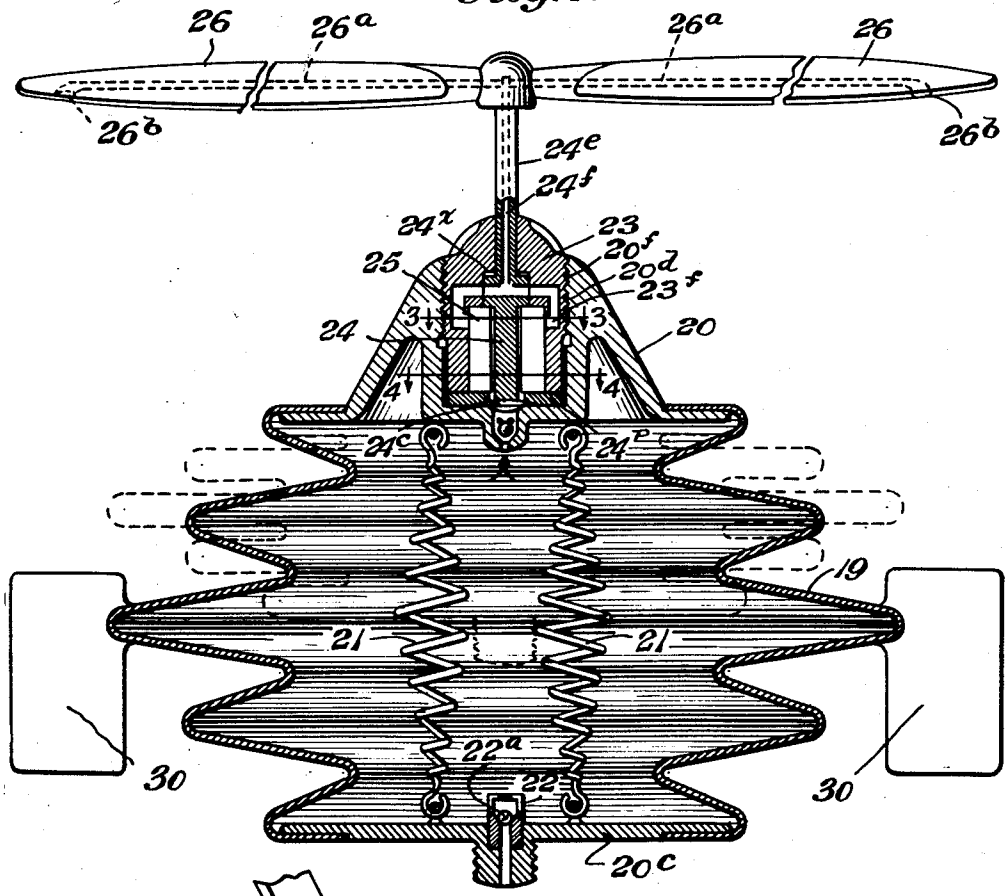
May 24, 1960 C. H. VLACHOS 2,937,473

TOY HELICOPTER

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Fig. 1.



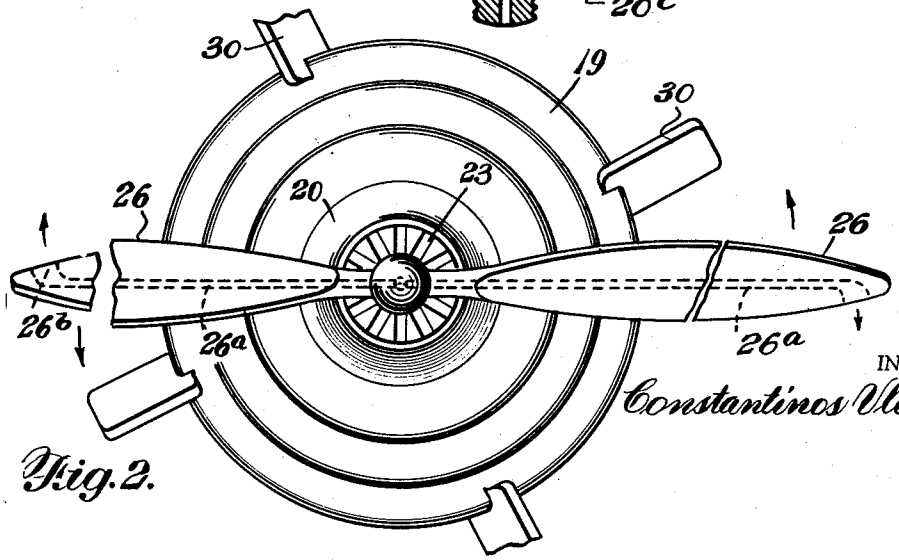


Fig. 2.

