in that** the **ducted propeller 9** is provided with a second **duct 35** and the inner part of the **duct 35** together with the exterior part of the **duct 10** forms an annular ejector of the Coanda type, and both **ducts 10** and **35** have in the rear part **ejection slits 38** and respectively, **39.**

11. Flight apparatus according to claims 1 to 10 **characterized in that** the electric engines are replaced by rotary type engines (Wankel).

12. Flight apparatus according to claims 1 to 10 **characterized in that that** the **propellers 9** are replaced by triple flow jet engines that is made up of a classic double flow turbofan having a **duct 10** which is provided with the **ejection slit 11** and the whole assembly is surrounded by a second **duct 35**, having an **ejection slit 37** and the inner part of the **duct 35** together with the outer part of the **duct 10** forms an annular Coanda ejector and the compressed air required for the operation of the entire ejection system is supplied through the **pipes 23** from a stage of the turbofan's **compressor 41**.

13. Flight apparatus according to claims 1 to 12, **characterized in that** the flight apparatus is provided with a **rescue parachute 18** by a wing type placed in the central portion of the upper wing and the pilot can manipulate the parachute controls.

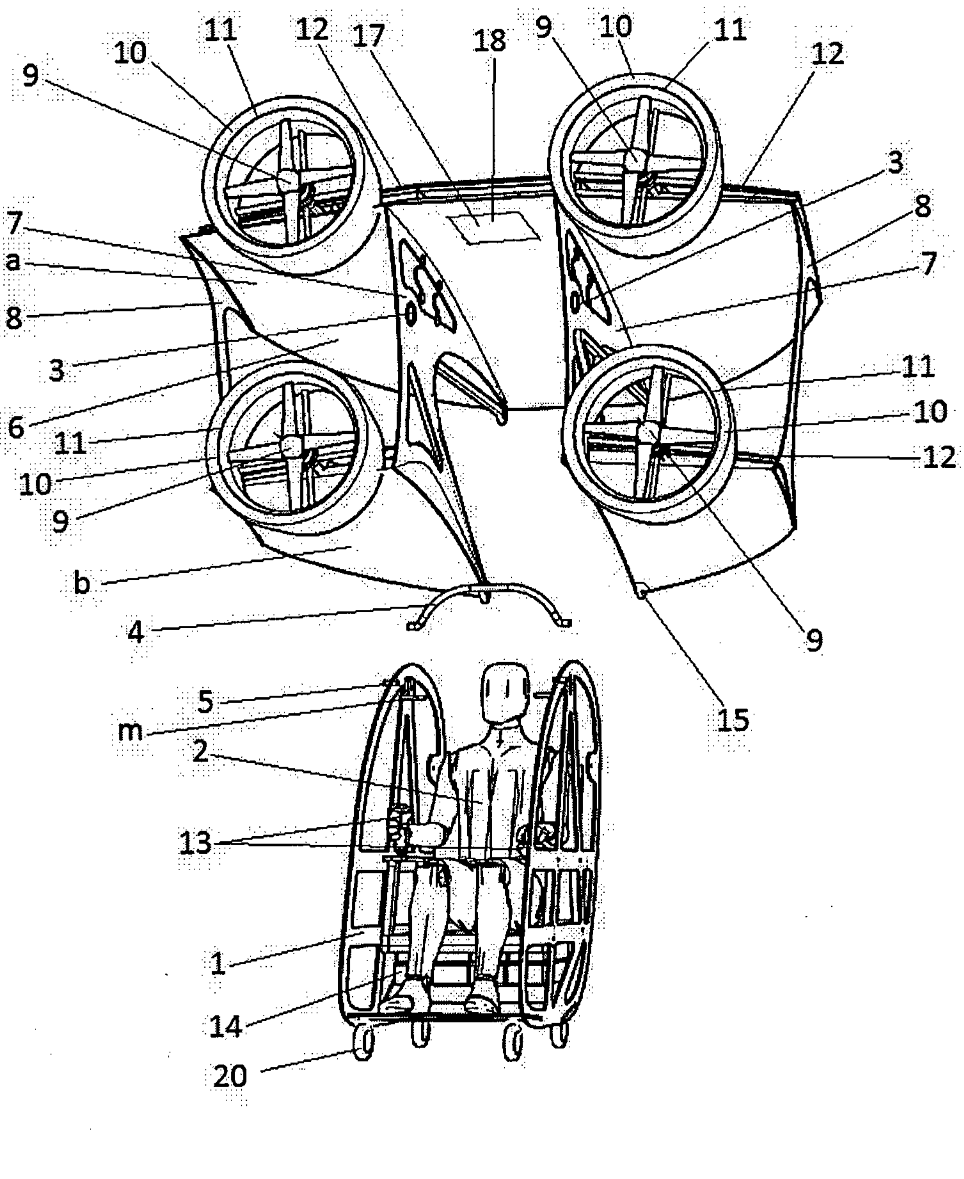
9
10
11
12
17
18
9
10
11
12
3
8
7
7
a
8
3
6
11
10
9
11
10
12
b
9
4
15
5
m
2
13
1
14
20

