Feb. 11, 1936. S. CEGLOWSKI 2,030,622

PROPELLER, FAN, AND EXHAUSTER

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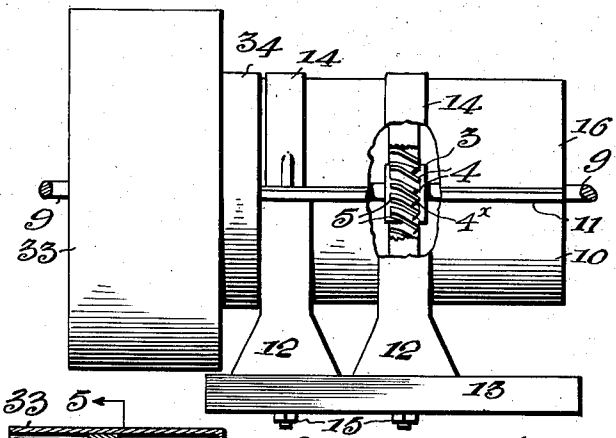


Fig. 1.

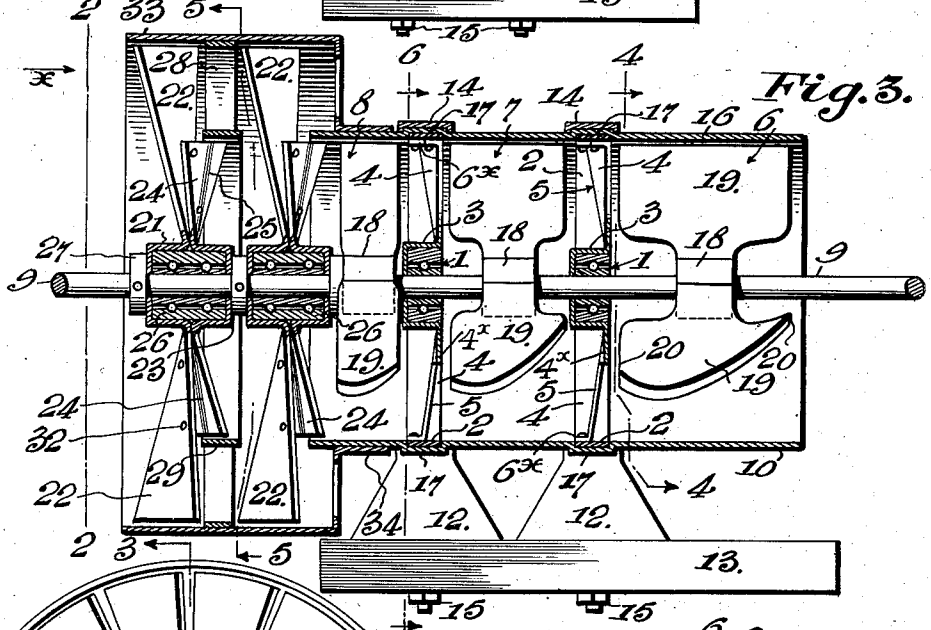


Fig. 3.

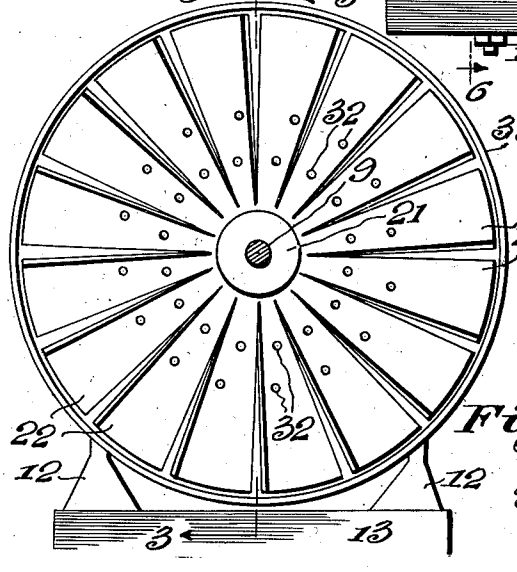


Fig. 2.

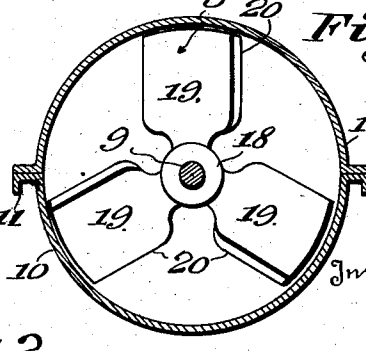


Fig. 4.

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Fig. 5.

