April 27, 1965

C. A. SERRIADES

3,180,424

PROPELLER STRUCTURE

Filed March 25, 1963

2 Sheets-Sheet 1

Fig. 1

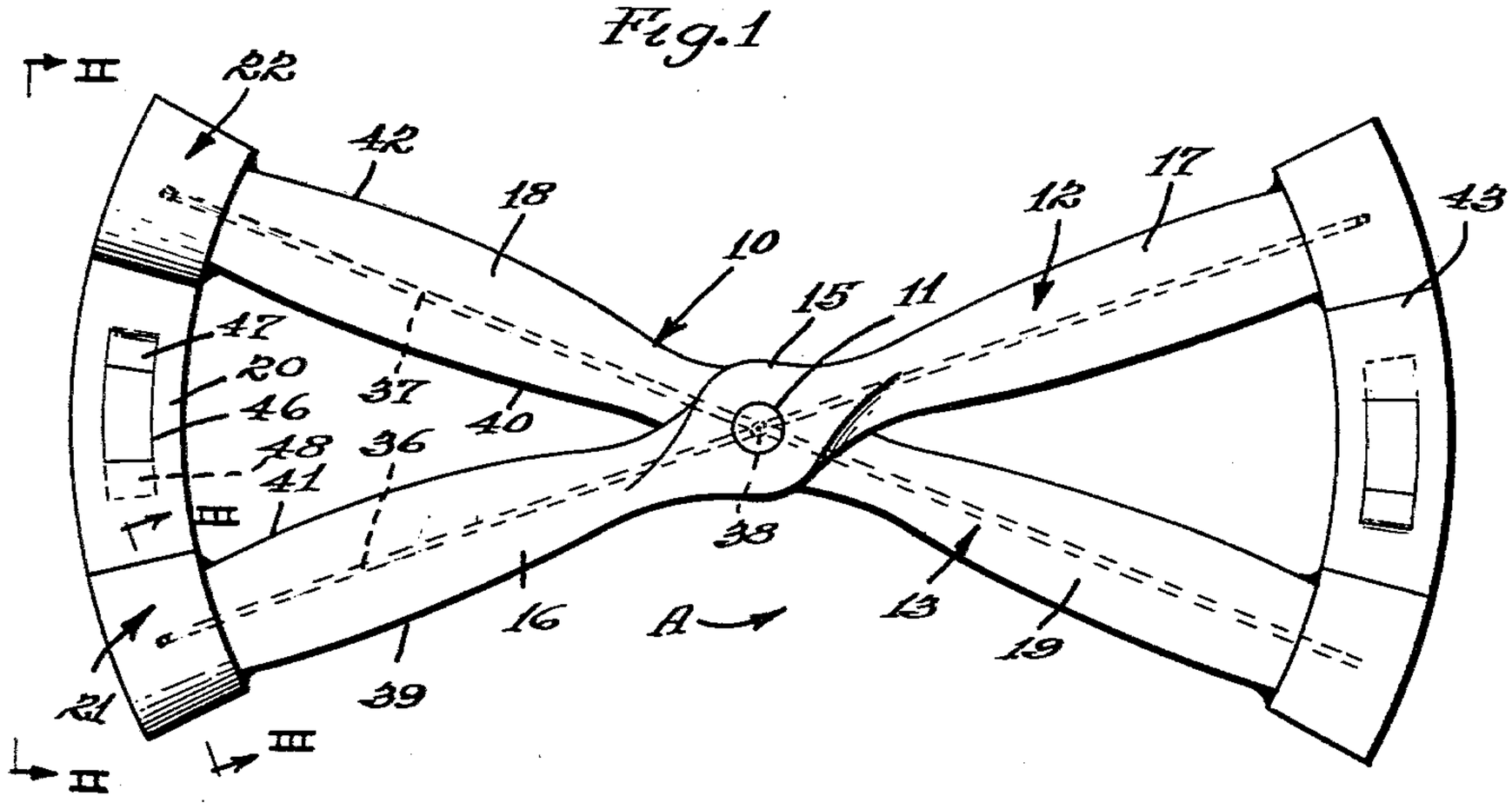

Fig. 2

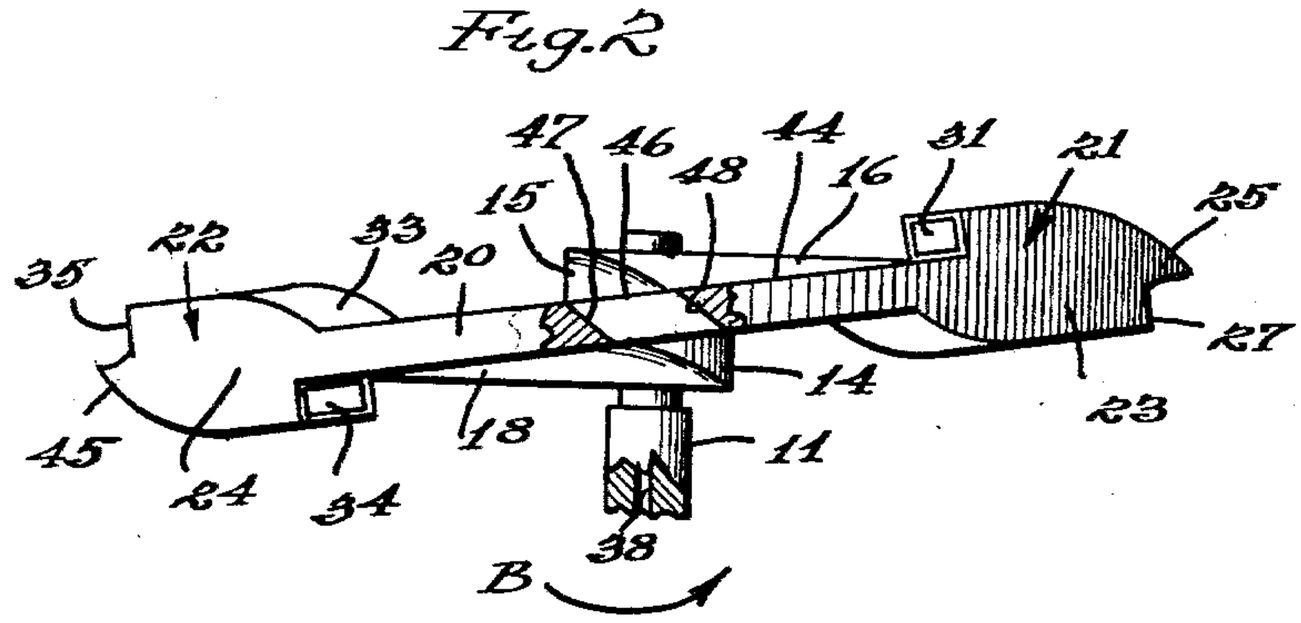

Fig. 3

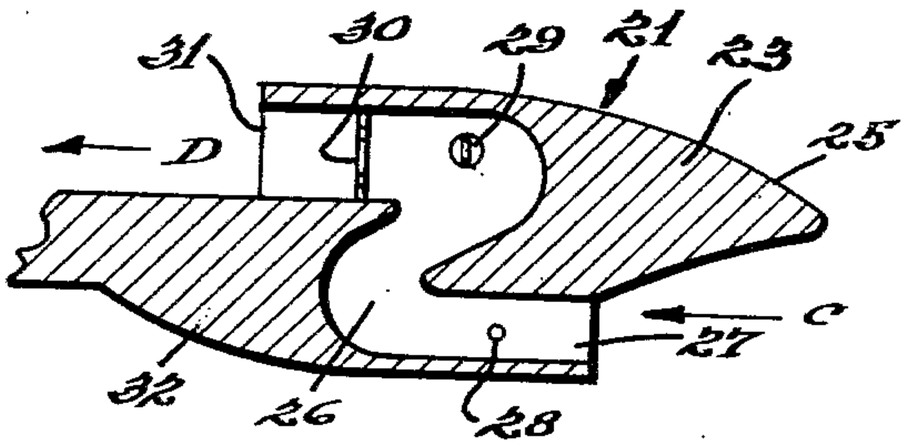

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Fig. 4

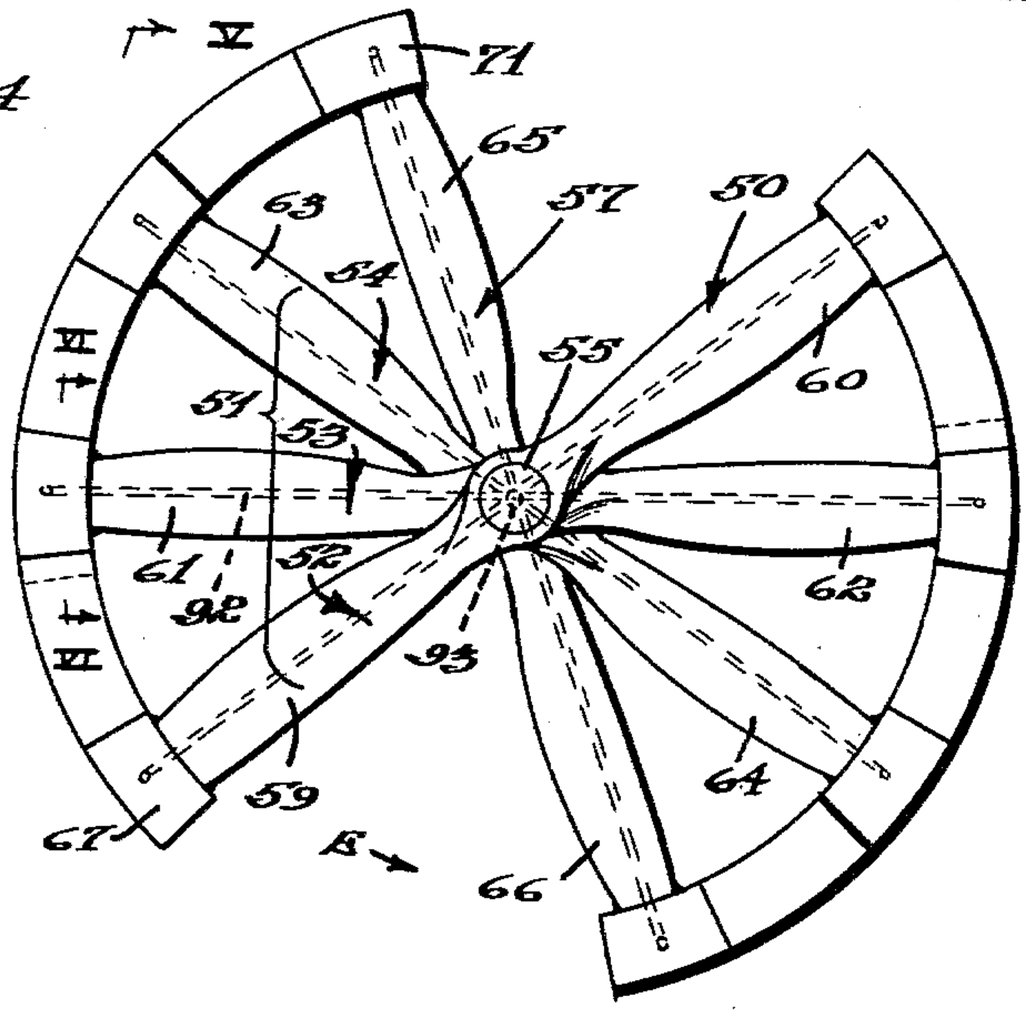


Fig. 5

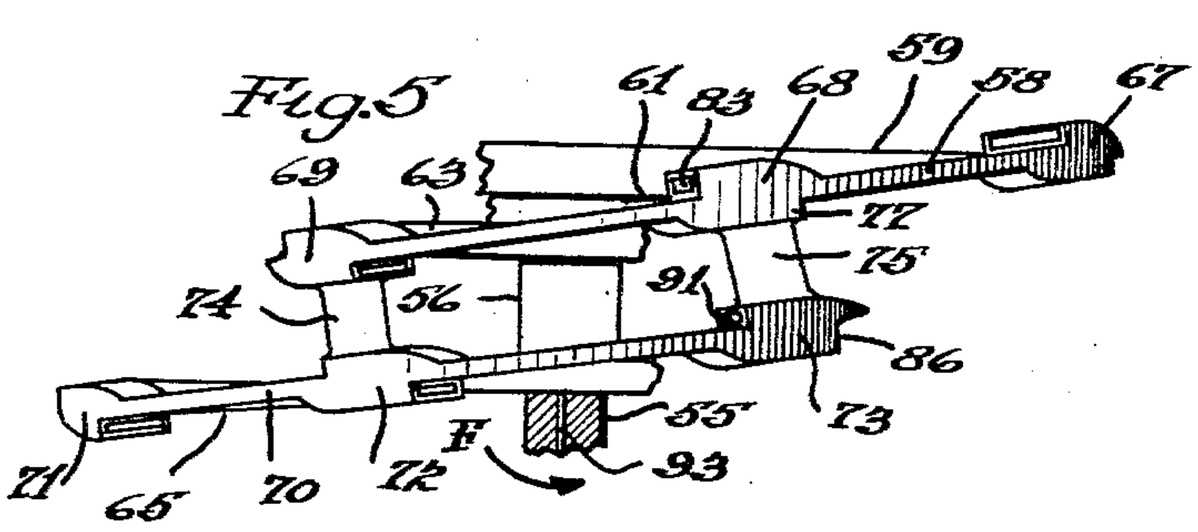
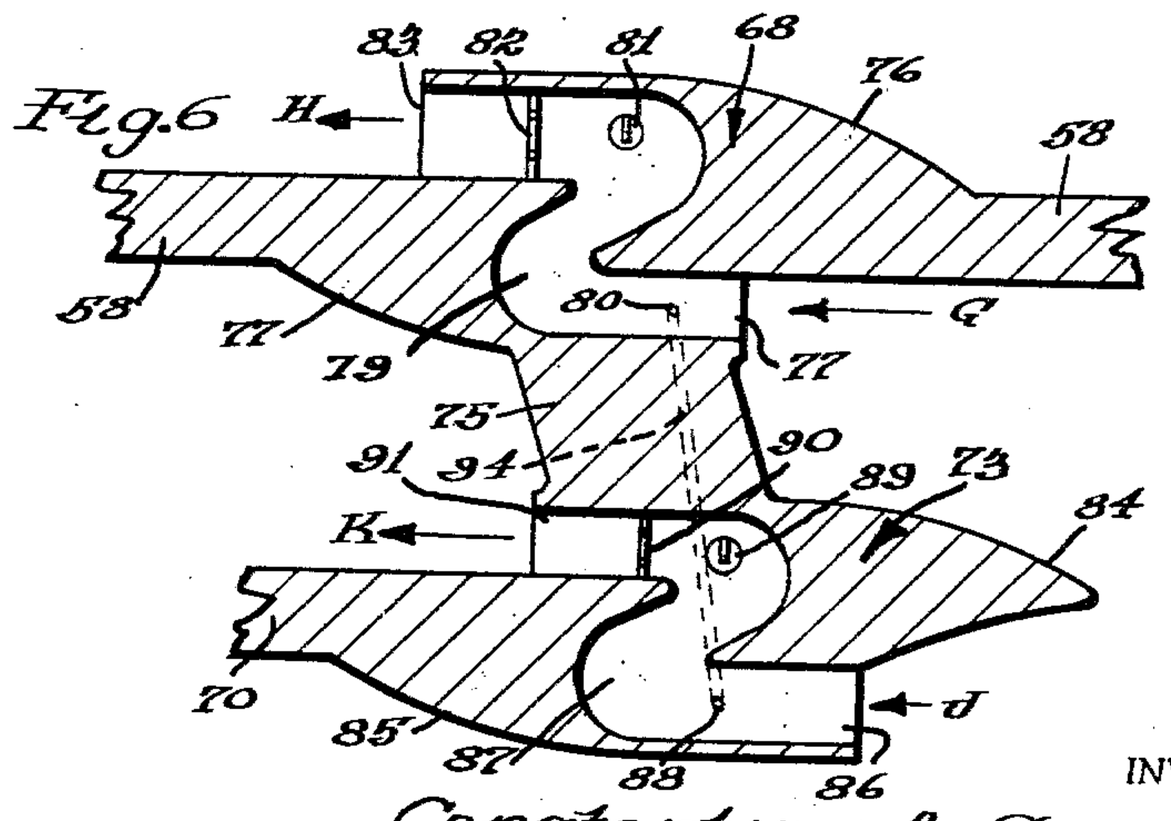


Fig. 6



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PROPELLER STRUCTURE

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This invention relates to a jet propelled propeller, and more particularly to a propeller comprising