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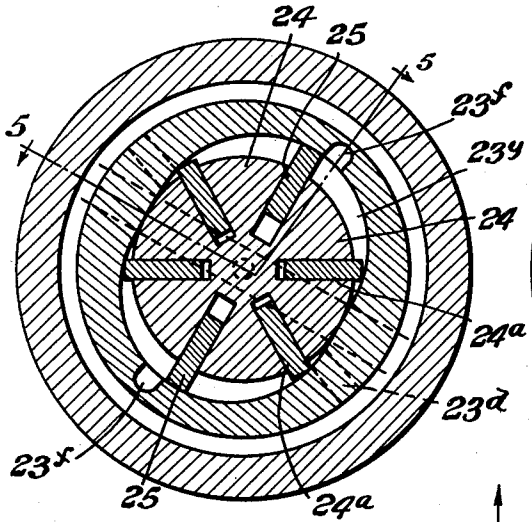


Fig. 3.

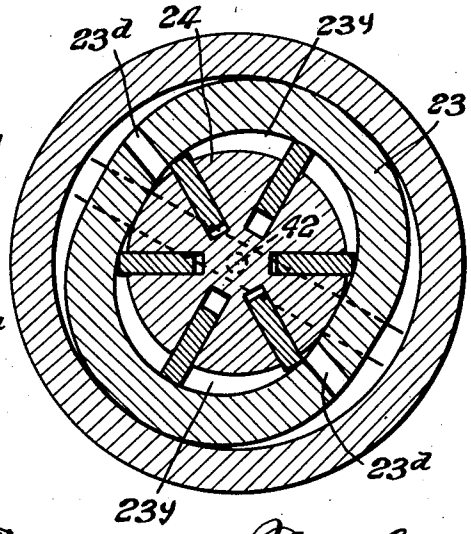


Fig. 4.