Fig.1

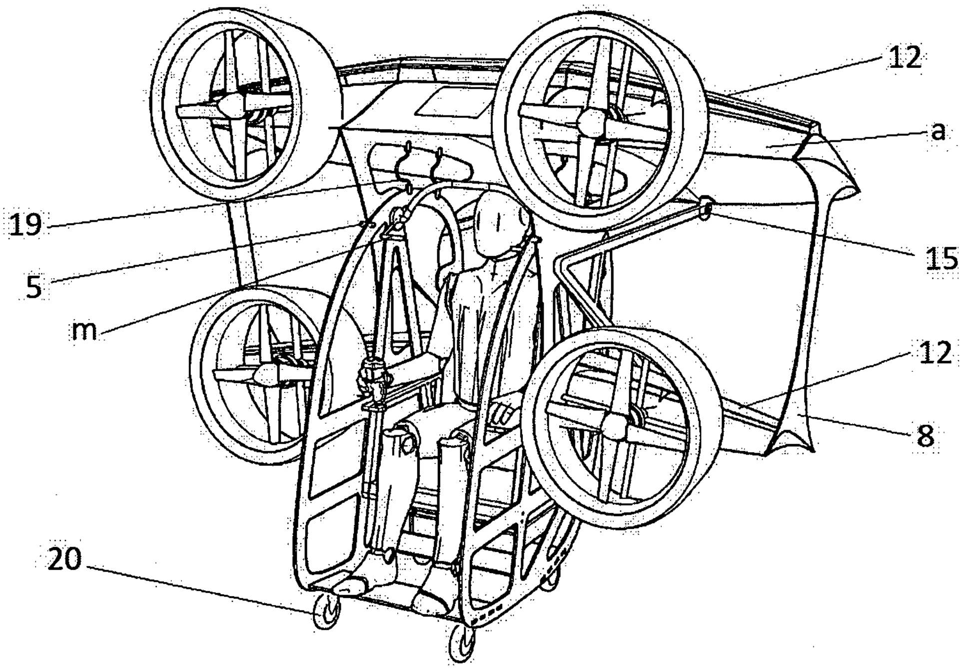

Fig. 2

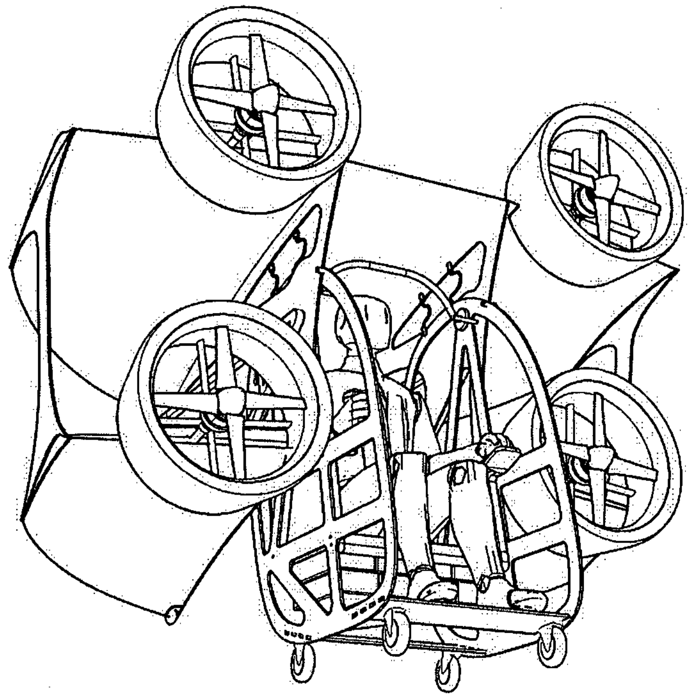

Fig.3

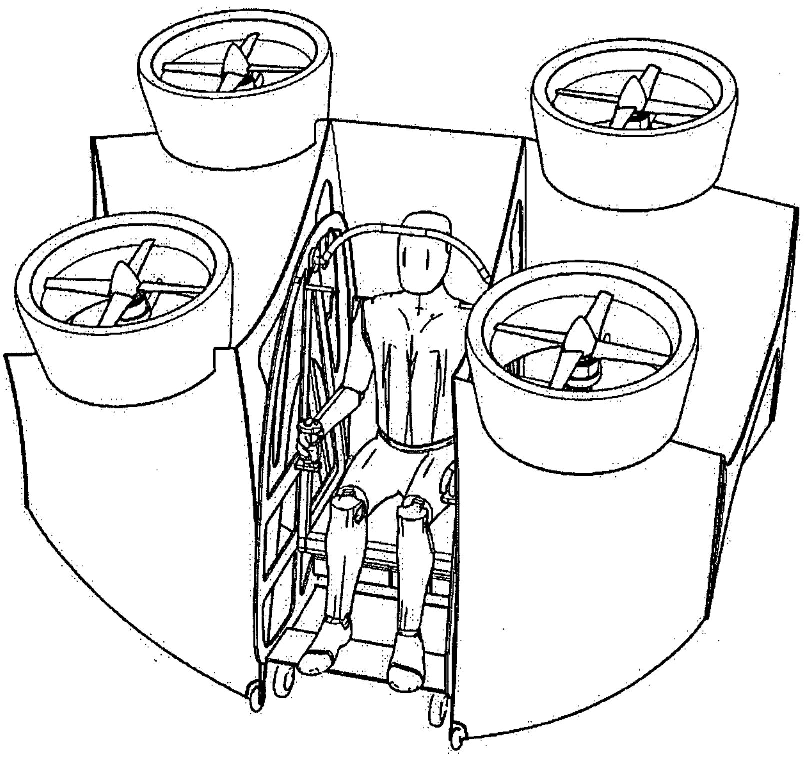

Fig. 4

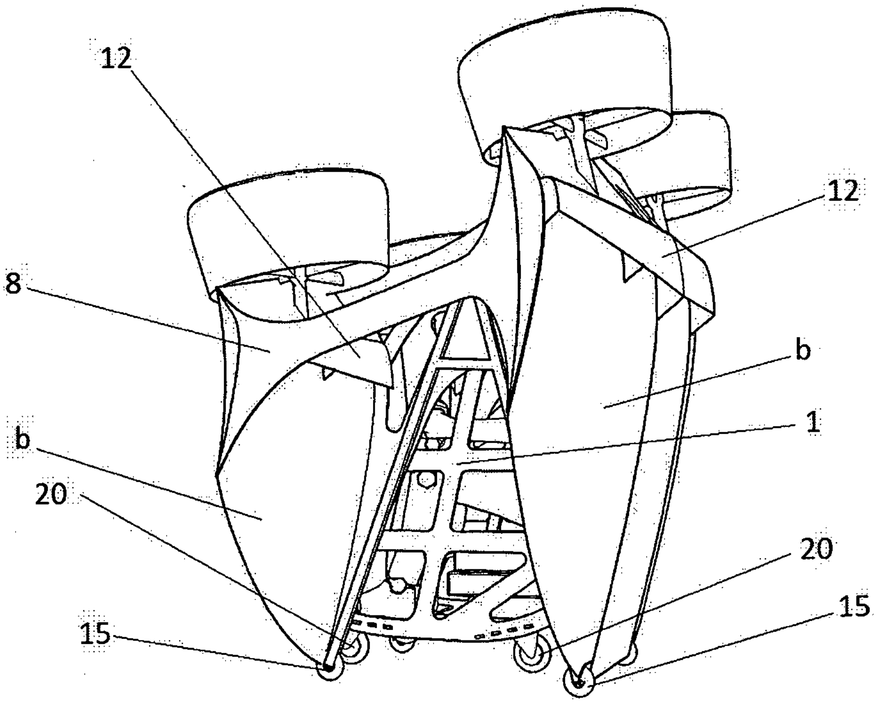

Fig. 5

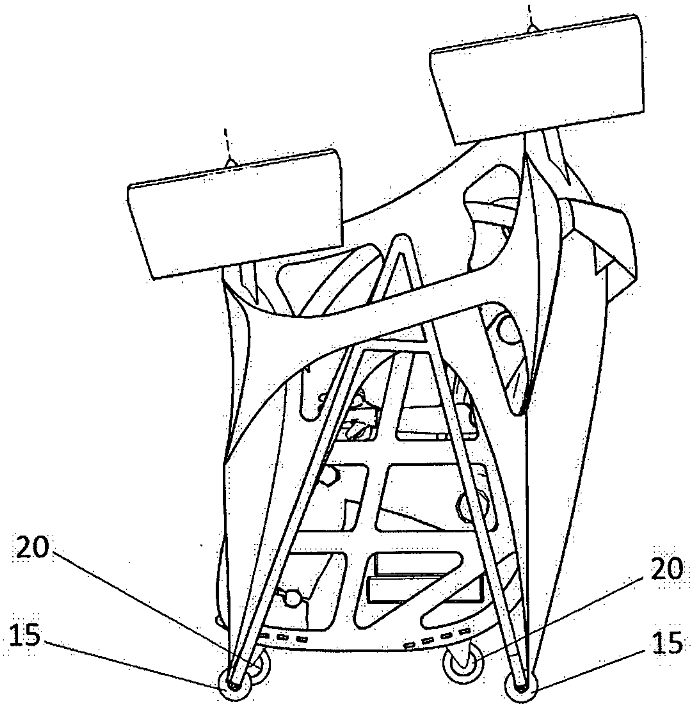

Fig.6

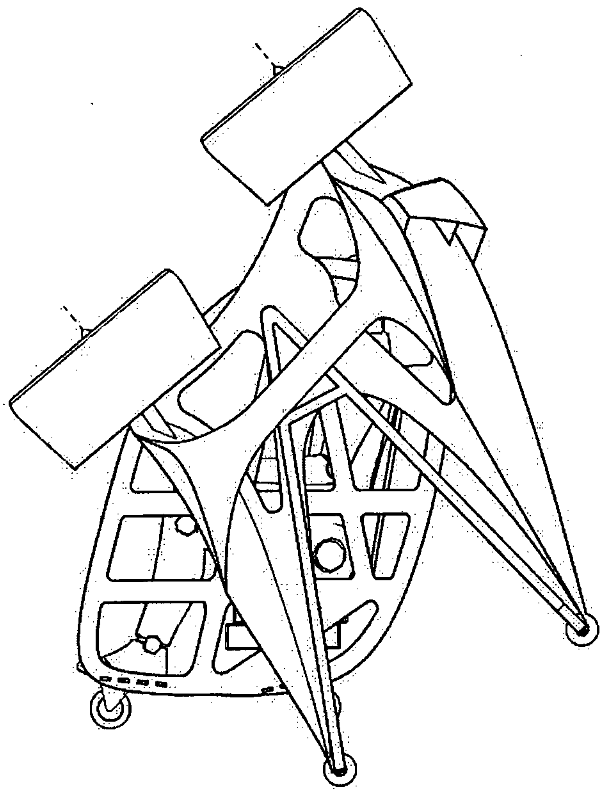

Fig.7

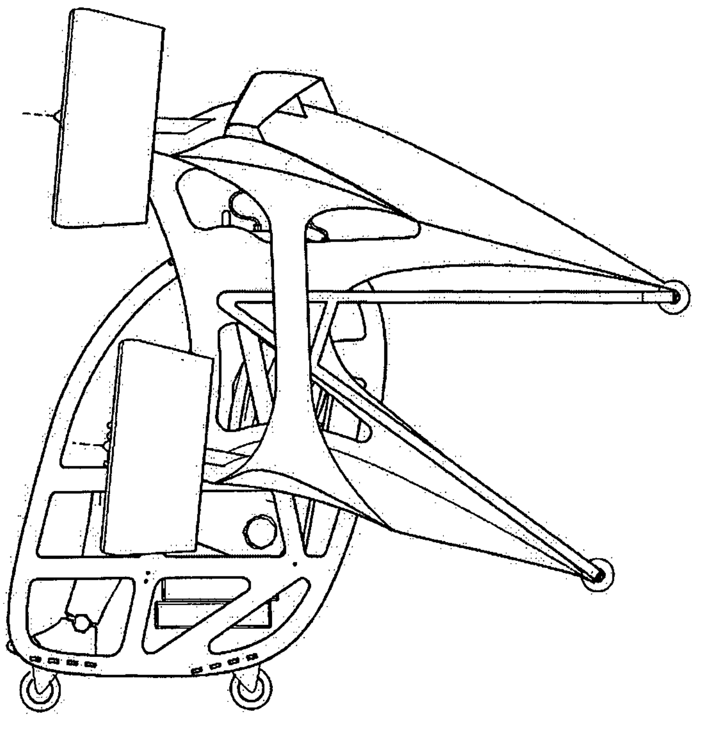

Fig.8

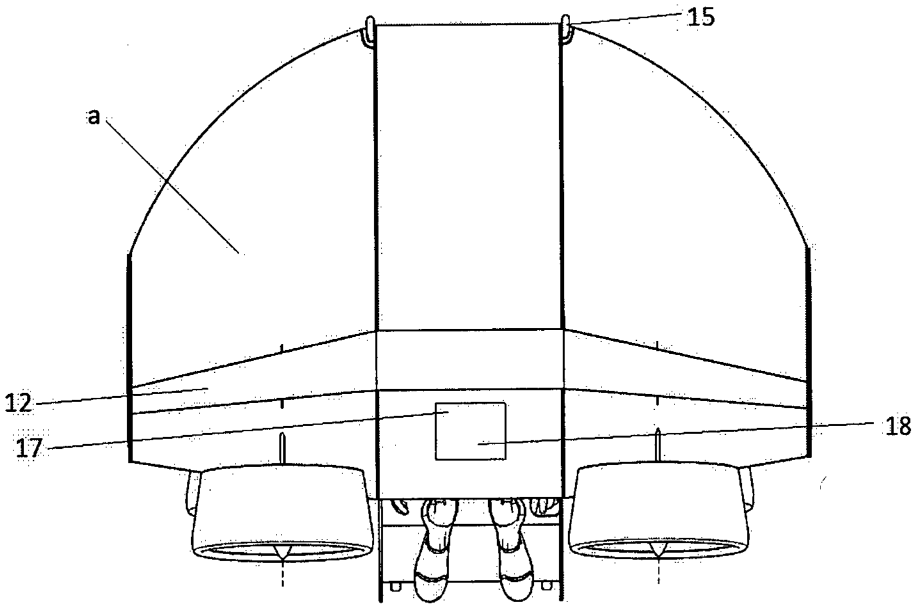

Fig.9

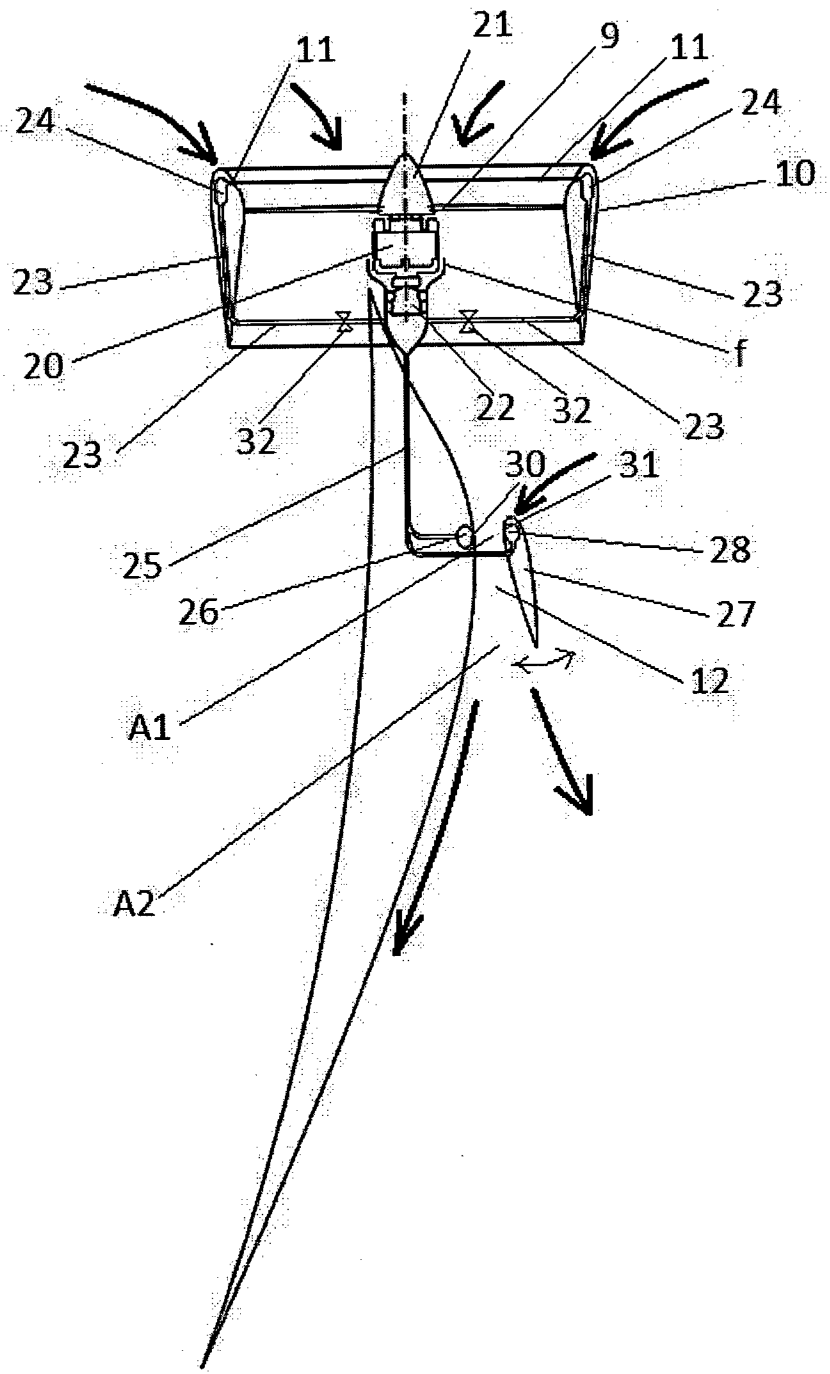

Fig.10

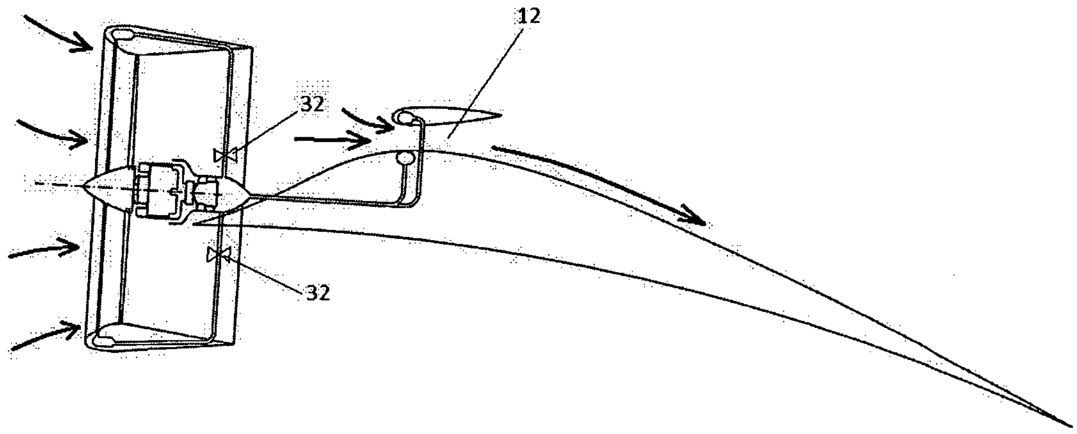

Fig.11

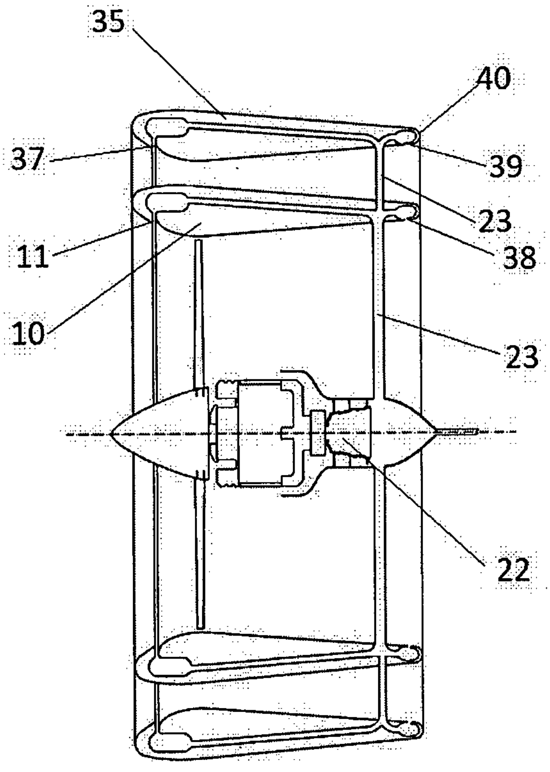

Fig.12

