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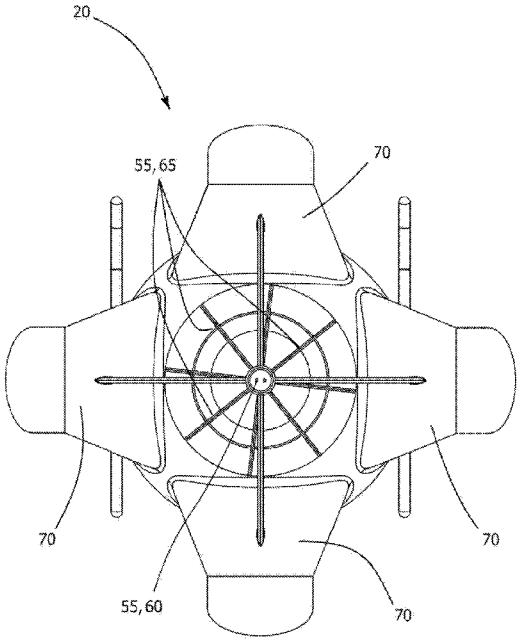
(54) Title: VTOL AIRCRAFT HAVING DUCTED THRUST FROM A CENTRAL FAN

Fig. 6



(57) Abstract: A VTOL aircraft having thrust and directional control comprises a fan for providing a centrifugal flow of air. At least one duct allows for and directs air flow. At least one nozzle allows for exhaust release. Each of the at least one nozzle has a first end attached to one of each of the at least one duct. Each of the at least one nozzle has a turn measuring 90 and faces downward from the second end of each of the at least one duct. Each of the at least one nozzle has a second end at which is a vane for redirecting airflow. The VTOL aircraft also has an attachment for landing.

VTOL Aircraft Having Ducted Thrust From A Central Fan

Cross-References to Related Applications

This application claims priority from U.S. Provisional Application Serial Number 62/448,891 filed January 20, 2017, which is hereby incorporated herein by reference in its entirety.

Field of the Invention

The present invention relates to a multi-ducted centrifugal fan VTOL aircraft.

Background of the Invention

Currently-available VTOL drone aircrafts are of the multi-rotor type that suffer from limited flight time and payload capacity due to two main reasons: their electrical operation which requires heavy batteries that must be recharged over a period of time, and the inefficiency of the use of rotors or propellers that do not provide high amounts of overall lift. They cannot accommodate the use of fuel (e.g. gasoline) for quick mission turnaround time and must use additional pre-charged batteries. The weight of the batteries limits the amount of payload they can carry, as well as the operational flight time, because batteries do not have a high energy capacity in relation to their weight like fuel does. The current aircraft typically have exposed rotors or propellers that create safety hazards to personnel and property.

It is thus an aim of the present invention to address at least one of these issues.

Brief Description of the Figures

Fig. 1 depicts an aspect of a VTOL aircraft of the invention.

Fig. 2 depicts a bottom view of the VTOL aircraft of the invention.

Fig. 3 depicts a top view of the VTOL aircraft of the invention.

Fig. 4 depicts an exploded view of the VTOL aircraft of the invention.

Fig. 5 depicts a bottom view of the VTOL aircraft of the invention.

Fig. 6 depicts a top view of the VTOL aircraft of the invention.

Fig. 7 depicts a cross-sectional view of the VTOL aircraft of the invention.

Fig. 8 depicts a perspective bottom view of a two outlet VTOL aircraft.

Fig. 9 depicts a perspective top view of a two outlet VTOL aircraft.

Brief Summary of the Embodiments of Invention

A VTOL aircraft having thrust and directional control comprises a main body. The main body has an upper shell in a shape of a parabola, with the shape of a parabola facing and expanding into a downward-facing end. The upper shell of the main body has a top opening in a shape of a circle. The main body also has a bottom plate in a shape of a flat circle, sealed to the downward-facing end of the upper shell of the main body. The top opening of the upper shell of the main body provides an inlet for air to enter into the housing. The upper shell of the main body has at least one opening.

A fan provides a centrifugal flow of air. The fan has a central hub, and a plurality of blades extends radially outward from the central hub. The fan is mounted to the bottom plate of the main body.

At least one duct allows and directs air flow. At least one nozzle allows for exhaust release. Each nozzle is attached one each of the ducts. Each nozzle has a turn measuring 90° and facing downward from its respective duct. Each nozzle has an end at which is a vane for redirecting airflow.

Detailed Description of the Embodiments of the Invention

First depicted in Fig. 1, a VTOL aircraft **20** comprises a housing **25**. The housing **25** comprises a main body **30**. The main body **30** has an upper shell **35** in a shape of a parabola, with the shape of a parabola facing and expanding into a downward-facing end **35a**. The upper shell **35** of the main body **30** has a top opening **40** in a shape of a circle. The main body **30** also has a bottom plate **45** in a shape of a flat circle, sealed to the downward-facing end **35a** of the upper shell **35** of the main body **30**. The bottom plate **45** has a top side **45a** (Fig. 4) and a bottom side **45b** (Fig. 2). The top opening **40** of the upper shell **35** of the main body **30** provides an inlet for air to enter into the housing **25**. The upper shell **35** of the main body **30** has at least one opening **50**, for instance a set of four openings **50**. The set of four openings **50** each has a shape of an oval. As illustrated in Fig. 3, each of the set of four openings **50** is placed around the upper shell **35** of the main body **30** at 90° to each other.

A fan **55** (Fig. 6) provides a centrifugal flow of air. The fan **55** has a central hub **60** (Fig. 6), and a plurality of blades **65** (Fig. 6) extends radially outward from the central hub **60**. The fan **55** is mounted to the top side **45a** of the bottom plate **45** of the main body **30**. An attachment **120** for landing the VTOL aircraft **20** is attached to the bottom side **45b** of the bottom plate **45** of the main body **30**, as depicted in Figs. 5 and 7.

