Sept. 1, 1942. T. H. TROLLER 2,294,586

AXIAL FLOW FAN STRUCTURE

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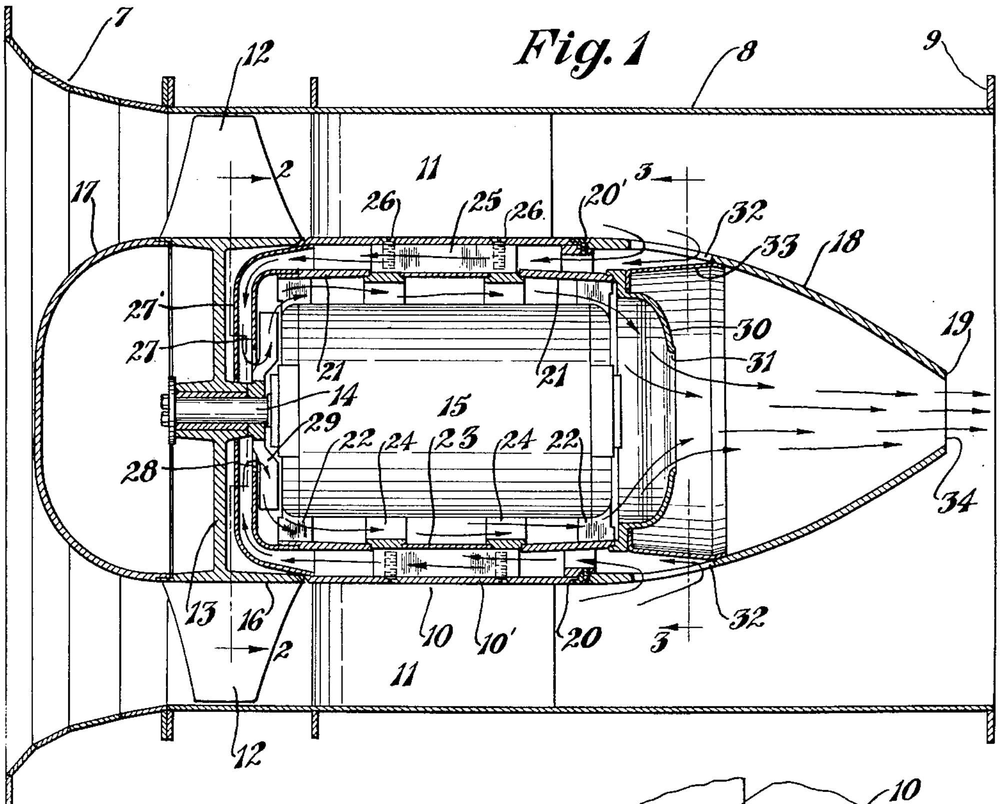
Fig. 1