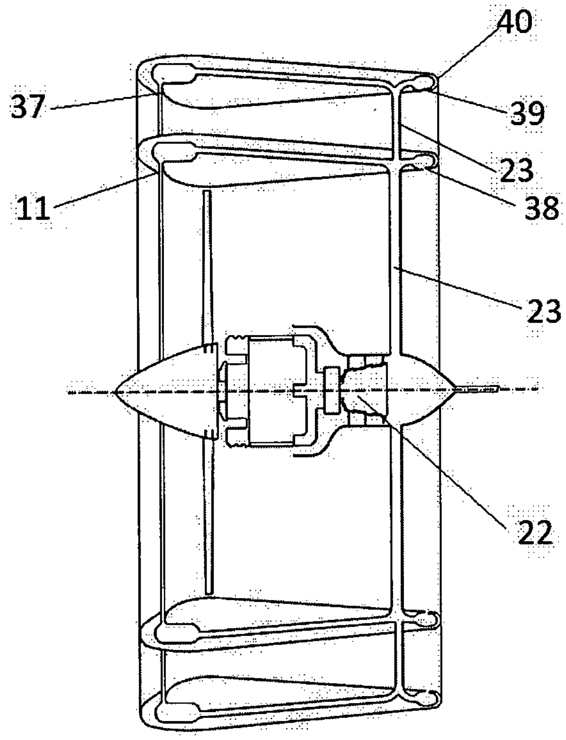

Fig.13

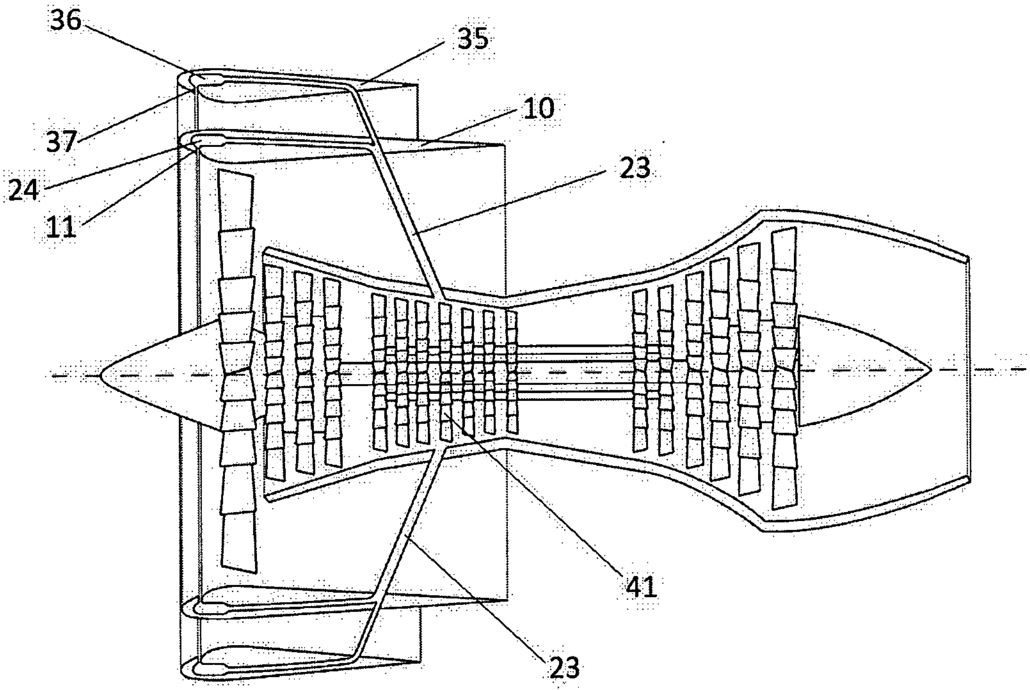

Fig.14

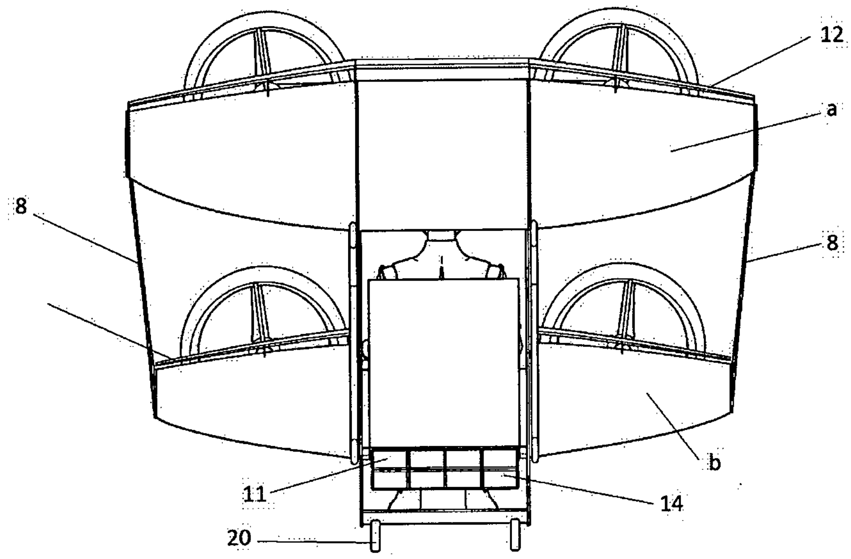

Fig.15

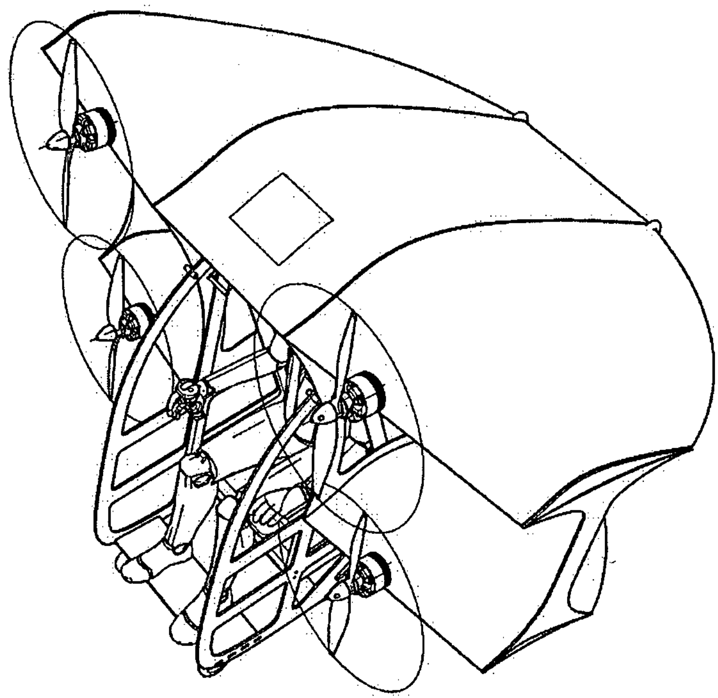

Fig.16

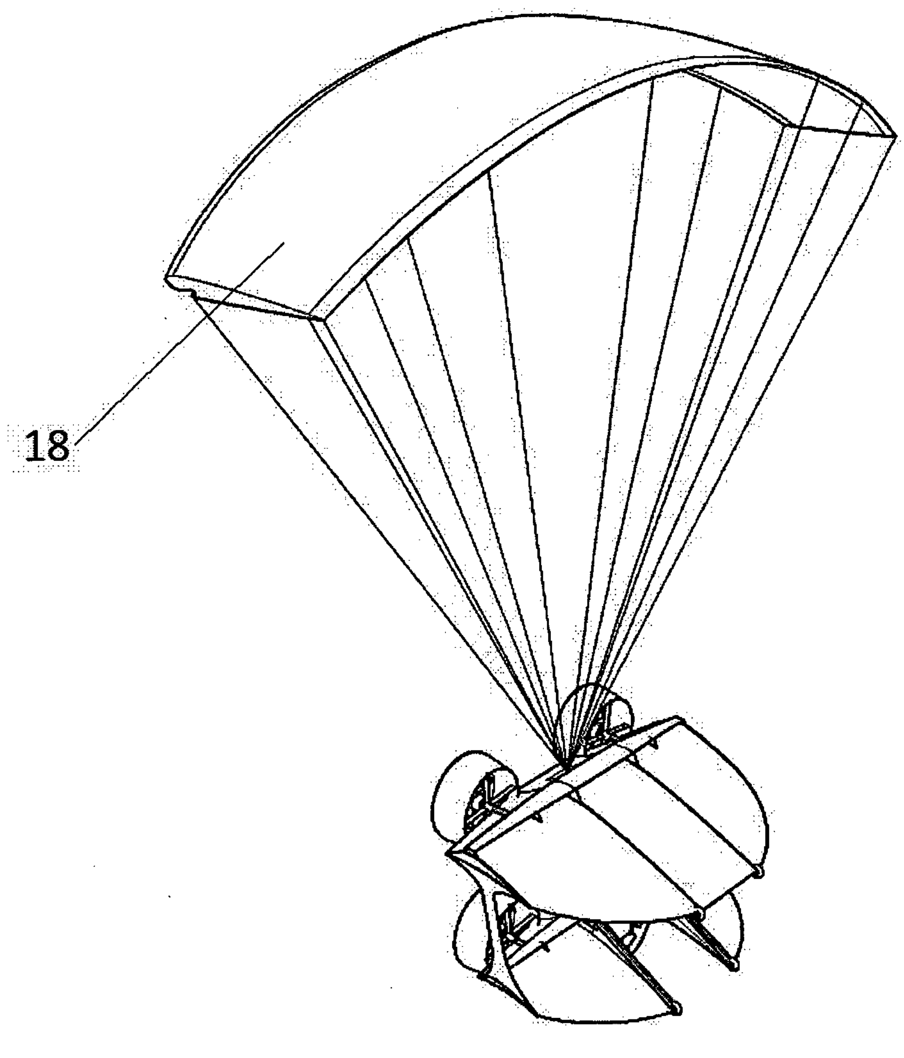

Fig.17

INTERNATIONAL SEARCH REPORT

International application No
PCT/RO2019/000011

A. CLASSIFICATION OF SUBJECT MATTER
INV. B64C29/00 B64C9/14 B64C21/04 B64C39/00 B64C39/08
ADD. B64C11/00

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)
B64C