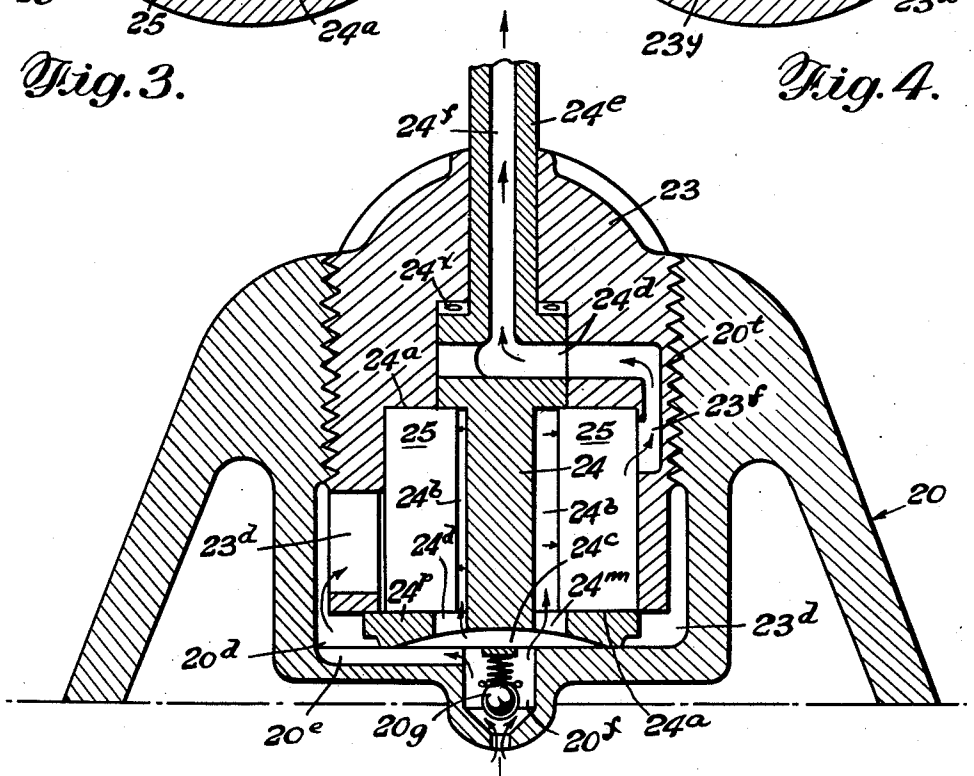


Fig. 5.

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Fig. 6.

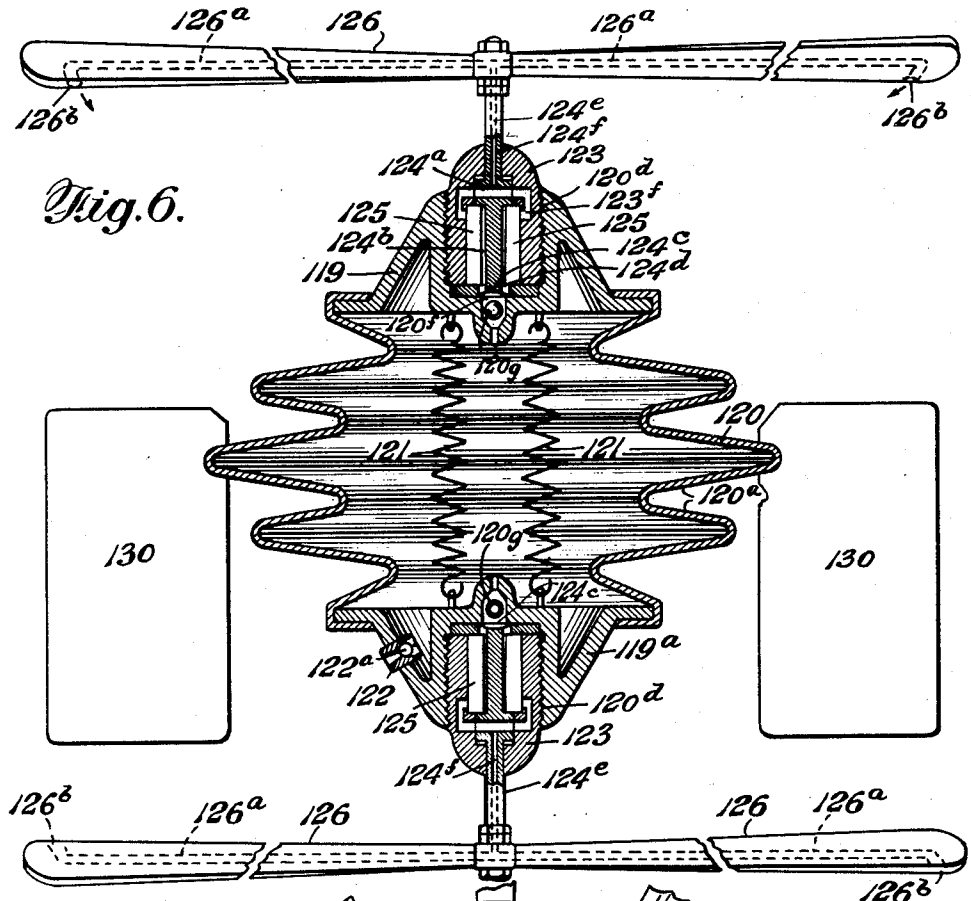
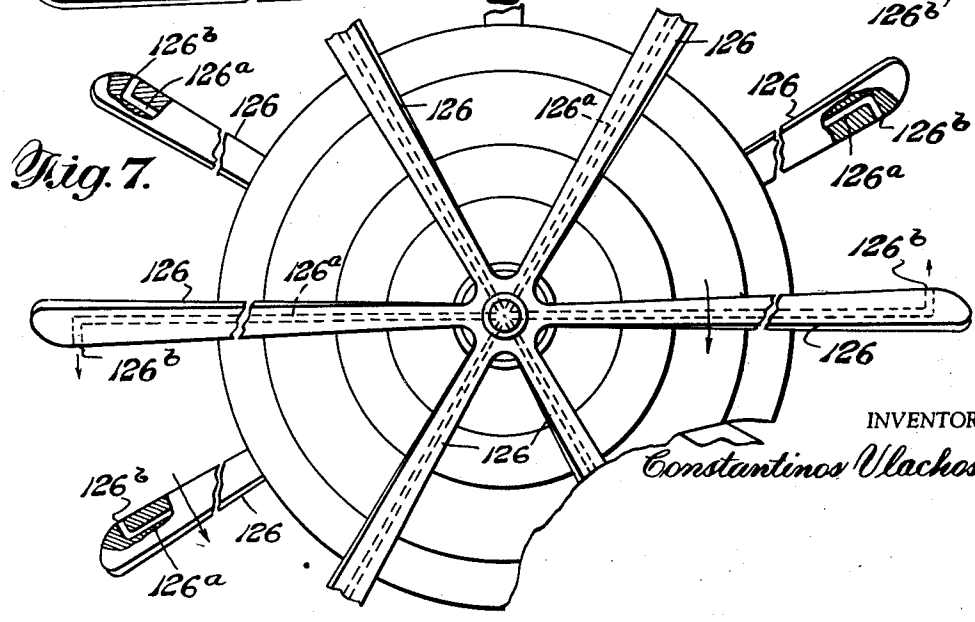