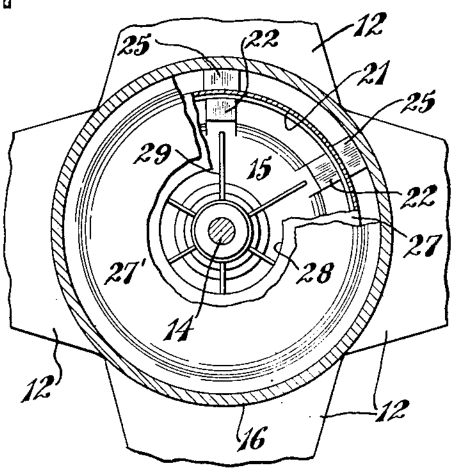


Fig. 2

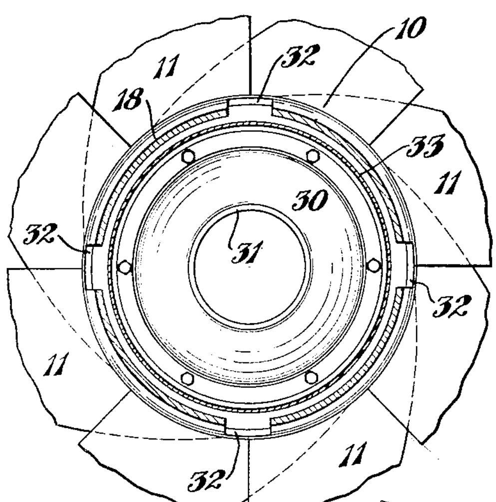


Fig. 3

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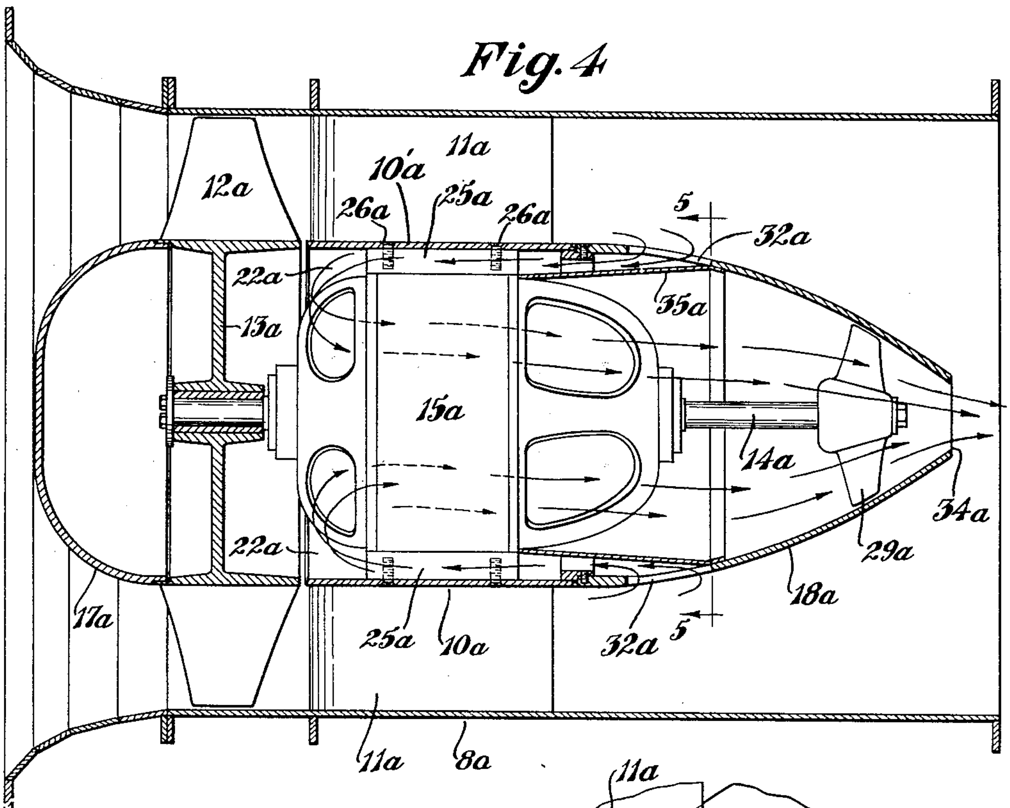
Fig. 4



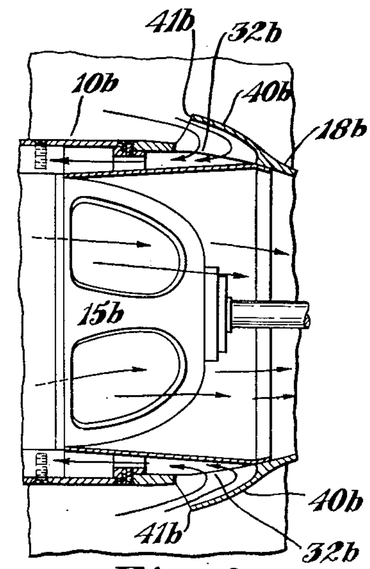


Fig. 6

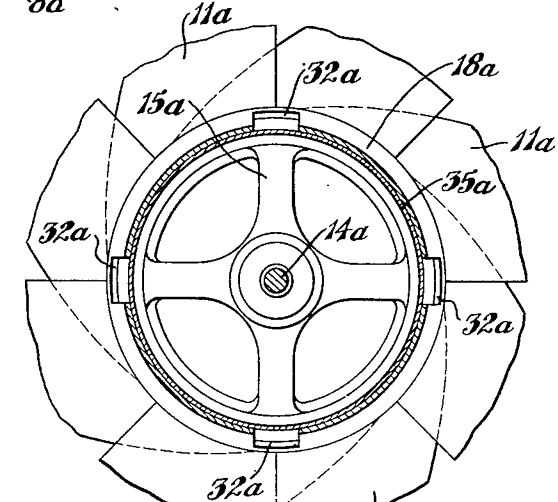


Fig. 5

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AXIAL FLOW FAN STRUCTURE

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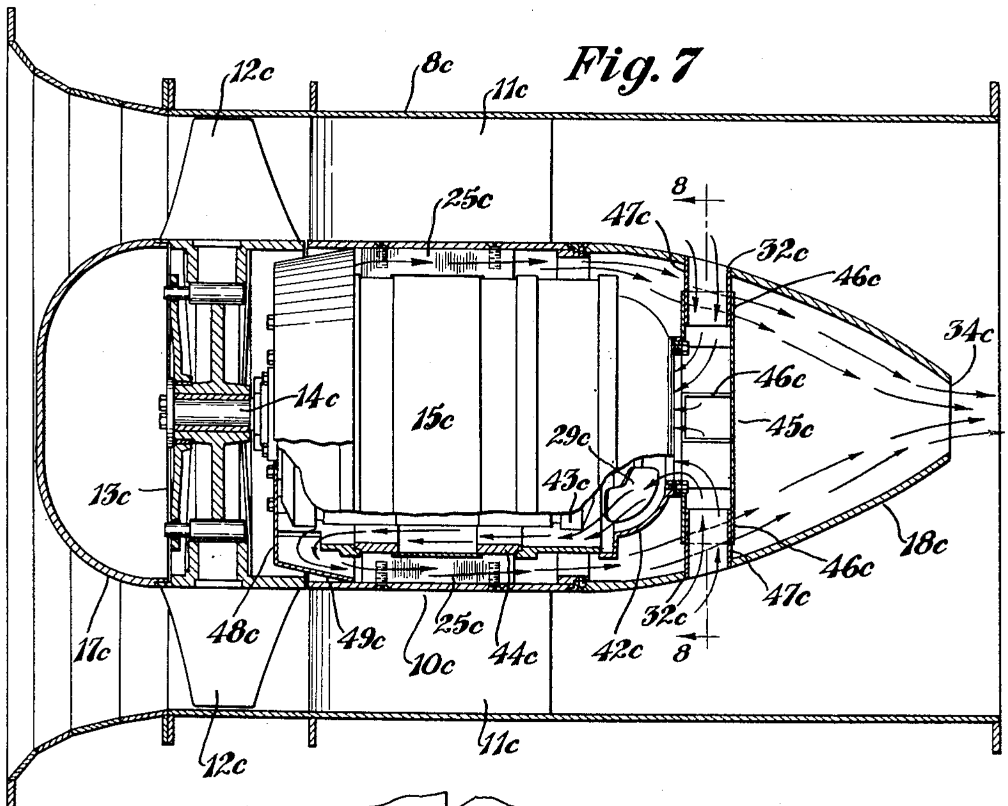
Fig. 7