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 2011/042509 A1 (BEVIRT JOEBEN [US] ET AL) 24 February 2011 (2011-02-24) paragraphs [0028], [0030], [0038] - [0042], [0045], [0046], [0049], [0050], [0058], [0059], [0067] - [0071], [0077] paragraph [0081] figures 1-9 -----	2,3,7, 11,13 6,8 1,4,5,9, 10,12
Y	US 5 071 088 A (BETTS EDWARD E [US]) 10 December 1991 (1991-12-10) figure 20 -----	6,8
X	US 2018/002013 A1 (MCCULLOUGH JOHN RICHARD [US] ET AL) 4 January 2018 (2018-01-04) paragraphs [0051], [0054], [0055], [0056], [0070]; figures 1A-D, 2A-E, 4A-S, 5A-D -----	3,7,13
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 September 2019	02/10/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Dorpema, Huijb

1

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 3 263 456 A1 (BELL HELICOPTER TEXTRON INC [US]) 3 January 2018 (2018-01-03) paragraphs [0019], [0020], [0029] - [0036], [0050] - [0055]; figures 1A-F, 2A-B, 3A-I, 4A-C, 8	3,7
A	US 2017/057648 A1 (EVULET ANDREI [US]) 2 March 2017 (2017-03-02) the whole document	4,6,10
A	US 3 259 343 A (ROPPEL CLARENCE L) 5 July 1966 (1966-07-05) column 3, lines 59-62; figure 1	3,12