a number of blade portions interconnected at the tips and having a built-in jet propulsion means for rotating the propeller.

An object of the present invention is to provide a new and improved propeller employing jet propulsion means for rotation.

A further object of the present invention is to provide a simple power plant for aircraft which can be economically constructed with a minimum of parts.

A further object of this invention is to simplify the repair and maintenance of the power plant of an aircraft.

A further object of this invention is to provide a propeller comprising a number of blade portions interconnected at their tips to provide added thrust when rotated.

A further object of this invention is to provide a unique jet engine for use at the tip of a propeller.

A further object of this invention is to provide a jet-propelled propeller of unitary construction, preferably for use with a helicopter type aircraft, but which can be used on other types of aircraft as well.

Briefly, the embodiment of the invention disclosed herein comprises a propeller made up of a number of propeller blades mounted next to each other on the propeller shaft and at a slight rotational angle to each other. Adjacent blade portions are interconnected at their tips by a relatively flat-surfaced arcuate sector. Several small jet engines, integral with the arcuate sector, are provided to rotate the propeller. By reason of the fact that the propeller portions are mounted next to each other on the shaft with an arcuate sector extending between the tips, each arcuate sector is disposed so as to extend through a plane at a slight angle to a plane normal to the propeller shaft. Each arcuate sector is, in this manner, generally parallel to the blade of each propeller portion. In this manner, each sector provides an additional lifting or thrust surface when the propeller is rotated by the jet engine. If desired, slots having end walls at a slight angle to the direction of rotation can be provided in each arcuate sector for even greater thrust.