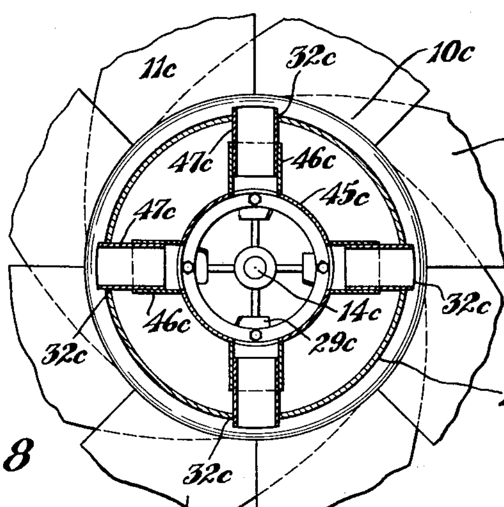


Fig. 8

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AXIAL FLOW FAN STRUCTURE

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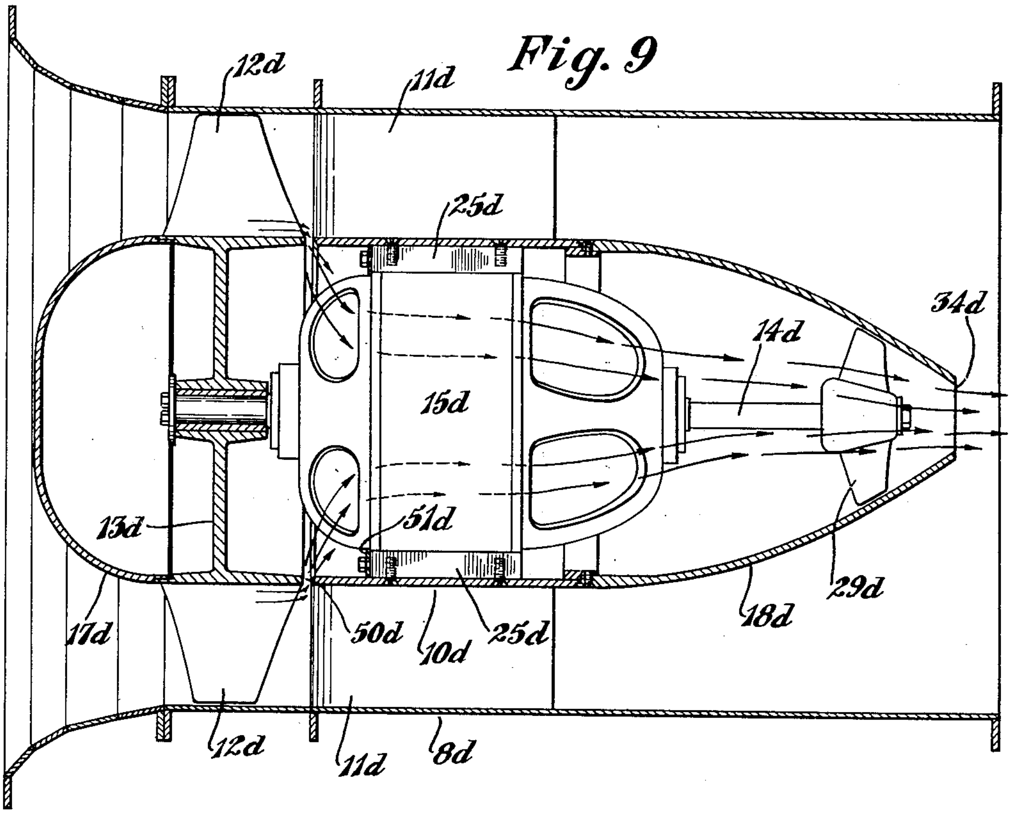
Fig. 9