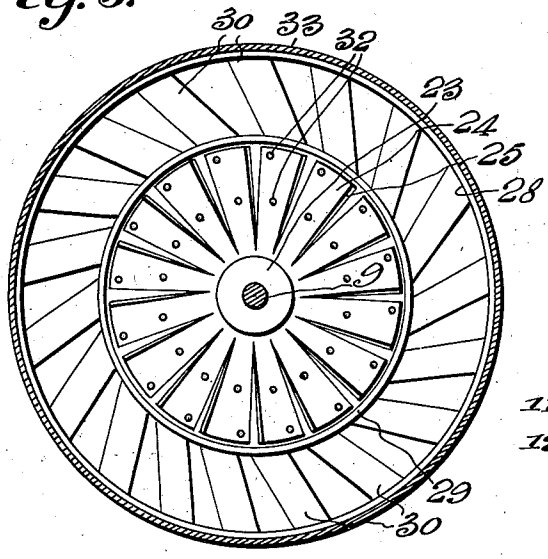


Fig. 6.

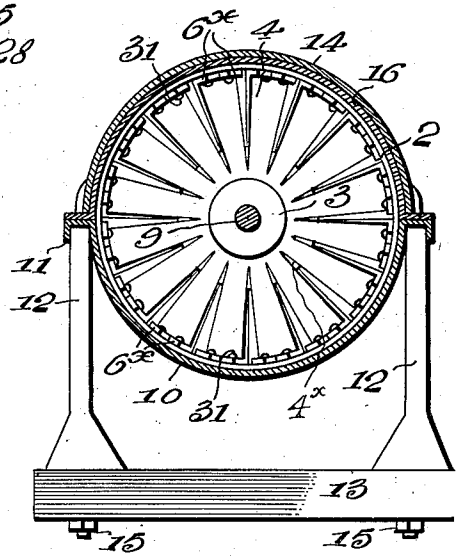


Fig. 9.

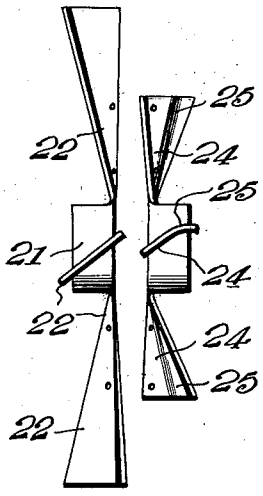


Fig. 10.

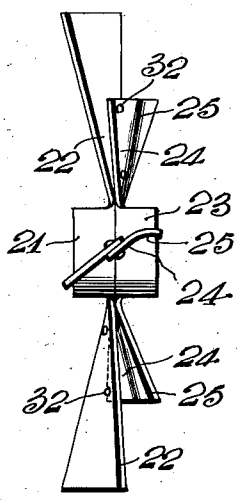
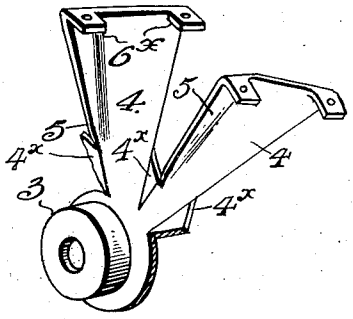


Fig. 7.



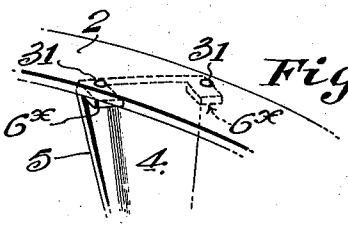


Fig. 8.

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UNITED STATES PATENT OFFICE

2,030,622

PROPELLER, FAN, AND EXHAUSTER

Stanley Ceglowski, Hillside, N. J.

Application July 11, 1935, Serial No. 30,897

14 Claims. (Cl. 230—116)

My invention relates to certain new and useful improvements in propellers for the propulsion of airplanes, water craft and other vehicles, ventilating fans, and exhaust fans. It has for an object to provide a mechanism of the character stated in which provision is made to obtain the greatest efficiency possible.

Further, it is an object to provide a structure of the character stated in which a gang of propeller units mounted on a shaft cooperate with intermediate converter units for passing the whirling air of one propeller unit, in a direction parallel to the axis of rotation, to the next propeller unit and so on, whereby each propeller unit acts with its maximum efficiency so that the result produced will be the accumulated functions of the gang of propeller units, each unit adding its maximum effort to that of the others.

A further object is to associate with the gang of propeller units, a combined air-turbine-propeller (or a plurality of these with interposed converter units) so as to add to the effectiveness of the gang of propeller units.