The invention will be more fully understood from the following detailed description of an embodiment thereof.

On the drawings:

FIGURE 1 is a plan view of a propeller having two blade portions and a flat-surfaced arcuate sector interconnecting adjacent tips of the propeller portions. Also shown is a slot in each sector for providing added thrust.

FIGURE 2 is an elevational view taken along line II—II of FIGURE 1, showing the jet engines which are disposed adjacent the tips of each of the adjacent blades. The blade hubs are shown adjacent each other on the propeller shaft.

FIGURE 3 is an enlarged cross-sectional view taken along line III—III of FIGURE 1, showing a jet engine.

FIGURE 4 is a plan view of a modification of this invention, showing a larger number of blades having interconnecting sectors.

FIGURE 5 is an elevational view taken along line V—V of FIGURE 4, showing the arcuate sectors spaced apart and slightly overlapping, so as to create a bi-plane effect.

FIGURE 6 is an enlarged cross-sectional view of the jet engines taken along line VI—VI of FIGURE 4.

Referring now to the drawings, in FIGURES 1 and 2,

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there is shown a propeller 10 of the instant invention for use on an aircraft (not shown) having a rotational shaft 11 extending therefrom and rotatable in the direction shown by arrows A and B. The propeller 10 comprises two propeller portions 12 and 13, having hubs 14 and 15 respectively, which are mounted adjacent each other on the rotatable shaft 11. The propeller portion 12 has a blade section 16 and a blade section 17 extending from either side of the hub 15, while the propeller portion 13 has a blade section 18 and a blade section 19.

An arcuate sector 20 is shown between the tips of the blade sections 16 and 18 and is integral therewith. Similarly, an arcuate sector 43 is disposed between the tips of the blade sections 17 and 19. It should be noted that the portion of the propeller 10 to the right of the shaft 11 (as viewed in FIGURE 1) is identical to the portion to the left of the shaft 11. Accordingly, only the left portion will be described hereafter.

In FIGURE 2, it is observed that the jet propulsion means 21 and 22, having enlarged body members 23 and 24 respectively integral, with or built into the sector 20, are disposed adjacent the tips of the blades 16 and 18. As seen in FIGURE 3, the body member 23 has a generally V-shaped leading contour 25, with an intake port 27 disposed below the V-shaped contour 25. An S-shaped flow path 26 is formed in the body member 23, with the direction of flow indicated by the arrows C and D. Air entering the intake port 27, positioned below the plane of the sector 20, passes a fuel nozzle 28, an igniting means 29, through a grid means 30 which maintains combustion of the fuel-air mixture, and through an exhaust port 31 located above the plane of the sector 20 and directed tangentially to the blade 16. A trailing contour 32 of the body member 23 is aero-dynamically shaped to allow air to pass freely thereover.

Similarly, the body member 24 has an aero-dynamically shaped leading contour 33, an intake port 34, a fuel nozzle, igniting means and a grid means (all not shown) and an exhaust port 35 directed tangentially to the blade 18. Notice that a trailing contour 45 of the body member 24 is generally V-shaped, with the exhaust port 35 disposed above the V-shaped contour 45.

Fuel is fed to the fuel nozzles of the jet propulsion means 21 and 22 through hollow passages 36 and 37 respectively extending from the fuel line 38 in the center of the shaft 11. Operation of the jet propulsion means 21 and 22 creates exhaust gases which are emitted from the exhaust ports 31 and 35, tangentially to the peripheries of the blades 16 and 18 respectively. The exhaust gases thus create a thrust which rotate these blades about the shaft 11 in the direction shown by the arrows A and B. The structure of the propeller 10 of the instant invention is consequently much more than the mere provision of jet propulsion means at the tips of a propeller. The blades 16 and 18 have leading edges 39 and 40 respectively which are directed or tipped slightly away from the aircraft, and trailing edges 41 and 42 which are directed slightly toward the aircraft. By mounting the propeller portions 12 and 13 adjacent each other and placing them at a slight rotational angle relative to each other, the generally flat surfaces of the sectors 20 and 43 which interconnect the tips of the blades, lie in a plane which is substantially parallel to the normal planes of the blades. For this reason, the sectors 20 and 43 act as an additional thrust surface, similar to that of the blades 16 to 19.

Driving the propeller 10 by jet propulsion means utilizes the additional thrust surface provided by the sectors 20 and 43. Even greater thrust is created by the novel construction of the integral sector 20 and the jet propulsion means 21 and 22. For example, directing the exhaust port 31 across the upper surface 44 of the sector 20 creates an area of partial vacuum near the upper

surface 44 which causes the sector 20 to be continuously urged or lifted toward that area of partial vacuum. Similarly, the exhaust port 35 is directed across the upper side of the V-shaped contour 45 and creates a partial vacuum thereabove.