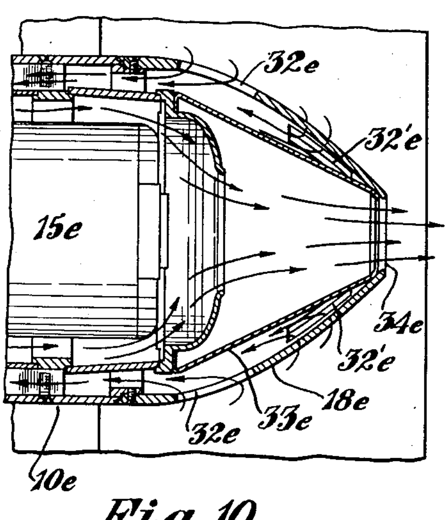


Fig. 10

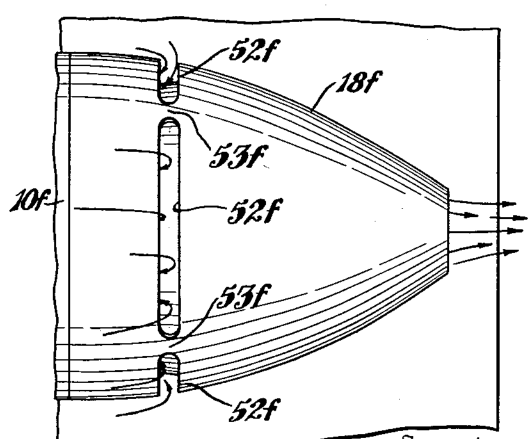


Fig. 11

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Patented Sept. 1, 1942 2,294,586

UNITED STATES PATENT OFFICE

2,294,586

AXIAL FLOW FAN STRUCTURE

Theodor H. Troller, Akron, Ohio, assignor to La-Del Conveyor & Manufacturing Company, New Philadelphia, Ohio, a corporation of Ohio

Application August 4, 1941, Serial No. 405,323

11 Claims. (Cl. 230—117)

The invention relates to propeller type fans for moving air or fluids under pressure through ducts, and more particularly to such fans wherein the fan motor is located within the duct.

There are many advantages derived from locating the fan motor in the air duct of a propellor type fan, including the fact that there is an inner fairing with a long converging tail portion provided coaxial with the fan in order to occupy the space behind the fan where pressure is not properly built up thereby, and the fan motor can conveniently be located within said inner fairing and the motor shaft directly connected to the fan.

However, when the motor is located within the inner fairing a serious problem of cooling the motor arises, because the inner fairing should constitute a streamlined substantially continuous shell in order to offer the least possible resistance to the air flow through the duct, and the motor is accordingly substantially completely enclosed by the inner fairing.

In certain prior constructions it has been proposed to cool the motor by conducting excessive heat therefrom through the metal frame of the motor and the metal fairing into the airstream. This method of cooling is not at all satisfactory for large motors or motors of any substantial size because the heat conducting surface is not large enough as compared with the size of the motor to conduct sufficient heat to cool the motor.

On the other hand, even where a small motor is used it is essential to have good metal-to-metal contact from the motor frame to the fairing to insure good heat conduction for cooling the motor. Due to the fact that with propeller type fans operating in ducts, the diameter of the inner fairing is substantially fixed by the required pressure build up in the duct and the motor speed, the result is that a small motor frame may be much smaller than the required inner fairing and in such case the motor frame must therefore be built up considerably to mount it in the fairing. This condition makes it increasingly difficult to obtain the necessary metal-to-metal contact for satisfactorily conducting heat away from the motor.

In certain installations, it is feasible to bring cooling air to the motor from outside the air duct, by conducting it through streamlined conduits in the air stream and through the inner fairing to the motor. However, this is a complicated and expensive procedure involving a certain amount of exterior space which very frequently is not available.

It has been proposed to cool the fan motor by exhausting the hot air from the motor out through ports in the nose of the inner fairing ahead of the fan. There are two serious disadvantages to this method: first, the exhausting hot air interferes with and reduces the efficiency of the air flow through the duct, and second, the exhausted hot air is recirculated through the motor, which minimizes the cooling effect.

It is therefore a principal object of the present invention to provide an improved axial flow fan construction having the fan motor located within the air duct, said construction embodying means and methods for utilizing air flowing through the duct for cooling the motor, and at the same time increasing the efficiency of the fan or blower.

More specifically, it is an object of the invention to provide novel means for cooling the motor by utilizing a portion of the impelled air which has lost some of its energy, in such a way that uniformity of velocity distribution is increased behind the fan.

Another object is to provide improved means for circulating a part of the impelled air through and around the motor and exhausting it into the air stream in such a way as to still further improve uniformity of velocity distribution behind the fan.

A further object is to provide novel means for air cooling the motor and increasing air flow efficiency, which means is adapted for use with varying sizes and various types of motors located within the inner fairing.

Another object is to provide novel means for cooling the fan motor and at the same time permitting a reduction in length of the converging tail portion of the inner fairing.

A still further object is to provide means and methods for air cooling the motor and increasing air flow efficiency, which can be applied to existing axial flow fan structures with a minimum of time, labor and expense.

These objects and others which may be apparent from the following description, are accomplished by the improvements comprising the present invention, which may be briefly stated in general terms as comprising providing air intake ports in the inner fairing and behind the propeller and conducting a part of the impelled air through the ports to and around the motor for cooling the same, said cooling air being then directed, preferably by an auxiliary blower within the fairing, out through the converging tail of the fairing axially thereof, where it acts to aid in producing uniform velocity distribution in the air stream behind said inner fairing.