Further, it is an object to provide a mechanism of the character specified which will retain the advantages of variable pitch blade propellers while still using propeller blades of fixed pitches; this is accomplished by employing propeller units, in the gang, of progressively different pitches, varying from, say, 75 degrees to the plane of rotation for the first unit, and gradually making the pitch more acute in successive units.

Further, it is an object to provide a mechanism of the character stated in which the several propeller units and the converter units are assembled in a tunnel in such a way that each propeller unit is enabled to add its effect with full efficiency to the column of air passed through the tunnel so that the total result produced is that of the full equivalent of the sum of each propeller unit's action at its maximum efficiency, something that cannot be accomplished by merely duplicating propeller units in a tunnel-way.

Further, the invention has for its objects to provide certain improvements in the mechanical construction of the various units and parts comprising the entire assembly, including improvements in the propeller units themselves and in the air-turbine-propeller units; to provide new and useful converter units associated with the propeller units; to provide improvements in the manner of mounting the shaft and the rotative parts carried thereby in the casing, and, further, for mounting the casing parts together on a suitable base or support.

Further, it is an object to provide an apparatus or mechanism of the character stated which may be used as a buffer (pushing) propeller, or as a suction (pulling) propeller, for moving vehicles, or used as a stationary fan for ventilating rooms and buildings, or employed as an exhauster fan, as may be desired.

Other objects will in part be obvious and in part be pointed out hereinafter.

To the attainment of the aforesaid objects and ends the invention still further resides in the novel details of construction, combination and arrangement of parts, all of which will be first fully described in the following detailed description and then be particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which:—

Figure 1 is a side elevation of my invention in its complete form.

Figure 2 is an end elevation of the same, looking in the direction of the arrow x in Figure 3.

Figure 3 is a central vertical longitudinal section on the line 3—3 of Figure 2.

Figure 4 is a cross section on line 4—4 of Figure 3.

Figure 5 is a cross section on line 5—5 of Figure 3.

Figure 6 is a cross section on line 6—6 of Figure 3.

Figure 7 is a detail perspective view of a converter hub with two blades in place thereon.

Figure 8 is a detail perspective view showing how a converter blade is attached to its ring.

Figure 9 is a detail side elevation of one of the fans of an air-turbine-propeller unit (only three blades being shown for clearness of illustration) and also a detail side elevation of the driving fan of an air-turbine-propeller unit (only three blades being shown for clearness of illustration), the two fans being separated.

Figure 10 is a detail side elevation of the two fans shown in Figure 9, assembled.

In the drawings, in which like numerals indicate like parts in all the figures, 10 represents the lower half of a cylindrical tunnel, while 16 indicates the upper half thereof. The lower half 10 is provided with inverted U-shaped or channel-like flanges 11 which rest on pillars or posts 12 that are provided with passages for the threaded rods of the channeled clamps 14. These clamps embrace the annular channeled portions 17 of the tunnel and cooperate with nuts 15 to fasten the

two parts 10 and 16 of the tunnel together to the support 12—12.

Within the tunnel, 10 and 16, is located the principal propelling mechanism which comprises a gang of propeller units and intermediate converter units. In the embodiment of the invention illustrated, three propeller units 6, 7 and 8, and two converter units are employed. Each propeller unit includes a hub 18. The hub is mounted on and turns with the power shaft 9, and has a set of blades (three being shown) 19, whose front and rear edges 20 lie parallel to the plane or direction of rotation.

The propeller units are preferably of progressively decreasing width in side elevation, from the largest at the front or entrant end of the tunnel to the smallest at the rear or exit end thereof. Further, in order to obtain the advantages of a variable pitch propeller, the blades 19 of the several propeller units vary in pitch progressively, that of the front propeller unit being, for instance, 75 degrees to the plane of rotation, that of the intermediate unit being at 70 degrees and that of the rear unit being at 65 degrees (as indicated at Figure 3).

The converter unit may have a hub 3 (in which is located an anti-friction bearing 1 for the shaft 9). It is composed principally of a rim 2 and blades 4, the blades having curved edges 5 at the rear and having portions 6 at their ends, which portions are secured to the rim 2 in any suitable way, as for example by rivets 31.

The blades 4, hub 3, etc., are preferably formed integrally out of a disc by die-stamping, or other suitable process.

The openings between the adjacent blades 4 are restricted near the center by webs 4x so that the central portion of the converter unit, which lies directly in front of the central open portion of the propeller, will present an unbroken wall, in virtue of which construction the creation of a whirlwind is prevented.