If desired, even more thrust can be obtained by providing a slot 46 having a pair of end walls 47 and 48 lying at a slight angle to the shaft 11. Air flow through the slot 46 tends to urge the sector 20 upwardly and in a direction parallel to the shaft 11.

In the modification shown in FIGURES 4 to 6, a propeller 50 including a group 51 of three blades 52, 53 and 54 (having blade sections 59 to 60, 61 and 62, 63 to 64, respectively) have been provided adjacent each other on a rotatable shaft 55. A spacer 56 on the shaft 55 positions a fourth blade 57 (having blade sections 65 and 66) a predetermined distance below the group 51. Once again, the portion of the propeller 50 to the right of the shaft 55 (as viewed in FIGURE 4) is identical to the portion to the left of the shaft 54. Therefore, only the left portion will be described hereafter.

The direction of rotation of the propeller 50 is as indicated by arrows E and F in FIGURES 4 and 5, respectively. A first flat arcuate sector 58 integrally connects the tips of the blade sections 59, 61 and 63. Jet propulsion means 67, 68 and 69 are provided adjacent the respective tips of the aforementioned blades. A second flat arcuate sector 70 is integral with the tip of the blade section 65 and is disposed in a plane substantially parallel to and slightly overlapping the plane of the first sector 58. Other jet propulsion means 72 and 73, integral with the second sector 70, are disposed directly below and opposite the jet propulsion means 69 and 68 respectively. Web members 74 and 75 interconnect the jet means 69 and 72, and 68 and 73 respectively. Notice particularly that the jet propulsion means 72 and 73 have no blades integral therewith, but are supported only by the web members 74 and 75, and the second sector 70.

The detail construction and operation of each jet propulsion means is substantially as described for FIGURES 1 to 3. For example, see FIGURE 6 where it is shown that the jet means 68 is substantially the same width as the first sector 58, and has an aero-dynamically shaped leading contour 76 and trailing contour 77. Air enters an intake port 78 as indicated by the arrow G, and moves through a substantially S-shaped flow path 79 past a fuel nozzle 80, an igniting means 81, through a grid means 82 which maintains combustion of the fuel-air mixture, and through an exhaust port 83 and out as indicated by the arrow H. In like manner, the jet propulsion means 73 is substantially the same width as the jet propulsion means 68 and has a generally V-shaped leading contour 84. And an aero-dynamically shaped trailing contour 85. Air enters an intake port 86 as indicated by the arrow J, and moves through a substantially S-shaped flow path 87, past a fuel nozzle 88, an igniting means 89, through a grid means 90, and through an exhaust port 91 and out as indicated by the arrow K. Fuel is fed to the fuel nozzle 80 of the jet propulsion means 68 through a hollow passage 92 (in the blade 61) extending from a fuel line 93 in the center of the shaft 55. Similarly, fuel is fed to the fuel nozzle 88 of the jet propulsion means 73 through a duct 94 which extends from the passage 92 and through the web 75.

The modified propeller 50 shown in FIGURES 4 to 6, is constructed to provide even greater thrust surface than the former structure by reason of the greater length of the sectors 58 and 70, as well as the bi-plane positioning of these sectors. The greater thrust surface is accompanied by several additional jet propulsion means to rotate the propeller 50, so as to utilize this greater thrust surface.

It should be understood that this invention has been described with reference to a particular embodiment, and

that a great number of other modifications and embodiments will be readily apparent to those skilled in the art. Therefore, the invention should not be limited to the particular arrangement shown and described but should encompass all modifications within the spirit and scope of the appended claims.

I claim as my invention:

1. In a propeller structure including a rotatable propeller shaft:

(*a*) a plurality of blades mounted on said shaft,

(*b*) an arcuate member connecting the outer ends of at least two adjacent blades,

(*c*) said member having therein an S-shaped passage with an intake adjacent a leading edge, an exhaust adjacent a trailing edge, and an intermediate portion that turns from said intake toward said leading edge,

(*d*) said shaft and at least one of said blades providing a connecting fuel line opening into said S-shaped passage, and

(*e*) means in said passage for firing said fuel in admixture with air introduced into said intake.