Referring to the drawings in which preferred embodiments of the invention are shown by way of example,

Figure 1 is a longitudinal sectional view of a fan and duct construction embodying the present invention, and showing one type of motor located within the inner fairing in the duct;

Fig. 2 is a fragmentary transverse sectional view taken on line 2—2, Fig. 1;

Fig. 3 is a fragmentary transverse sectional view taken on line 3—3, Fig. 1;

Fig. 4 is a longitudinal sectional view similar to Fig. 1, showing another type of motor located within the inner fairing;

Fig. 5 is a fragmentary transverse sectional view as on line 5—5, Fig. 4;

Fig. 6 is a fragmentary longitudinal sectional view similar to Fig. 4 showing modified intake ports;

Fig. 7 is a longitudinal sectional view similar to Fig. 1, showing still another type of motor located in the inner fairing;

Fig. 8 is a fragmentary transverse sectional view as on line 8—8, Fig. 7;

Fig. 9 is a longitudinal sectional view similar to Fig. 4, showing a modified arrangement of air intake ports through the fairing;

Fig. 10 is a longitudinal sectional view similar to Fig. 1, showing a further modified arrangement of intake ports in the converging tail; and

Fig. 11 is a fragmentary elevation of the converging tail portion of the inner fairing, showing a still further modification of air intake ports.

Similar numerals refer to similar parts throughout the several views of the drawings.

The fan construction shown and described herein is particularly adapted for use in ventilating systems where it is desired to convey air against substantial pressure through a duct. The entrance end of the duct is indicated at 7 and may be outwardly flared as shown, and the portion of the duct surrounding the propeller blades, straightener vanes and the tail portion of the inner fairing is indicated at 8, being adapted for connection at its exhaust end 9 with a suitable duct for conveying air to desired locations.

The inner fairing indicated generally at 10 is coaxial with the outer duct 8 and is supported therein by a series of circumferentially arranged straightener vanes 11 which are secured at their inner ends to the cylindric portion 10′ of the inner fairing 10 and at their outer ends to the outer duct 8. These straightener vanes are located behind the blades 12 of the fan and serve to straighten out the air flow while avoiding losses in energy of the air stream connected with its reduction in velocity while passing through the straightener vanes. Preferably the straightener vanes 11 are designed and constructed substantially in accordance with my prior Patents No. 2,219,499, dated October 29, 1940, and entitled Propeller type fan construction, and No. 2,040,452, dated May 12, 1936, and entitled Fan construction.

The hub 13 of the fan is preferably secured on the shaft 14 of the motor 15 mounted within the inner fairing 10, and the outer surface 16 of the hub at its rear end is made equal in diameter to the diameter of the cylindric portion 10′ of the fairing so as to provide a minimum of resistance to the air stream, a rounded nose 17 being secured to the hub 16 for the same purpose. The blades 12 may be four in number as shown, although this number can be varied as desired, and the blades are preferably of substantially standard design having a greater pitch at the hub than at their outer ends.

The inner fairing 10 is provided with a converging tail portion 18 at its downstream end, and the tail portion 18 begins just behind the straightener vanes 11 and converges gradually therefrom to a relatively small circumference at its rear end 19. The front end of the tail portion may be rabbeted as indicated at 20 to make a smooth exterior connection with the straight cylindric portion 10′ of the inner fairing, and may be connected thereto by means of screws 20′ screwed through the tail portion and into a ring flange on the straight cylindric portion 10′.

As shown in Fig. 1, the motor 15 is considerably smaller in circumference than the inner surface of the fairing 10, and an enclosure is provided for the motor within the fairing 10. This enclosure may include tubular members 21 encircling the end portions of the motor. Spacer supports 22 are secured at circumferential intervals between the motor end portions and the tubular members 21 for non-rotatably mounting the motor 15. The tubular members 21 are thus spaced radially outward from the motor, and at their inner or adjacent edges they are connected to a cylindrical housing member 23 by reinforcing rings 24 surrounding the central portion of the motor. The cylindrical housing member 23 has outwardly projecting spacer bars 25 secured thereto at circumferential intervals, and the cylindrical portion of the inner fairing is preferably secured to the spacer bars 25 by means of screws 26.

As shown, the front member 21 has secured thereto a cup-shaped end piece 27 spaced from the front end of the motor and having an axial intake aperture 28 therein through which the motor shaft 14 extends forming an annular opening. A cup-shaped baffle shield 27′ extends from the front end of portion 10′ of the inner fairing forwardly and inwardly to form an air passage in front of end piece 27. An auxiliary fan or blower 29 is mounted on the motor shaft 14 between the front end of the motor and the end wall of the end piece 27, for sucking air through the intake opening 28 and forcing it rearwardly around the outside of the motor proper and within the enclosure consisting of members 21 and 23 surrounding the motor. A dome-shaped deflector end member 30 may be secured to the rear housing member 21, and is provided with an axial aperture 31 for exhausting the air which is forced around the motor by the fan 29.

The means for supplying cooling air to the motor from the air stream impelled by the propeller fan 12 preferably includes a series of intake ports 32 located in the converging tail portion 18 of the inner fairing. As shown in Figs. 1 and 3 the ports 32 may be rectangular and may comprise a circumferential series of four ports located at the start of the converging portion.

Baffle means for directing air entering the intake ports 32 forwardly between the sectional housing around the motor and the inner fairing may consist of a ring 33 of sheet metal and the like having its rear edge secured to the inner surface of the tail portion 18 immediately adjacent to the ports 32, and having its front end flanged and secured to the outer periphery of the dome-shaped end member 30 of the sectional housing.