At least one duct **70** (Figs. 1 and 3), for instance a group of four ducts **70**, allows and directs air flow. Each of the group of four ducts **70** has a cross-section having a shape of an oval. Each of the group of four ducts **70** has a first end **75** and a second end **80**. The first end **75** of each of the group of four ducts **70** fits into one of the set of four openings **50**, and the second end **80** of each of the group of four ducts **70** extends horizontally outward therefrom. Each of the group of four ducts **70** has a width **85** and a height **90** (Figs. 1 and 3). The width **85** of each of the group of four

ducts **70** decreases from the first end **75** to the second end **80** of each of the group of four ducts **70**. The height **90** of each of the group of four ducts **70** remains constant from the first end **75** to the second end **80** of each of the group of four ducts **70**.

As illustrated in Figs. 4 and 7, at least one nozzle **100**, for instance, a group of four nozzles **100**, allows for exhaust release. Each of the group of four nozzles **100** has a cross-section having a shape of an oval. Each of the group of four nozzles **100** has a first end **105** attached to the second end **80** of one of each of the group of four ducts **70**. Each of the group of four nozzles **100** has a turn **115** (Figs. 4 and 7) measuring 90° and facing downward from the second end **80** of each of the group of four ducts **70**. Each of the group of four nozzles **100** has a second end **110** at which is a vane **95** for redirecting airflow.

In a variant, the size of the top opening **40** of the main body **30** is 87.5% of the size of the fan **55**. Each of the four ducts **70** is 15.6% of the size of the top opening **40** of the main body **30**. Each of the second ends **80** of each duct **70** is 50% of the size of the first ends **75** of each duct **70**. Each of the second ends **80** of each duct **70** is 7.8% of the size of the top opening **40** of the main body **30**.

In another variant, depicted in Figs. 8 and 9, a VTOL aircraft **200** comprises exactly two outlets for thrust. The VTOL **200** has a housing **25** and comprises a main body **30**. The main body **30** has an upper shell **35** in a shape of a parabola, with the shape of a parabola facing and expanding into a downward-facing end **35a**. The upper shell **35** of the main body **30** has a top opening **40** in a shape of a circle. The main body **30** also has a bottom plate **45** in a shape of a flat circle, sealed to the downward-facing end **35a** of the upper shell **35** of the main body **30**. The top opening **40** of the upper shell **35** of the main body **30** provides an inlet for air to enter into the housing **25**. The upper shell **35** of the main body **30** has two openings **50**. The set of two openings **50** each has a

shape of an oval. Each of the two openings **50** is placed around the upper shell **35** of the main body **30** at 180° to each other, facing each other.

As with the previous variant, a fan provides a centrifugal flow of air, similar to Fig. 6. The fan has a central hub, and a plurality of blades extends radially outward from the central hub. The fan is mounted to the top side of the bottom plate **45** of the main body **30**.

Two ducts **70** allow and directs air flow. Each of the ducts **70** has a cross-section having a shape of an oval. Each of the ducts **70** has a first end **75** and a second end **80**. The first end **75** fits into one of the set of the openings **50**, and the second end **80** of each extends horizontally outward therefrom. Each of the ducts **70** has a width and a height **90**. The width remains constant from the first end **75** to the second end **80** of each duct **70**. The height **90** of each of the ducts **70** remains constant from the first end **75** to the second end **80** of each of the ducts **70**. Similar to Figs. 4 and 7, at least one nozzle **100**, allows for exhaust release. Each of the nozzles **100** has a cross-section having a shape of an oval. Each of the nozzles **100** has a first end **105** attached to the second end **80** of one of each of the ducts **70**. Each of the nozzles **100** has a turn **115** measuring 90° and facing downward from the second end **80** of each of the ducts **70**. Each of the nozzles **100** has a second end **110** at which is a vane **95** for redirecting airflow.

The advantages of the invention are that it provides directed airflow of a VTOL aircraft, thus providing a greater lift and thrust compared to that of current technology. There is less of a need for multiple motors and propellers, thus also reducing fuel consumption and output of carbon emissions. In addition, the nature of the centrifugal fan creates evacuation of the air in the housing by sweeping away the boundary layer of air, thereby greatly reducing the air pressure immediately above the bottom plate. This creates higher pressure of ambient air below the bottom plate to exert force in an upward direction, increasing lift greatly.

Claims

What is claimed is:

1. A VTOL aircraft having thrust and directional control, comprising:

a housing;

a fan for providing a centrifugal flow of air;

at least one duct for directing air flow;

at least one nozzle in fluid communication with and connected to the duct, for expelling air flow.

2. The VTOL aircraft of claim 1, wherein:

the housing comprises a main body;

the main body has an upper shell in a shape of a parabola, the shape of a parabola faces and expands into a downward-facing end;

the upper shell of the main body has a top opening in a shape of a circle;

the main body also has a bottom plate in a shape of a flat circle, sealed to the downward-facing end of the upper shell of the main body;

the bottom plate having a top side and a bottom side; and

the top opening of the upper shell of the main body provides an inlet for air to enter into the housing.

3. The VTOL aircraft of claim 1, wherein:

the fan has a central hub; and

the fan has a plurality of blades extending radially outward from the central hub.

4. The VTOL aircraft of claim 1, wherein each of the at least one duct has a cross-section having a shape of an oval.

5. The VTOL aircraft of claim 1, wherein each of the at least one nozzle has a cross-section having a shape of an oval.

6. The VTOL aircraft of claim 1, wherein:

each of the at least one duct has a width and a height;

the width of each of the at least one duct decreases from the first end to the second end of each of the at least one duct; and

the height of each of the at least one duct remains constant from the first end to the second end of each of the at least one duct.

7. The VTOL aircraft of claim 1, wherein:

each of the at least one nozzle has a first end attached to the second end of one of each of the at least one duct;

each of the at least one nozzle has a turn measuring 90° and faces downward from the second end of each of the at least one duct; and

each of the at least one nozzle has a second end at which is at least one vane for redirecting airflow, with the vane having a curvature.

8. The VTOL aircraft of claim 1, wherein the at least one duct is a group of four ducts.

9. The VTOL aircraft of claim 1, wherein the at least one nozzle is a group of four nozzles.

10. The VTOL aircraft of claim 1, further comprising an attachment to the bottom side of the bottom plate, to allow the VTOL aircraft to land.