A	US 2006/254255 A1 (OKAI KEIICHI [JP] ET AL) 16 November 2006 (2006-11-16) figures 6a, b	12

1

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011042509 A1	24-02-2011	US 2011042509 A1	24-02-2011
		US 2011042510 A1	24-02-2011
		WO 2011081683 A1	07-07-2011
US 5071088 A	10-12-1991	NONE	
US 2018002013 A1	04-01-2018	US 10343773 B1	09-07-2019
		US 2018002013 A1	04-01-2018
EP 3263456 A1	03-01-2018	CA 2972527 A1	01-01-2018
		CA 3050137 A1	01-01-2018
		EP 3263456 A1	03-01-2018
		US 2018002026 A1	04-01-2018
US 2017057648 A1	02-03-2017	AU 2016315450 A1	22-03-2018
		AU 2016338382 A1	15-03-2018
		AU 2016338383 A1	22-03-2018
		BR 112018004252 A2	12-02-2019
		BR 112018004256 A2	12-02-2019
		BR 112018004262 A2	09-10-2018
		CA 2996284 A1	20-04-2017
		CA 2996285 A1	20-04-2017
		CA 2996302 A1	09-03-2017
		CN 108137149 A	08-06-2018
		CN 108137150 A	08-06-2018
		CN 108349585 A	31-07-2018
		EP 3344535 A2	11-07-2018
		EP 3344536 A2	11-07-2018
		EP 3344537 A1	11-07-2018
		EP 3363731 A1	22-08-2018
		EP 3363732 A1	22-08-2018
		JP 2018526287 A	13-09-2018
		JP 2018532075 A	01-11-2018
		JP 2018532647 A	08-11-2018
		KR 20180061182 A	07-06-2018
		KR 20180070560 A	26-06-2018
		KR 20180073564 A	02-07-2018
		US 2017057621 A1	02-03-2017
		US 2017057647 A1	02-03-2017
		US 2017057648 A1	02-03-2017
		US 2018312268 A1	01-11-2018
		US 2019047712 A1	14-02-2019
		US 2019112062 A1	18-04-2019
		US 2019118958 A1	25-04-2019
		US 2019193864 A1	27-06-2019
		WO 2017041018 A1	09-03-2017
		WO 2017065858 A2	20-04-2017
		WO 2017065859 A2	20-04-2017
US 3259343 A	05-07-1966	NONE	
US 2006254255 A1	16-11-2006	JP 4092728 B2	28-05-2008
		JP 2006205755 A	10-08-2006
		US 2006254255 A1	16-11-2006