When the propeller fan is operated by turning on the motor 15, the air is delivered by the blades 12 through the straightener vanes 11 toward the right as viewed in Fig. 1. As this air travels between the outer duct 8 and the inner fairing, friction with the inner fairing slows up a thin inner layer of air. It is well-known that the rear end or the tail portion of the inner fairing is streamlined with a gradual convergency to permit the transition of velocity energy of the air stream to static energy without undue losses in total energy, and as the converging portion of the tail is traversed by the air stream the inner layer of air which is losing energy tends to leave the flared portion and cause vortices of air, which decrease the uniformity of velocity of the air stream and accordingly decrease efficiency of the same.

By providing the intake ports 32 for supplying cooling air to the motor and locating them in the converging tail portion, some of the inner layer of air which has lost much of its energy due to friction is removed, and an outer layer of fully energized air moves inwardly and is substituted along the inner fairing. This substituted inner layer of air has sufficient energy to overcome the adverse or rising pressure gradient beginning at the start of the tail portion and ending at its converging end. The result is that the velocity distribution in the duct at the converging end of the tail portion is greatly improved, because there is very little air which has lost its energy present at the converging end of the tail portion and at the axis of the duct.

As shown by the arrows in Fig. 1, air from the inner layer along the outer surface of the tail portion 18 is drawn through the ports 32 forwardly between the enclosure for the motor and the inner fairing and through the opening 28 in the end member 27, by the fan 29. From the fan 29 the air is forced along and around the motor 15 within the enclosure and exhausted into the converging tail portion through the axial exhaust opening 31 from which it is exhausted directly into the air stream through the axial opening 34 in the rear end 19 of the tail portion 18.

By drawing in to the motor the inner layer of impelled air which has lost much of its energy and circulating this air through and around the motor by means of the fan 29, a substantial amount of energy is restored to this air so that when it is exhausted through the axial opening 34 of the tail portion into the air stream, air having an axial velocity is being supplied at the point where it is normally hardest to get velocity due to the frictional losses along the inner fairing and its converging tail. Consequently, the exhausting of the motor cooling air through the opening 34 greatly aids in producing an even velocity distribution in the air stream behind the inner fairing.

Moreover, the substantial prevention of vortices of air along the tail portion by drawing the inner layer of air through the fairing, results in a reduction in the required length of the tail portion 18 as compared with usual practice, because the transition from velocity energy to static energy is made possible more abruptly.

In Figs. 4 and 5 the construction of the outer duct 8a, the inner fairing 10a, and the straightener vanes 11a is substantially identical with that shown in Figs. 1, 2 and 3. The propeller hub 13a, the propeller blades 12a and the rounded nose 17a are also substantially identical to the construction shown in Figs. 1, 2 and 3.

The motor 15a which is located within the inner fairing 10a is a different conventional type of motor from that shown in Figs. 1, 2 and 3, and has the usual open frame at the ends through which air can circulate for cooling the motor. Accordingly, it is not necessary to provide a separate enclosure for the motor within the inner fairing, and the auxiliary fan for circulating the cooling air can conveniently be located in the converging tail portion.

As shown the auxiliary fan 29a is secured on the motor shaft 14a at the rear end thereof and is located close to the converging end of the tail portion 18a. The intake ports 32a for the cooling air are located in the front end of the tail portion 18a, and a tubular baffle member 35a is secured to the inner surface of the tail portion 18a immediately behind the ports 32a and extends therefrom to the central portion of the motor 15a as shown. The motor is supported within the fairing 10a by means of spacer bars 25a projecting outwardly from the motor and secured to the straight cylindric portion 10'a of the inner fairing by means of screws 26a. Spacer supports 22a extend between the inner fairing cylindric portion 10'a and the front end of the motor frame, for preventing movement of the motor in the inner fairing.

As shown by the arrows in Fig. 4, as the auxiliary fan 29a sucks in the inner layer of cooling air from along the outer surface of the converging tail portion 18a, the air travels forwardly between the fairing and the motor frame and then in to the motor at its front end and out through its rear end to be exhausted through the axial opening 34a in the tail portion. Thus the same advantages, with respect to cooling the motor and improving the air flow at the tail portion and increasing the uniformity of velocity distribution, are attained with the different type of motor 15a and the slightly modified construction within the inner fairing shown in Figs. 4 and 5.

The holes or intake ports 32 and 32a in the tail portion of the inner fairing should be so shaped as to make an efficient transition from velocity energy to static energy in the cooling air which is conducted to the motor. In some cases lips or scoop-shaped protuberances on the tail over the intake ports will help to make such transition. As shown in Fig. 6 the tail portion 18b of the inner fairing 10b surrounding the motor 15b is provided with lips 40b which are substantially arcuate in cross section, and which project outwardly and forwardly from the rear ends of the intake ports 32b and substantially cover the same. Obviously, these lips 40b serve to scoop a portion of the inner layer of impelled air into the inner fairing through the ports 32b.

The total cross sectional area of the openings formed between the front ends 41b of the lips and the outer surface of the inner fairing is calculated to be sufficient for taking in the required amount of cooling air for cooling the motor and for improving the velocity distribution in the air stream behind the inner fairing. In many cases it has been found that the total cross sectional area of the openings formed by the lips may be as low as 1 to 5 per cent of the cross sectional area of the air flow in the duct at those points, and still function to take in a required amount of cooling air efficiently and control the air flow to increase velocity distribution and improve the efficiency of the fan.