11. The VTOL aircraft of claim 2, wherein:

the upper shell of the main body has at least opening;

the at least one opening has a shape of an oval; and

each of the at least one opening is placed around the upper shell of the main body at 90° to each other.

12. The VTOL aircraft of claim 2, wherein:

each of the at least one duct has a first end and a second end;

the first end of each of the at least one duct fits into one of the at least one opening; and the second end of each of the at least one duct extends horizontally outward therefrom.

13. The VTOL aircraft of claim 3, wherein the fan is mounted to the top side of the bottom plate of the main body.

14. The VTOL aircraft of claim 8, wherein the at least one vane is a group of three vanes.

15. The VTOL aircraft of claim 12, wherein the at least one opening is a set of four openings.

16. The VTOL aircraft of claim 1, wherein the at least one duct is a group of exactly two ducts.

17. The VTOL aircraft of claim 1, wherein the at least one nozzle is a group of exactly two nozzles.

18. The VTOL aircraft of claim 12, wherein the at least one opening is a set of two openings.

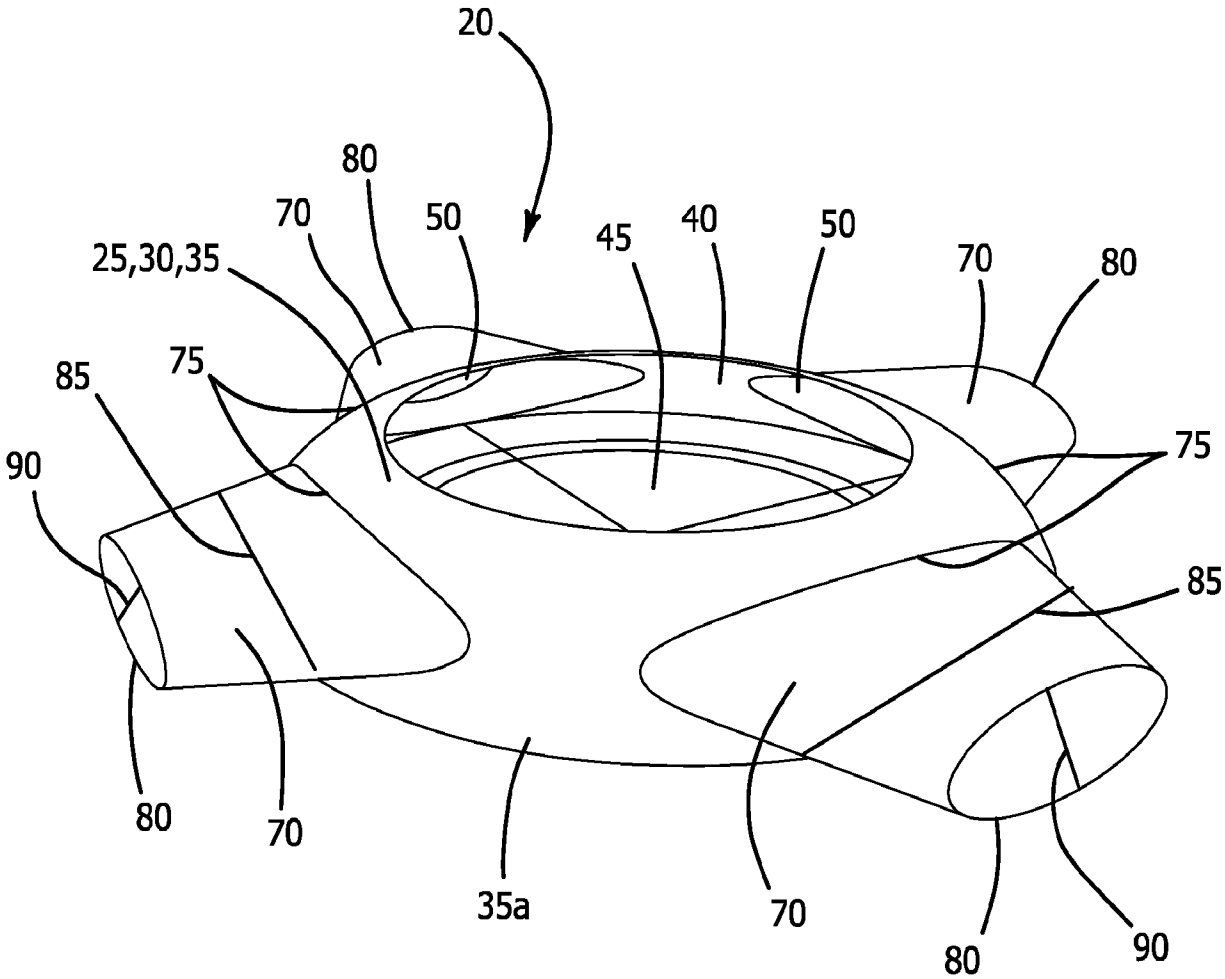


FIG. 1

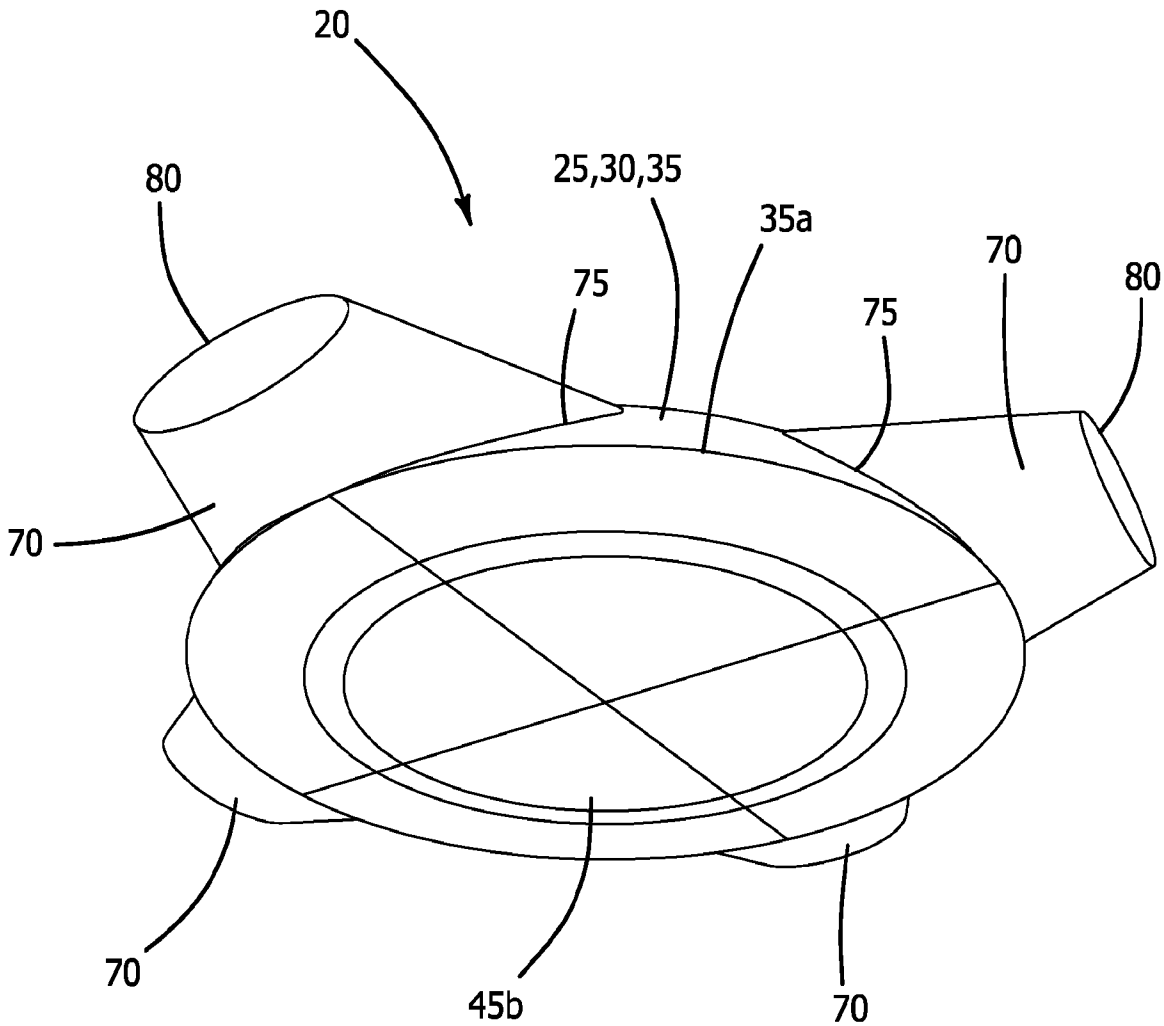


FIG. 2

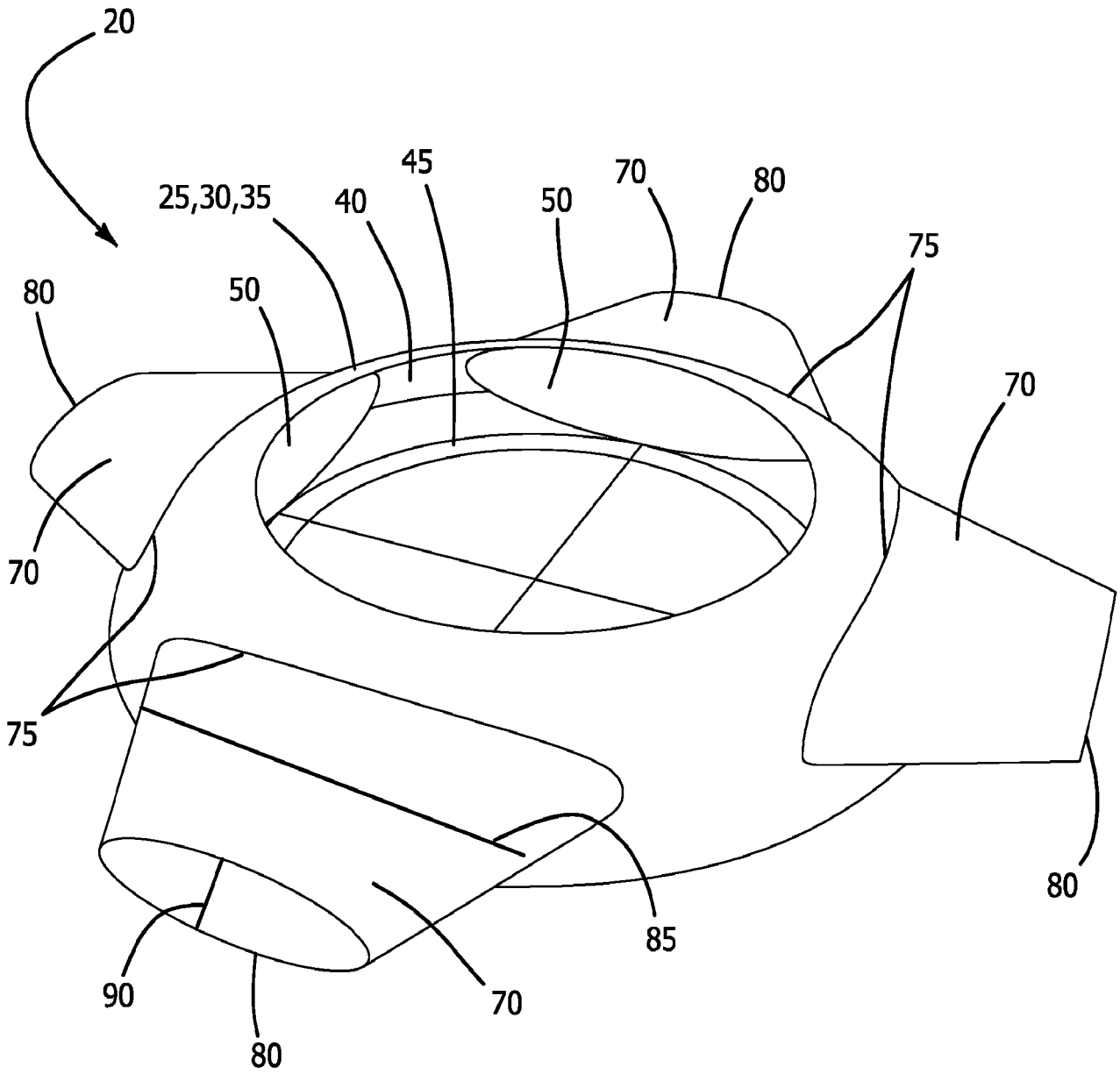


FIG. 3

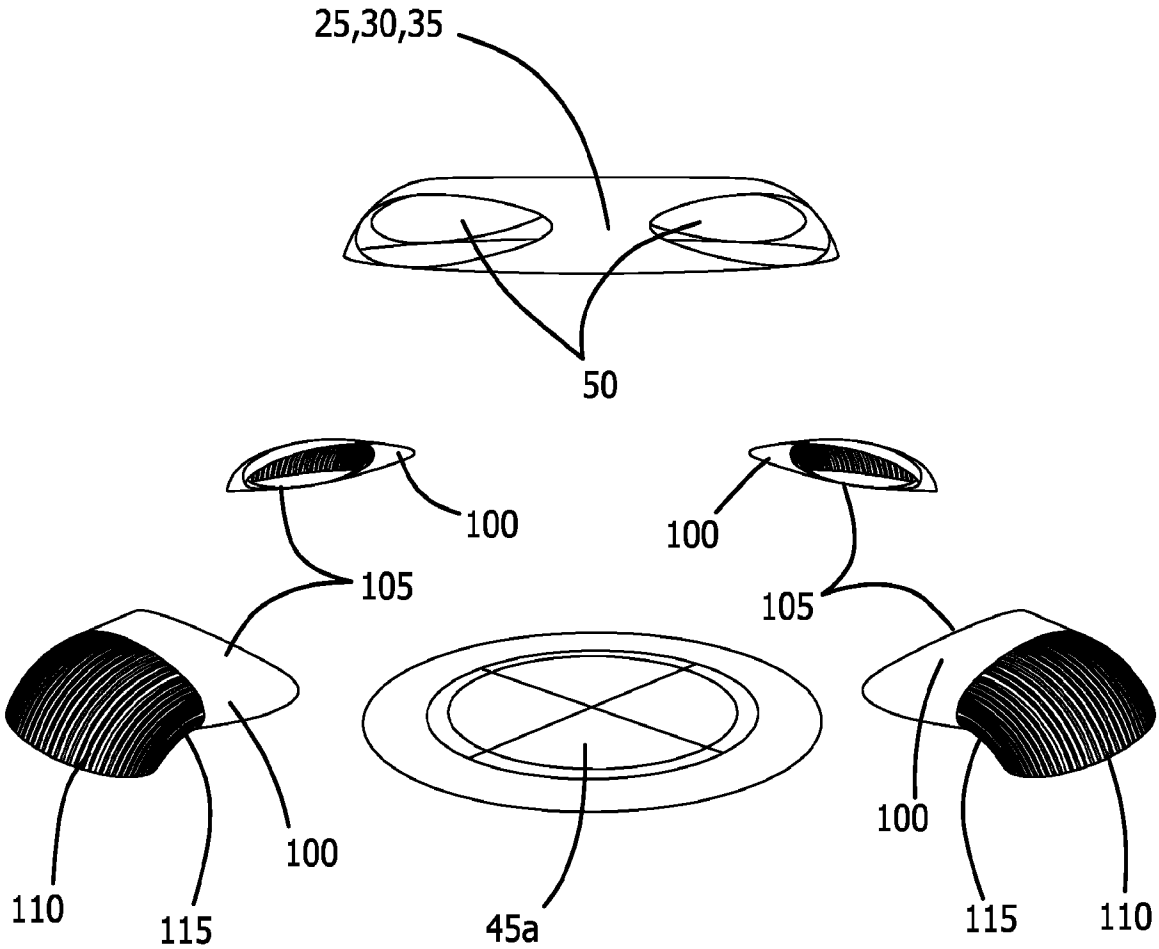


FIG. 4

Fig. 5

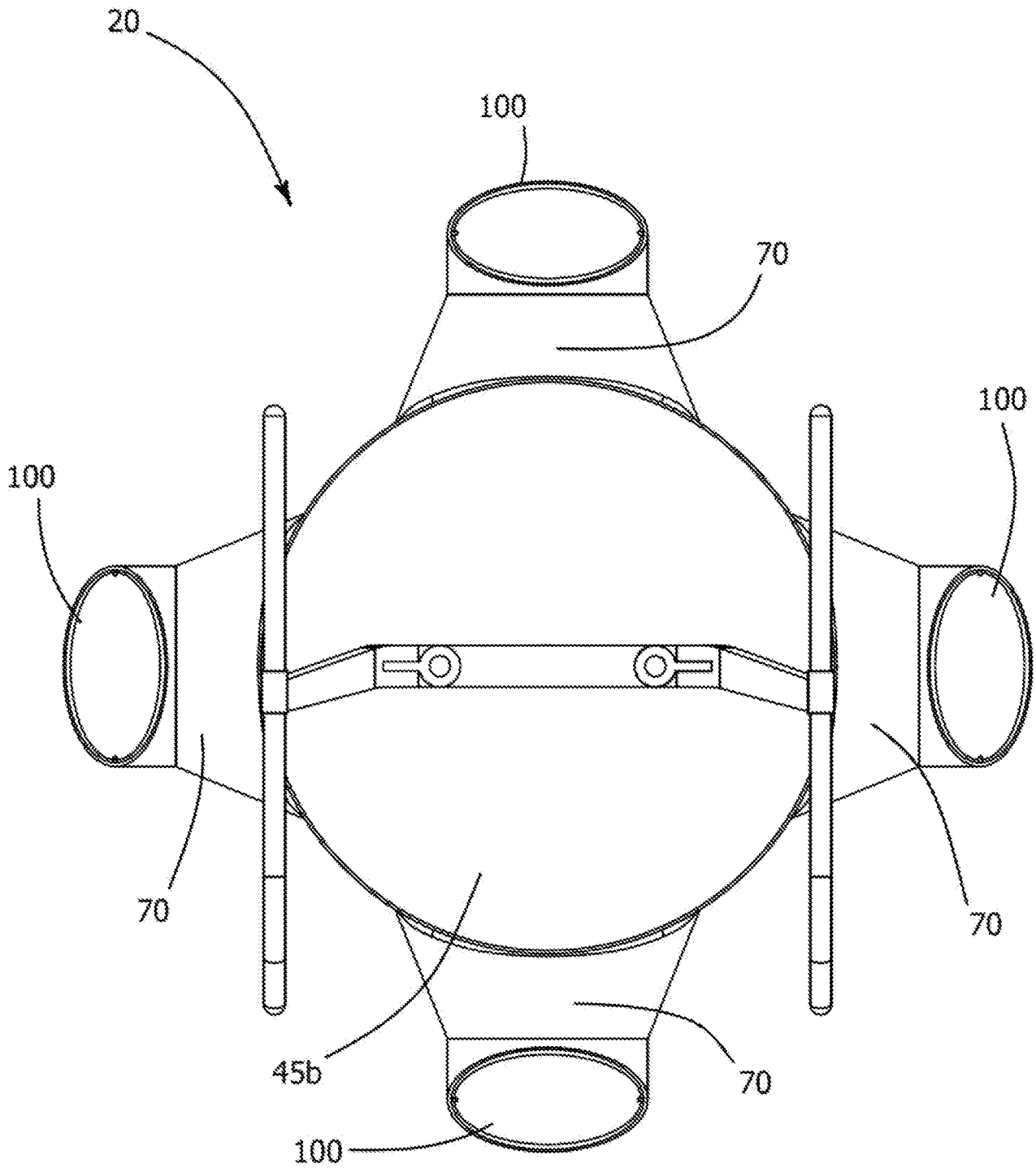


Fig. 6

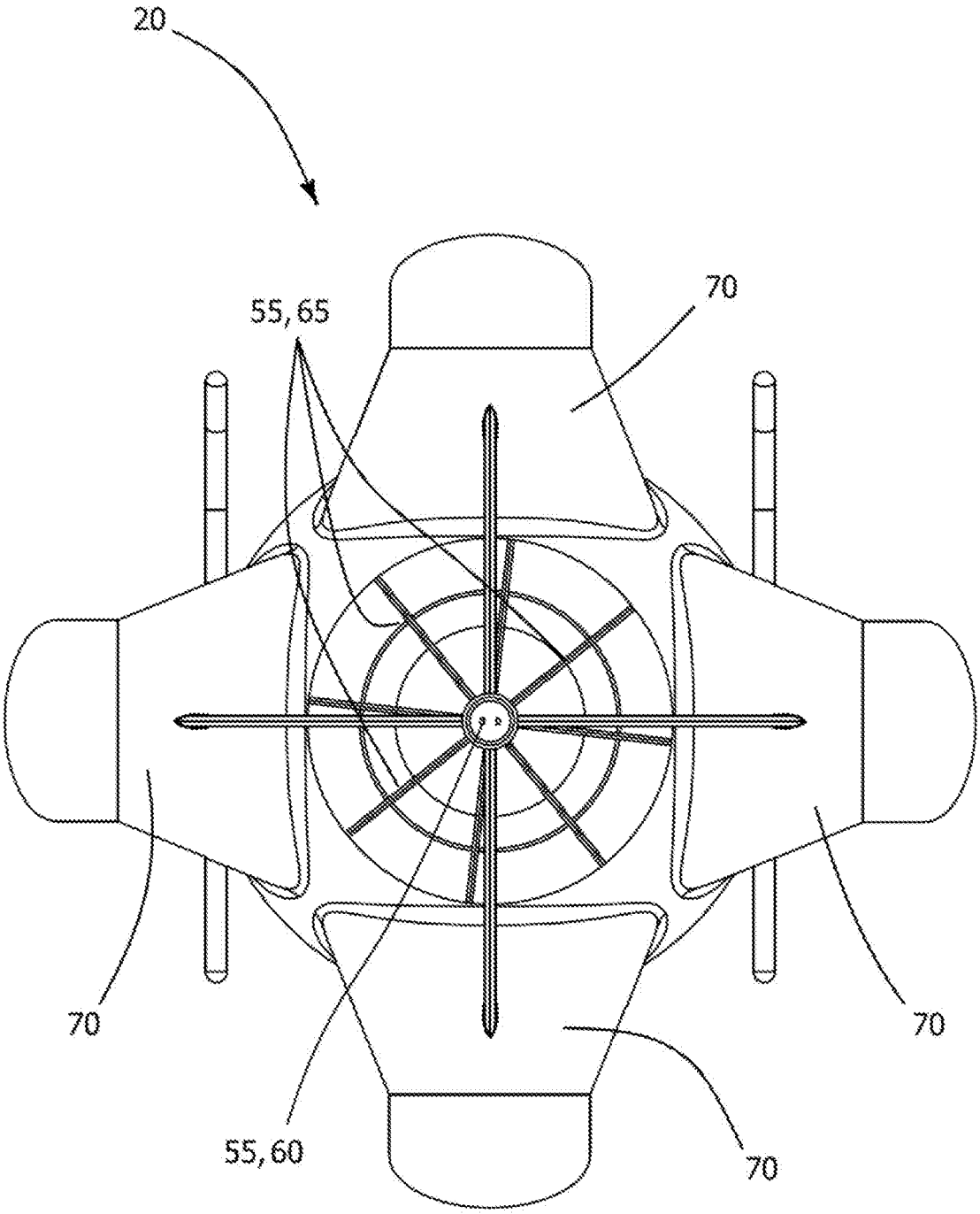
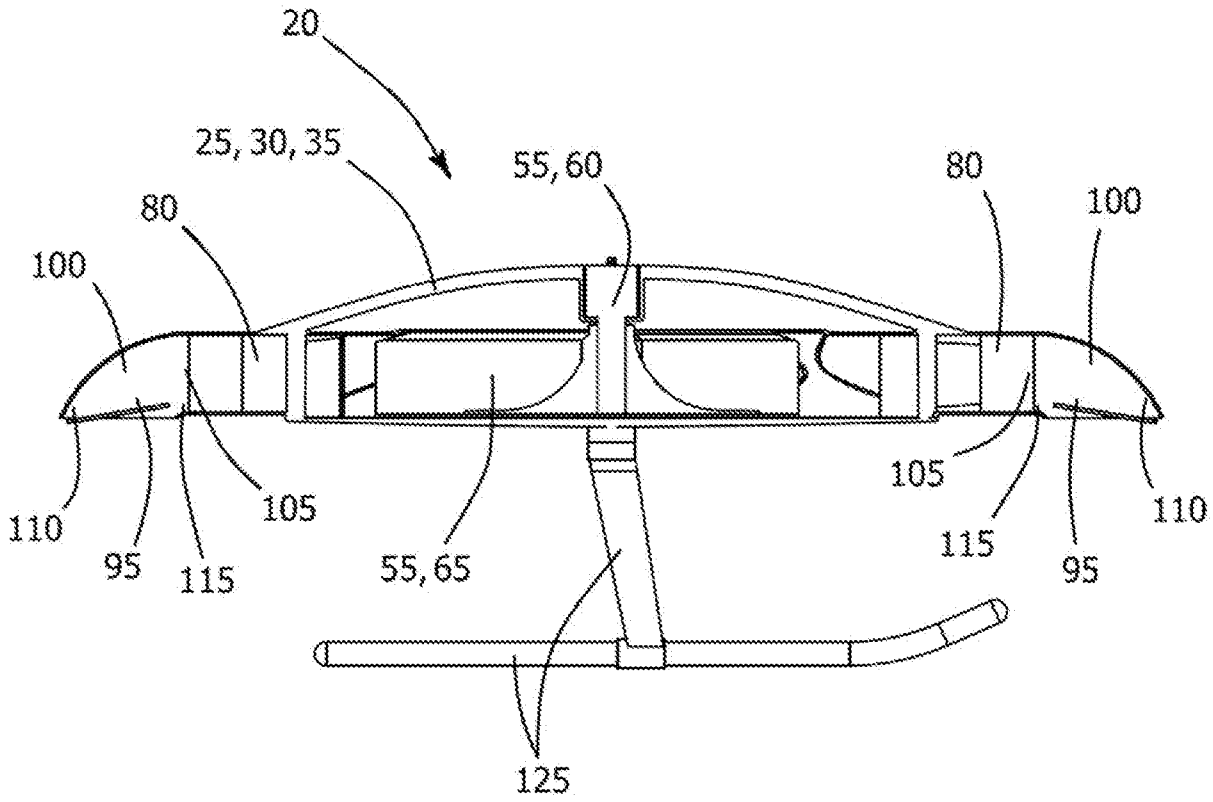