2. A propeller structure for use with an aircraft having a rotatable shaft extending therefrom, said propeller structure comprising:

(*a*) a plurality of propeller portions mounted adjacent each other on said shaft, and disposed at a rotational angle relative to each other,

(*b*) each said propeller portion having a blade on either side of said shaft,

(*c*) each said blade having a leading and a trailing edge,

(*d*) a flat arcuate sector extending between the tips of adjacent blades, and having a first surface and a second surface disposed away from said first surface,

(*e*) jet propulsion means for rotating said blades about said central axis, said jet propulsion means including,

(*f*) an enlarged body member integral with said sector opposite the tip of at least one of said blades, and having a front portion corresponding to said leading edge and a rear portion corresponding to said trailing edge,

(*g*) said front portion being aero-dynamically formed so as to permit uninterrupted flow of air thereacross, and including an intake port therein, said intake port disposed adjacent the plane of said first surface,

(*h*) said rear portion having an exhaust port therein,

(*i*) a substantially S-shaped flow path through said body member from said intake port to said exhaust port,

(*j*) said exhaust port disposed adjacent the plane of said second surface and directed thereacross,

(*k*) whereby the rapid flow of exhaust across said second surface creates an area of partial vacuum near said second surface which causes said sector to be continuously urged toward said area.

3. A propeller structure for use with a helicopter having a rotatable shaft extending therefrom, said propeller structure comprising:

(*a*) a lower propeller portion and an upper propeller portion disposed in stack relationship on said shaft,

(*b*) each said propeller portion having a hub mounted on said shaft and having a blade extending from either side of said hub,

(*c*) each said blade having a leading edge and a trailing edge,

(*d*) said upper propeller portion disposed at a rotational angle to said lower propeller portion such that each said leading edge of said upper propeller portion is slightly in advance of said leading edge of said lower propeller portion,

(*e*) a pair of flat arcuate sectors, each extending between the tip of one blade of said lower propeller portion and the tip of the adjacent blade of said upper propeller portion,

(*f*) jet propulsion means for rotating said blade about said shaft including,

(*g*) a first pair of enlarged body members integral with each said sector and disposed opposite the tip of each blade of said upper propeller, each of said first body members of substantially the same width as said sector, and having a generally V-shaped leading contour, with an intake port disposed below said V-shaped contour and below the plane of said sector, and having an aero-dynamically shaped trailing contour with an exhaust port disposed therein, said exhaust port positioned above the plane of said sector and directly tangentially to said blade,

(*h*) a second pair of enlarged body members integral with said sector and disposed opposite the tip of each blade of said lower propeller, each of said second body members of substantially the same width as said sector, and having an aero-dynamically shaped leading contour with an intake port disposed below the plane of said sector, and having a generally V-shaped trailing contour, with an exhaust port disposed therein and positioned above the plane of said sector and directed tangentially to said blade,

(*i*) a substantially S-shaped flow path through each of said body members from said inlet port to said exhaust port,

(*j*) fuel means for supply of fuel to said flow path,

(*k*) means for igniting said mixture, and

(*l*) grid means for maintaining combustion of said mixture.

4. A propeller structure as claimed in claim 2 wherein:

(*a*) each of said sectors has an arcuate slot along the length thereof, the end walls of which lie at a slight angle to said shaft,

whereby air flow through said slot tends to urge said sector in a direction parallel to said shaft and away from said helicopter.

5. A propeller structure comprising:

(*a*) a plurality of propeller portions mounted adjacent each other on a central axis, each disposed at a rotational angle relative to the other,

(*b*) at least one of said propeller portions spaced apart on said central axis from the remaining of said propeller portions,

(*c*) each of said propeller portions having a blade on either side of said central axis,

(*d*) a first pair of flat arcuate sectors, each extending circumferentially from the tip of one of said blades of said one propeller portion,

(*e*) a second pair of flat arcuate sectors integral with the tips of the blades of said remaining propeller portions, each of said second pair of sectors disposed substantially parallel to, spaced apart from, and slightly overlapping each of said first pair of sectors,

(*f*) a plurality of web members interconnecting said first and second pair of sectors,

(*g*) a plurality of jet propulsion means integral with each of said first and second pair of sectors and having an exhaust port therein directed tangentially to said blades for rotating said blades about said central axis.

6. A propeller structure comprising:

(*a*) a plurality of propeller portions mounted adjacent each other on a central axis, each disposed at a rotational angle relative to the other,

(*b*) at least one of said propeller portions spaced apart on said central axis from the remaining of said propeller portions,

(*c*) each of said propeller portions having a blade on either side of said central axis,

(*d*) a first pair of flat arcuate sectors extending circumferentially from the tip of each blade of said one propeller portion,

(*e*) a second pair of flat arcuate sectors integral with the tips of the blades of said remaining propeller portions, each of said second pair of sectors disposed substantially parallel to, spaced apart from, and slightly overlapping each of said first pair of sectors,

(*f*) a plurality of web members interconnecting said first and second pair of sectors,

(*g*) a plurality of jet propulsion means integral with each of said sectors for rotating said blades about said central axis, including,

(*h*) an enlarged body member substantially the width of said sector, and having an intake port disposed behind the plane of said respective sector, and having an exhaust port disposed in front of the plane of said respective sector and directed tangentially to said blades and across the front plane of said sector,

(*i*) a substantially S-shaped flow path through each of said body members from said intake port to said exhaust port,

(*j*) fuel means for supplying fuel to said flow path,

(*k*) means positioned in said flow path for igniting said mixture,

(*m*) and means for maintaining combustion of said mixture.