Fig. 7.



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United States Patent Office 2,937,473 Patented May 24, 1960

2,937,473

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Filed Mar. 2, 1956, Ser. No. 569,092

11 Claims. (Cl. 46—75)

This invention relates to toys and has particular relation to aerial toys.

The primary object of the invention is the provision of an improved aerial toy.

Another object of the invention is the provision of an improved aerial toy wherein a propeller is operated by compressed air.

Another object of the invention is the provision of an improved aerial toy having a propeller with jet openings in the trailing edges of the propeller blades.

Another and further object of the invention is the provision of an improved aerial toy wherein there is a body member including a bellows having internal tension springs which serve to compress air to drive a motor connected to a propeller.

Another and still further object of the invention is the provision of an improved aerial toy having two propellers, one turning in one direction and another turning in the opposite direction.

Still another object of the invention is the provision of an improved aerial toy wherein there is a propeller on the top and another on the bottom of an expansible body portion having an air compressor chamber to provide compressed air for driving motors and having the exhausts from the motors connected to jets at the trailing edges of the propeller blade.

Referring to the drawing wherein I have illustrated embodiments of my invention,

Fig. 1 is a sectional elevation of one form of my invention.

Fig. 2 is a top plan view of my invention shown on Fig. 1.

Fig. 3 is a sectional view on the line 3—3 of Fig. 1.

Fig. 4 is a sectional view on the line 4—4 of Fig. 1.

Fig. 5 is a rotated vertical sectional view taken on the line 5—5 of Fig. 3.

Fig. 6 is a vertical sectional view of a modified form of my invention.

Fig. 7 is a top plan view of the construction shown on Fig. 6.

Referring to Figs. 1 to 5 of the drawing, **19** indicates the body member of the toy. The body member is constructed of folds of flexible material providing a bellows which forms an expanding and contracting air compressor chamber.

At one end the body member **19** is provided with a head **20** which serves as the stator of a fluid pressure or air driven motor. A plate **20***c* acts as a closure member for the opposite end of the body member. Secured to the head member **20** and to the plate **20***c* and extending therebetween within the body member **19** are coil tension springs **21** which normally tend to pull the head and tail pieces toward each other.

A check valve **22** is provided in a passage in the plate **20***c* which will permit air to be drawn into the chamber of the body member **19** when the air pressure is less within than without the chamber and closes whenever the pressure within becomes greater than the air pressure outside the chamber. The ball **22***a* provides the actual checking action.