Fig. 7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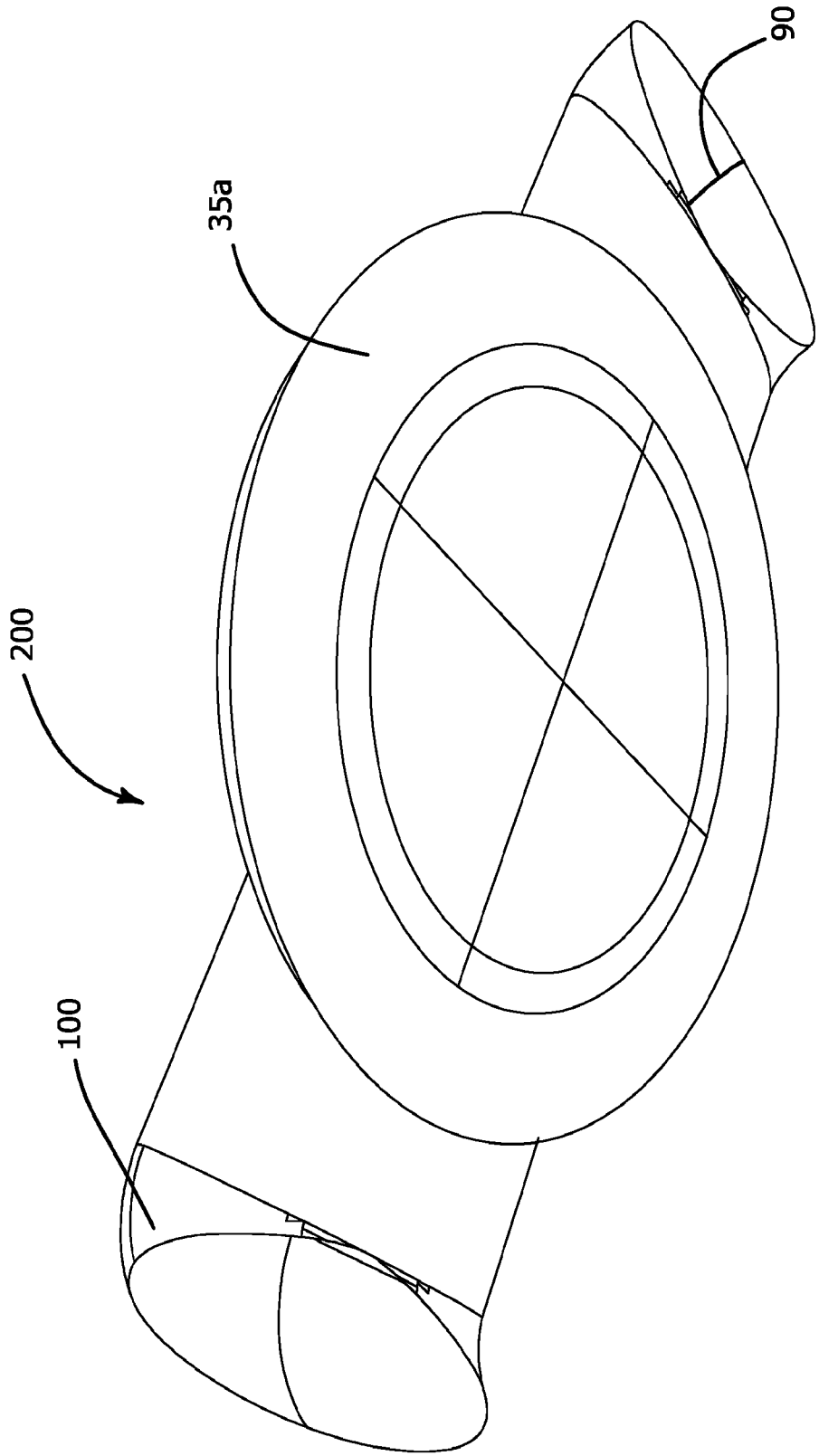