The parts numbered 1 to 20, inclusive, and 31, comprise a primary propeller, fan or exhauster assembly with which (for airplane propulsion, especially) is combined a second unit consisting of an air-turbine-propeller, composed of a driving fan and a driven fan, the latter having a hub 21 and blades 22, while the former includes a hub 23 and blades 24. The front or leading edges of the blades are curved as at 25. The fan 23—24—25 is of a diameter corresponding to the inside diameter of the tunnel 10 and 16, and in part projects into the outlet of said tunnel (see Figure 3); the fan 21—22 is of greater diameter than that of the outside of the tunnel (10 and 16), and takes air from around the outside of the tunnel, as well as air from inside the tunnel.

The driven fan (21—22) and the driving fan (23—24—25) are secured together by rivets 32, or in any other suitable way, so as to turn as one, and their hubs 21 and 23 carry radial and thrust bearings 26 by means of which the unit (21—25) rotates freely on the shaft 9. A collar 27 is fixed to the shaft to take up the axial thrusts of the fan.

If desired, a second air-turbine-propeller unit may be similarly mounted on the shaft 9, in which event an auxiliary tunnel 33 is provided to encircle the units, and a converter is provided between the two units (see Figure 3). The tunnel 33 may be mounted on the tunnel 10 and 16, by a collar, as at 34. The converter used between the air-turbine-propeller units consists of an outer ring 28 and an inner ring 29 with inclined (non-radial) blades 30, so designed as to direct the air from the larger fan 22 of the first unit (21—25) toward the second unit in a direction forwardly and toward the shaft 2 whereby some air is drawn into the supplemental tunnel 33 by the first fan (21—22) of the first auxiliary unit and used, in addition to the air-stream from the primary unit in tunnel, 10 and 16, to turn the second unit (21—22). The air impelled by the two fans (21—22) unites with the air-stream from the tunnel, 10 and 16, and is discharged from the tunnel 33 in a direction approximately parallel with the direction of the axis of the shaft 9.

By the construction described it will be seen that none of the air passing the various propeller units is thrown off by any one of them in a radial direction, but the air is caused to pass through the tunnels, 10 and 16, and 33, in a condensed column and discharged from the tunnel 33 in a direction parallel to the line of flight (when the mechanism is used, for example, as an airplane propeller).

Rotating propellers in the open causes them to lose their efficiency, due to the air thrown off radially; with a gang of ordinary propellers rotating in a tunnel without converters in between them the air stream will rotate about the axis of the propeller shaft, caused by the centrifugal force and a vortex will be produced adjacent the shaft, while a considerable pressure against the tunnel wall will induce considerable air friction and impede the flow of the air through the tunnel from the entrance to the exit thereof. These objectionable features are not present in any marked degree in the construction herein described and illustrated in the accompanying drawings.

It is also to be observed that when the auxiliary unit 21—25 (enclosed in tunnel 33) is used the last propeller unit 18—19 discharges the highly compressed air with cyclonic velocity against the turbine-fan or wheel (23—25), turning the free unit (21—25) which then draws air from around the outside of the tunnel 10 and 16; the air-turbine-propeller acts as a floating buffer from the air-stream tunnel 10 and 16, and the forces acting on the same will all be utilized to do work in the proper way to attain the highest efficiency.

With my invention, the faster the airplane moves the more air goes into the tunnel, which causes the apparatus to work with high pressure and increases the speed of the turbine propeller.

From the foregoing description, taken in connection with the accompanying drawings, it is though that the complete construction, operation and advantages of the invention will be clear to those skilled in the art to which it appertains.

What I claim is:

1. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, certain of said converters having bearings in which said shaft is journaled, said converters each including fan-like blades restricted near the center by webs forming an unbroken wall, said blades being shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis.

2. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, said pro-

pellers varying in pitch from one end of the tunnel toward the other progressively, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, certain of said converters having bearings in which said shaft is journaled, said converters each including fan-like blades restricted near the center by webs forming an unbroken wall, said blades being shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis.

3. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, said propellers varying in pitch and size from one end of the tunnel toward the other progressively, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters having bearings in which said shaft is journaled, said converters each including fan-like blades restricted near the center by webs forming an unbroken wall, said blades being shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis.

4. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters having bearings in which said shaft is journaled, said converters each including fan-like blades shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis, and an air-turbine-propeller unit rotatably mounted on said shaft adjacent the outlet end of said tunnel.

5. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, said propellers varying in pitch from one end of the tunnel toward the other progressively, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters having bearings in which said shaft is journaled, said converters each including fan-like blades shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis, and an air-turbine-propeller unit rotatably mounted on said shaft adjacent the outlet end of said tunnel.

6. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters having bearings in which said shaft is journaled, said converters each including fan-like blades shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis, said air-turbine-propeller unit comprising two fans, one of a diameter to conform to the inside diameter of said tunnel and the other of a greater diameter than the outside of said tunnel.

7. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, said propellers varying in pitch from one end of the tunnel toward the other progressively, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters having bearings in which said shaft is journaled, said converters each including fan-like blades shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis, and an air-turbine-propeller unit rotatably mounted on said shaft adjacent the outlet end of said tunnel, said air-turbine-propeller unit comprising two fans, one of a diameter to conform to the inside diameter of said tunnel and the other of a greater diameter than the outside of said tunnel.

8. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters having bearings in which said shaft is journaled, said converters each including fan-like blades shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis, an air-turbine-propeller unit rotatably mounted on said shaft adjacent the outlet end of said tunnel, said air-turbine-propeller unit comprising two fans, one of a diameter to conform to the inside diameter of said tunnel and the other of a greater diameter than the outside of said tunnel, and a second air-turbine-propeller unit rotatably mounted on said shaft and spaced from the first air-turbine-propeller unit, an auxiliary tunnel embracing said air-turbine-propeller units and a converter in said auxiliary tunnel between said air-turbine-propeller units to receive auxiliary air from the first air-turbine propeller unit and direct the same toward the center of the second air-turbine-propeller unit.

9. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, said propellers varying in pitch from one end of the tunnel toward the other progressively, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters having bearings in which said shaft is journaled, said converters each including fan-like blades shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis, and an air-turbine-propeller unit rotatably mounted on said shaft adjacent the outlet end of said tunnel, said air-turbine-propeller unit comprising two fans, one of a diameter to conform to the inside diameter of said tunnel and the other of a greater diameter than the outside of said tunnel, and a second air-turbine-propeller unit rotatably mounted on said shaft and spaced from the first air-turbine-propeller unit, an auxiliary tunnel embracing said air-turbine-propeller units and a converter in said auxiliary tunnel between said-air-turbine-propeller units to receive auxiliary air from the first air-turbine-propeller unit and direct the same toward the center of the second air-turbine-propeller unit.

10. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters having bearings in which

said shaft is journaled, said converters each including fan-like blades restricted near the center by webs forming an unbroken wall, said blades being shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis, said tunnel comprising two half members, a support for the same, said tunnel having grooved annular portions to receive said converters and channeled straps passed over said annular portions and secured to said support for purposes specified.

11. In a mechanism of the character described, a tunnel, a gang of propellers mounted to rotate in unison in said tunnel, means by which said propellers are rotated in unison, said propellers being spaced apart, a set of stationary converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters each including fan-like blades restricted near the center by webs forming an unbroken wall, said blades being shaped to receive air from a preceding propeller and direct the same approximately paralled to the axis of rotation of the propellers to the next succeeding propeller, substantially as shown and described.

12. In a mechanism of the character described, a tunnel, a gang of propellers mounted to rotate in unison in said tunnel, means by which said propellers are rotated in unison, said propellers being spaced apart, a set of stationary converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters each including fan-like blades shaped to receive air from a preceding propeller and direct the same approximately parallel to the axis of rotation of the propellers to the next succeeding propeller, substantially as shown and described, an air-turbine-propeller unit rotatably mounted on said shaft adjacent the outlet end of said tunnel, said air-turbine-propeller unit including a driving fan and a driven fan secured together as one, the driving fan being driven by the air leaving the interior of the tunnel and the driven fan being of greater diameter than the driving fan to impel an auxiliary air stream.

13. In a mechanism of the character described, a tunnel, a gang of propellers mounted to rotate in unison in said tunnel, means by which said propellers are rotated in unison, said propellers being spaced apart, a set of stationary converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters each including fan-like blades shaped to receive air from a preceding propeller and direct the same approximately parallel to the axis of rotation of the propellers to the next succeeding propeller, an air-turbine-propeller unit rotatably mounted on said shaft adjacent the outlet end of said tunnel, said air-turbine-propeller unit including a driving fan and a driven fan secured together as one, the driving fan being actuated by the air leaving the interior of the tunnel and the driven fan being of greater diameter than the driving fan to impel an auxiliary air stream.

14. In a mechanism of the character described, a tunnel, a rotatable shaft passing into said tunnel, a gang of propellers mounted on said shaft within said tunnel and spaced apart, a set of converters located in said tunnel between adjacent propellers, means to hold said converters stationary, said converters each including fan-like blades restricted near the center by webs forming an unbroken wall, said blades being shaped to receive air from said propellers diagonally to the axis and discharge the same parallel to the axis.

STANLEY CEGLOWSKI.