The head **20**, which provides the stator for the motor, is provided with a bored-out portion and has near its upper end a threaded portion **20***d* which receives a similarly threaded plug **23**. This plug **23** is provided with a bore **23***y* having an elliptical cross section for a purpose to be described.

Within the bore **23***y* is a cylindrical rotor **24** which is provided with slots cut substantially in the plane passing through the center of the rotor. These are designated as the slots **24***a*. The cylindrical portion of the rotor is of a size to fit the small dimension of the elliptical bore **23***y*. These slots **24***a* have vanes or blades **25** slidably mounted therein and of a length equal to the length of the elliptical cylinder.

The lower end of the elliptical bore is closed by a flange **24***p* which rotates with and as a part of the rotor **24**. Adjacent the inner ends of the slots **24***a* are openings **24***m* which connect the slots with the cut away portion **24***c*. This cut away portion **24***c* connects with the pressure chamber **20***f* which communicates with the space within the chamber of the body member **19**. When the pressure is greater in the chamber within the main body member **19**, than in the chamber **20***f*, the air will flow into the inner spaces behind the vanes **25** and force the latter outwardly against the wall of the elliptical cylinder.

As shown in Fig. 5, a space **20***d* is provided which connects to the chamber **20***f*. This space **20***d* has openings which register with the openings **23***d* in the plug **23**, and provide for the admission of air into the elliptical cylinder. There are two such openings which are oppositely disposed and extend parallel to the axis of the rotor.

At another level, preferably above, and at suitable angles of about 90° from the passages **23***d* are the outlets **23***f* which act as the exhausts for the motor. These exhaust passages are opposite in position and are connected with the end passages **24***d* of the duct **24***f* which in turn is connected to the ducts **26***a* and the jet outlets **26***b* in the trailing edges of the propeller blades **26**.

The seal between the shaft **24***e* and the plug **23** is a ring **24***x* which effectively seals the joint and provides a lubricant between the parts.

In order to give direction to the toy as a whole, I provide guiding vanes **30**. These guiding vanes are inclined or screw shaped to counter the tendency of the body **19** to turn in a backward direction as a reaction to the forward movement of the propeller **26**. The angle of the vanes **30** would depend upon the conditions in the particular construction.

In operation, the head **20** and plate **20***c* would be pulled apart, stretching the springs **21** to their limit. During this operation, the check valve **22** would permit the entrance of air into the chamber within the body **19**. On release of the plate **20***c*, the springs **21** pull the plate **20***c* toward the head **20** to compress the air and force it past the check valve **20***g*, through the chamber **20***f* as shown in Fig. 5.

The air under pressure would enter the elliptical cylinder at **23***d* (Fig. 3) and with the pressure behind the vanes **25**, there would be an effective seal between the vane **25** and the wall of the elliptical cylinder. With the rotation of the vanes and rotor as the result of air pressure applied to the vanes they would be pressed outwardly an increasing distance and remain in contact with the wall of the cylinder. About the time when the vanes reach their outermost limits they will pass the exhaust openings **23***f*. The exhaust air passes through the passage **24***f*, the passages **26***a* and is emitted from the jets **26***b*. The propeller is subjected to two forces, the turning forces of the rotor and the jet action on the outside air at the jets. This causes a reaction on the

stator but on releasing the toy for flight, the reaction of the guiding vanes **30** tends to prevent rotation of the body **19** and to keep the toy in flight.

In the embodiment of the invention illustrated in Figs. 6 and 7, there are two head members **119** and **119***a* secured together by the main body member **120** of bellows construction. The bellows **120** is composed of vari-sized folds **120***a* which construction assists in the collapsing operation when the toy is in flight.

Springs **121** are tension springs and tend to draw the heads together.

In order to admit air to the interior of the main body of the toy, I provide a check valve **122** having a check ball **122***a*. As the two heads **119** and **119***a* are drawn apart, the entry of air to the interior of the body member **120** is facilitated. When the heads **119** and **119***a* are permitted to approach each other, the valve **122***a* will stop the movement of air and the motor will be supplied with air under pressure as will presently be described.

The head members **119** and **119***a* are identical so that a description of one motor will serve as a description of both.