In Figs. 7 and 8 the construction of the outer duct 8c, the inner fairing 10c, and the straightener vanes 11c is substantially identical with that shown in Figs. 1, 2 and 3. The propeller blades 12c are shown mounted on a hub indicated at 13c having means for adjusting the pitch of the blades, and a rounded nose 17c is secured on the front end of said hub.

The motor 15c which is located within the inner fairing 10c is a conventional motor of a different type from motors 15 and 15a shown in Figs. 1 and 4 respectively, and the motor 15c has an auxiliary fan or blower 29c mounted on the motor shaft 14c and located in the rear end of the motor between the cup-shaped end housing piece 42c and the motor frame 43c. Air for cooling the motor 15c is taken in axially through the rear end of the motor to the intake of auxiliary fan 29c which circulates the air forwardly between the motor frame and the inclosure 44c around the same.

The means for supplying cooling air to the motor from the inner layer of air impelled over the fairing 10c by the propeller fan blades 12c, preferably includes a circumferential series of intake ports 32c, which may be four in number and located near the forward end of the converging tail portion 18c.

Conduit means for conveying air from said ports 32c to the intake of auxiliary fan 29c may include a tubular intake spider 45c having its central hub communicating with the rear end of the motor and having four radially projecting tubular arms 46c. Preferably extension tubes 47c are telescopically fitted in said arms 46c for insertion in the ports 32c, to facilitate assembly of said spider 45c in said tail 18c.

A baffle is preferably provided at the front end of motor 15c, for deflecting air which has passed over the motor and directing it rearwardly. As shown, a cup-shaped baffle 48c is secured to the front end of the motor and has an annular flange 49c for deflecting air flowing forwardly between the motor frame 43c and enclosure 44c, and directing it rearwardly through the passage provided between enclosure 44c and fairing 10c and around the circumferentially arranged spacer supports 25c.

As indicated by the arrows in Fig. 7, the motor cooling air flows rearwardly around and past the tubular arms 46c and 47c of the intake spider 45c, and is exhausted axially through the opening 34c in the rear end of the converging tail 18c. Thus the same advantages, with respect to cooling the motor and improving uniformity of velocity distribution at the rear end of the tail, are attained with a motor of the type of 15c and the construction of Figs. 7 and 8.

It will be understood that other types of conventional motors can be used and the purposes of this invention attained by slight modifications in the motor supports, air ducts and baffles within the inner fairing, without departing from the scope of this invention as defined in the claims.

Referring now to Fig. 9, the motor 15d is of the type shown in Fig. 4, and is located within a streamlined inner fairing 10d within a duct 8d, and there being a propeller fan with blades 12d and a rounded nose 17d located at the front end of said inner fairing and straightener vanes 11d behind the propeller fan and extending between said fairing and said duct.

The air intake through the fairing 10d for supplying cooling air to the motor in this embodiment of the invention is located immediately behind the propeller blades 12d, and preferably consists of a circumferential slot 50d through the fairing between the rear end of the propeller hub 13d and the straightener vanes 11d, or in other words, between the rotating part and the stationary part of the inner fairing.

The auxiliary fan 29d within the fairing 10d is secured on the motor shaft 14d at the rear end of the motor and is located close to the exhaust opening 34d in the tail 18d. Preferably a baffle ring 51d is secured to the front ends of the spacer supports 25d for closing off the annular space between the motor of the fairing.

In the air delivered by the blades 12d of the propeller fan, the thin inner layer flowing over the inner fairing which loses energy due to friction begins immediately behind the propeller blades and increases somewhat in thickness as it flows over the remainder of the fairing. By providing the circumferential air intake slot 50d, the cooling air for the motor is taken from this thin inner layer immediately behind the propeller blades and drawn through the motor by the auxiliary fan 29d, to be exhausted through the axial exhaust port 34d. The slot 50d may be used supplemental to intake ports in the tail 18d, such as shown in Fig. 4, but in many cases the effectiveness of the slot 50d will be sufficient for accomplishing the purposes of the present invention, so that the sides of the tail may be completely closed as shown in Fig. 9.

Referring to Fig. 10, the motor 15e is of the type shown in Fig. 1 and the supporting construction within the fairing 10e is generally similar to that shown in Fig. 1, except that a conically shaped baffle ring 33e extends from the rear end of the motor rearwardly into the converging tail 18e and is secured thereto adjacent to the exhaust port 34e.

This particular extended shape of baffle 33e is required because in the converged tail 18e shown in Fig. 10, two longitudinally spaced circumferential series of intake ports 32e and 32'e are provided, the rear ports 32'e being preferably staggered with respect to ports 32e. Because of having two series of intake ports sucking air from the inner layer of impelled air flowing over the outer surface of the converging tail, it is possible to further shorten the length of the tail and still get an efficient transition from velocity energy to static energy. Accordingly, it will be observed that the tail 18e is shorter than the tails 18, 18a and 18c having one series of intake ports.

Referring to Fig. 11, another modified construction of the converging tail is shown at 18f connected to an inner fairing 10f. In this embodiment, instead of providing substantially rectangular air intake ports through the tail, elongated relatively narrow arcuate or circumferential slots 52f are provided, being closely spaced circumferentially by narrow portions 53f of the tail.