7. A propeller structure comprising:

(*a*) a plurality of propeller portions mounted adjacent each other on a central axis, each disposed at a rotational angle relative to the other,

(*b*) at least one of said propeller portions spaced apart on said central axis from the remaining of said propeller portions,

(*c*) each of said propeller portions having a blade on either side of said central axis,

(*d*) said blades of said remaining propeller portions disposed in a first group on one side of said central axis and a second group on the other side thereof,

whereby said first group of blades and one of said blades of said one propeller portion form a stair-step arrangement in a direction parallel to said central axis,

(*e*) a first pair of flat arcuate sectors extending between the tips of said blades of said first and second groups respectively,

(*f*) a second pair of arcuate sectors, each extending from the tip of one of said blades of said one propeller portion and disposed substantially parallel to, spaced apart from, and slightly overlapping said each of said first pair of sectors respectively,

(*g*) a plurality of web members interconnecting said first and second pair of sectors,

(*h*) a plurality of jet propulsion means integral with said each of said first and second pair of sectors and having an exhaust port directed tangentially to said blades for rotating said blades about said central axis.

8. A propeller structure for use with a helicopter having a rotatable shaft extending upwardly therefrom, said propeller structure comprising:

(*a*) three propeller portions mounted in stacked relationship on said shaft, each disposed at a slight rotational angle relative to the other,

(*b*) a single propeller portion mounted on said shaft a predetermined distance below said propeller portions,

(*c*) each of said propeller portions having a blade on either side of said shaft,

(*d*) said blades of said three propeller portions disposed in a first group on one side of said central axis, and a second group on the other side thereof, whereby said first group of blades and one of said blades of said one propeller portion form a stair-step arrangement in a direction parallel to said central axis,

(*e*) an upper pair of flat arcuate sectors extending between the tips of said blades of said first and second groups respectively,

(*f*) a lower pair of arcuate sectors, each extending circumferentially in the direction of rotation, from the tip of one of said blades of said single propeller portion and extending beneath the tips of two blades of said first and second groups,

(*g*) a plurality of web members extending downwardly from said upper pair of sectors opposite the tips of said two blades of said first and second groups to said lower pair of sectors, whereby said upper and lower sectors are rigidly interconnected,

(*h*) a plurality of jet propulsion means integral with each of said sectors for rotating said blades about said shaft, each including

(*i*) an enlarged body member substantially the width of said respective sector, and having an intake port disposed below the plane of said respective sector, and having an exhaust port disposed above the plane of said respective sector and directed tangentially to said blade and across the upper plane of said sector,

(*j*) a substantially S-shaped flow path through each of said body members from said intake port to said exhaust port,

(*k*) fuel means for supplying fuel to said flow path,

(*l*) means positioned in said flow path for igniting said mixture,

(*m*) and means for maintaining combustion of said mixture.

9. A propeller structure for use with an aircraft having a rotatable shaft extending therefrom, said propeller structure comprising:

(*a*) a plurality of propeller portions mounted adjacent each other on said shaft, and disposed at a rotational angle relative to each other,

(*b*) each said propeller portion having a blade on either side of said shaft,

(*c*) each said blade having a leading and a trailing edge,

(*d*) a flat arcuate sector extending between the tips of adjacent blades, and having a first surface and a

second surface disposed away from said first surface,

(*e*) jet propulsion means for rotating said blades about said central axis, said jet propulsion means including,

(*f*) an enlarged body member integral with said sector opposite the tip of at least one of said blades, and having a front portion corresponding to said leading edge and a rear portion corresponding to said trailing edge,

(*g*) said front portion being aero-dynamically formed so as to permit uninterrupted flow of air thereacross, and including an intake port therein, said intake port disposed adjacent the plane of said first surface,

(*h*) said rear portion having an exhaust port therein,

(*i*) said exhaust port disposed adjacent the plane of said second surface and directed thereacross,

(*j*) whereby the rapid flow of exhaust across said second surface creates an area of partial vacuum near said second surface which causes said sector to be continuously urged toward said area.

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