A plug **123**, which together with the head member **119** serves as a stator, is secured in a bore in the head member **119** by the screw thread portion **120***d*. The interior of the plug **123** has an elliptical bore similar to the bore **23***y* already described.

At the inside of the head members **119** and **119***a* are placed check valves **120***g* similar in construction and operation to the check valve **20***g* already described.

The small chamber **120***f* communicates with the passage controlled by the check valve **120***g* and connects with the passages **124***c* and **124***d* and the rear spaces **124***b* of the vanes **125**. These vanes **125** are forced outwardly during operation as already described for the vanes **25**.

The outlets or exhaust passages **123***f* are provided to permit the exhaust air to escape through the passages **124***a*, **124***f*, **126***a* and the jet openings **126***b* in the trailing edges of the propeller blades **126** to the open air, as explained for the escape of the air through the jets **26***b*. As the construction and operation of the motors are the same for this form of the invention as for the form disclosed in Figs. 1 to 5, it is believed that further description is unnecessary. Moreover, the details of the motor are not a part of the invention per se.

In this form of the invention, there are provided two propellers—a puller at the top and a pusher at the bottom. These propellers rotate in opposite directions to take care of and neutralize the reactions from the two propellers.

In order to give direction and prevent tumbling, guiding vanes **130** are provided. These guiding vanes are preferably attached to the outer edges of the large fold of the main body member **120** and are three or four in number. These should be spaced equally around the circumference and should preferably be mostly on the lower side or, in other words, below the center of gravity, to give a trailing effect.

When it is desired to cause the toy to fly, the heads **119** and **119***a* are drawn apart to the limit of the folds of the main body member **120**. This action fills the chamber within the main body member with air, through the check valve **122***a*. On release the check valve **122***a* will close and the valves **120***g* adjacent the motors will open and air will flow to the motors to drive the same. The toy is then released for flight. It may be found to be necessary to have the small opening to the upper check valve slightly larger than the corresponding opening to the lower check valve **120***g*. This would give the upper propeller a slightly greater speed than the speed of the lower propeller.

The material of this invention may be any light material as, for example, some of the light stable plastics.

The general type of motor is shown in the patent to Rice, 2,103,180.

While embodiments of my invention have been disclosed in detail it is to be understood that the disclosure is merely illustrative and that modifications and changes may be made without departing from the spirit of the invention and within its scope as claimed.

Having described my invention, what I claim is:

1. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, a check valve in said air inlet, an exhaust outlet on said motor communicating with an axial passage in said shaft, a passage in each blade of said propeller terminating in a jet opening in the trailing edge of each blade adjacent the tip and communicating with the passage in said shaft, a plate closing the opposite end of said body, an air supply passage in said plate communicating with the interior of said body, a check valve in said air supply passage, tension spring means connecting said head member and said plate to collapse said bellows and compress the air within said body to drive said motor and propeller and inclined guide vanes on said body to stabilize the flight of said toy and counteract the torque of said motor and propeller.

2. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, a check valve in said air inlet, an exhaust outlet on said motor communicating with an axial passage in said shaft, a passage in each blade of said propeller terminating in a jet opening in the trailing edge of each blade adjacent the tip and communicating with the passage in said shaft, a plate closing the opposite end of said body, an air supply passage in said plate communicating with the interior of said body, a check valve in said air supply passage, tension spring means connecting said head member and said plate to collapse said bellows and compress the air within said body to drive said motor and propeller and means on said body to stabilize the flight of said toy and counteract the torque of said motor and propeller.

3. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, a check valve in said air inlet, an exhaust outlet on said motor, a plate closing the opposite end of said body, an air supply passage in said plate communicating with the interior of said body, a check valve in said air supply passage, tension spring means connecting said head member and said plate to collapse said bellows and compress the air within said body to drive said motor and propeller and means on said body to stabilize the flight of said toy and counteract the torque of said motor and propeller.

4. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said

head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, a check valve in said air inlet, an exhaust outlet on said motor, a closure for the opposite end of said body, an air supply passage in said closure communicating with the interior of said body, a check valve in said air supply passage, tension springs connecting said head member and said closure to collapse said bellows and compress the air within said body to drive said motor and propeller and means on said body to stabilize the flight of said toy and counteract the torque of said motor and propeller.

5. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, an exhaust outlet on said motor, a closure for the opposite end of said body, an air supply passage communicating with the interior of said body, a check valve in said air supply passage, tension spring means connecting said head member and said closure to collapse said bellows and compress the air within said body to drive said motor and propeller and means on said body to stabilize the flight of said toy and counteract the torque of said motor and propeller.

6. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, a check valve in said air inlet, an exhaust outlet on said motor communicating with an axial passage in said shaft, a passage in each blade of said propeller terminating in a jet opening in a trailing edge of each blade adjacent the tip and communicating with the passage in said shaft, a second head member closing the opposite end of said body, a second air operated motor mounted on said second head member and having a propeller shaft projecting axially of said body, a second propeller fixed to said last named shaft, an air inlet to said second motor communicating with the interior of said body, a check valve in said last named air inlet, an exhaust outlet on said second motor communicating with an axial passage in said last named shaft, a passage in each blade of said second propeller terminating in a jet opening in the trailing edge of each blade adjacent the tip and communicating with the passage in said last named shaft, an air supply passage in said second head communicating with the interior of said body, a check valve in said air supply passage, tension spring means connecting said head members to collapse said bellows and compress the air within said body to drive said motors and propellers, and guide vanes on said body to stabilize the flight of said toy.

7. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, a check valve in said air inlet, an exhaust outlet on said motor, a second head member closing the opposite end of said body, a second air operated motor mounted on said second head member and having a propeller shaft projecting axially of said body, a second

propeller fixed to said last named shaft, an air inlet to said second motor communicating with the interior of said body, a check valve in said last named air inlet, an exhaust outlet on said second motor, an air supply passage in said second head communicating with the interior of said body, a check valve in said air supply passage, tension spring means connecting said head members to collapse said bellows and compress the air within said body to drive said motors and propellers, and means on said body to stabilize the flight of said toy.

8. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, an exhaust outlet on said motor, a second head member closing the opposite end of said body, a second air operated motor mounted on said second head member and having a propeller shaft projecting axially of said body, a second propeller fixed to said last named shaft, an air inlet to said second motor communicating with the interior of said body, an air supply passage in said second head communicating with the interior of said body, a check valve in said air supply passage, tension spring means connecting said head members to collapse said bellows and compress the air within said body to drive said motors and propellers, and means on said body to stabilize the flight of said toy.

9. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, an exhaust outlet on said motor, a second head member closing the opposite end of said body, a second air operated motor mounted on said second head member and having a propeller shaft projecting axially of said body, a second propeller fixed to said last named shaft, an air inlet to said second motor communicating with the interior of said body, an air supply passage communicating with the interior of said body, a check valve in said air supply passage, tension spring means connecting said head members to collapse said bellows and compress the air within said body to drive said motors and propellers, and means on said body to stabilize the flight of said toy.

10. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, an exhaust outlet on said motor, a second head member closing the opposite end of said body, a second air operated motor mounted on said second head member and having a propeller shaft projecting axially of said body, a second propeller fixed to said last named shaft, an air inlet to said second motor communicating with the interior of said body, tension spring means connecting said head members to collapse said bellows and compress the air within said body to drive said motors and propellers, and means on said body to stablize the flight of said toy.

11. A self-propelled aerial toy comprising a hollow tubular body open at opposite ends and formed of flexible air impervious material having spaced transverse folds to provide a bellows, a head member closing one end of said body, an air operated motor mounted on said

head member and having a propeller shaft projecting axially of said body, a propeller fixed to said shaft, an air inlet to said motor communicating with the interior of said body, an exhaust outlet on said motor, a second head member closing the opposite end of said body, a second air operated motor mounted on said second head member and having a propeller shaft projecting axially of said body, a second propeller fixed to said last named shaft, an air inlet to said second motor communicating with the interior of said body, an exhaust outlet on said second motor and tension spring means connecting said head members to collapse said bellows and compress the air within said body to drive said motors and propellers.

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