FIG. 8

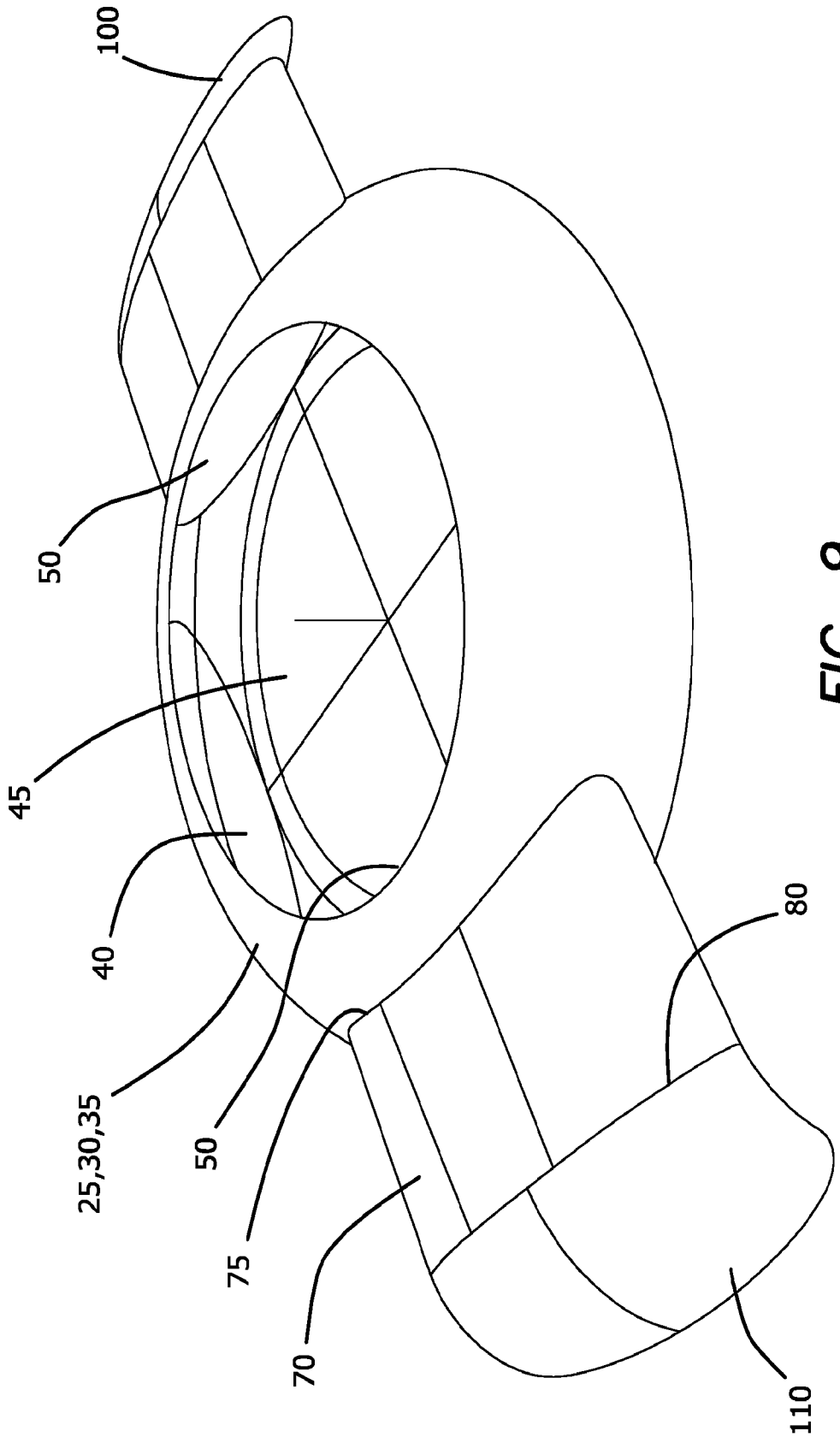

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 18/14596

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B64C 29/00 (2018.01)
CPC - B64C 29/00

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)
See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	WO 1997/01481 A1 (SADLEIR) 16 January 1997 (16.01.1997), entire document, especially Fig 1A-2C; pg 3, ln 3-4, 10-21, 24-30; pg 5, ln 27-31	1-2, 4-9, 11-12, 15-17, 18 --- 3, 10, 13-14
X --- Y	US 6,547,180 B1 (CASSIDY) 15 April 2003 (15.04.2003), entire document, especially Fig 1; col 4, ln 38-46; col 5, ln 66-67; col 6, ln 1-6, 18-25, 65-67; col 7, ln 1-3, 13-25	1, 3 --- 3, 13-14
Y	US 8,496,200 B2 (YOELI) 30 July 2013 (30.07.2013), entire document, especially Fig 10-12; col 10, ln 1-10, 19-24	10
A	US 8,646,721 B2 (CHAPMAN et al.) 11 February 2014 (11.02.2014), entire document	1-18
A	US 8,596,570 B1 (CARAMBAT) 03 December 2013 (03.12.2013), entire document	1-18
A	US 3,892,069 A (HANSFORD) 01 July 1975 (01.07.1975), entire document	1-18

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 March 2018	16 APR 2018
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774