All of the embodiments of the invention herein shown and described provide an axial flow fan structure having the fan motor located within a fairing in a duct, said structure embodying means and methods utilizing air flowing through the duct for cooling the motor and simultaneously increasing the efficiency of the fan.

I claim:

1. Axial flow fan structure including an outer duct, a streamlined inner fairing having a converging tail at its rear end, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said propeller fan, a series of straightener vanes

secured to said duct and said inner fairing immediately behind said propeller fan, said inner fairing being provided behind the propeller fan with an air intake opening adapted for withdrawing air into said fairing from the inner layer of air flowing along the outer surface of the fairing, and an auxiliary fan within said fairing driven by the motor for circulating air from the intake opening through the motor and exhausting it through the end of said converging tail.

2. Axial flow fan structure including an outer duct, a streamlined inner fairing, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said fan, a series of straightener vanes secured to said duct and said inner fairing immediately behind said fan, said inner fairing having a converging tail portion immediately behind said straightener vanes, said converging tail portion having air intake ports adapted for scooping air from the inner layer of impelled air flowing along the surface of said fairing and conducting it into said fairing for cooling the motor, and auxiliary fan means within said fairing driven by said motor for exhausting said air through the converging end of said tail portion axially of said duct.

3. Axial flow fan structure including an outer duct, a streamlined inner fairing, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said fan, said inner fairing having a converging tail portion at its rear end, said converging tail portion having air intake ports therein, auxiliary fan means within said fairing driven by said motor for sucking air through said intake ports, and baffle means in said fairing for circulating said air through the motor and then exhausting it through the converging end of said tail portion axially of said duct.

4. Axial flow fan structure including an outer duct, a streamlined inner fairing, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said fan, a series of straightener vanes secured to said duct and said inner fairing immediately behind said fan, said inner fairing having a converging tail portion immediately behind said straightener vanes, said converging tail portion having a series of circumferentially arranged air intake ports at its front end immediately behind the rear ends of said straightener vanes, said ports being adapted for withdrawing air into said fairing from the inner layer of air flowing along the outer surface of the fairing, and an auxiliary fan within said fairing driven by the motor for circulating air from the intake ports through the motor and exhausting it through the rear end of said tail portion.

5. Axial flow fan structure including an outer duct, a streamlined inner fairing, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said fan, a series of straightener vanes secured to said duct and said inner fairing immediately behind said fan, said inner fairing having a converging tail portion immediately behind said straightener vanes, said converging tail portion having longitudinally spaced circumferentially arranged series of air intake ports, said ports being adapted for withdrawing air into said fairing from the inner layer of air flowing along the outer surface of the fairing, and an auxiliary fan within said fairing driven by the motor for circulating air from the intake ports through the motor and exhausting it through the rear end of said tail portion.

6. Axial flow fan structure including an outer duct, a streamlined inner fairing, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said fan, said inner fairing having a converging tail portion at its rear end, said converging tail portion having air intake ports adapted for withdrawing air into the fairing from the inner layer of air flowing along the outer surface of said fairing, lips projecting outwardly and forwardly from the rear ends of said intake ports for scooping air into said ports, and auxiliary fan means within the fairing and driven by said motor for circulating air from said ports through the motor and exhausting it through the rear end of said tail portion.

7. Axial flow fan structure including an outer duct, a streamlined inner fairing, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said propeller fan, an auxiliary fan mounted in the rear end of said motor and driven thereby, said inner fairing having a converging tail portion at its rear end, said converging tail portion having air intake ports for withdrawing air into the fairing from the inner layer of air flowing along the outer surface of said fairing, tubes for conducting said air radially inward from said intake ports to the intake of said auxiliary fan for being circulated forwardly through the motor, and baffle means for deflecting said air rearwardly past said tubes to be exhausted through the rear end of said tail portion.

8. Axial flow fan structure including an outer duct, a streamlined inner fairing, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said propeller fan, an auxiliary fan mounted in the rear end of said motor and driven thereby, said inner fairing having a converging tail portion at its rear end, said converging tail portion having an axial exhaust opening and side air intake ports for withdrawing air into the fairing from the inner layer of air flowing along the outer surface of said fairing, walls in said fairing providing passages conducting said air radially inward to the intake of said auxiliary fan for being circulated forwardly through the motor and rearwardly past said passages to the axial exhaust opening in the end of the tail portion.

9. Axial flow fan structure including an outer duct, a streamlined inner fairing having a converging tail provided with an axial exhaust port in its rear end, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said propeller fan, said inner fairing being provided immediately behind said propeller fan with a circumferential air intake slot adapted for withdrawing air into the fairing from the inner layer of air impelled along the outer surface of the fairing by the propeller fan, and an auxiliary fan within said fairing driven by the motor for circulating air from said intake slot through the motor and exhausting it through the axial exhaust port in said converging tail.

10. Axial flow fan structure including an outer duct, a streamlined inner fairing having a converging tail at its rear end, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said propeller fan, a series of straightener vanes within said duct immediately behind said pro-

peller fan, said inner fairing being provided behind the propeller fan with an air intake opening adapted for withdrawing air into said fairing from the inner layer of air flowing along the outer surface of the fairing, and an auxiliary fan within said fairing driven by the motor for circulating air from the intake opening around the motor and exhausting it through the end of said converging tail.

11. Axial flow fan structure including an outer duct, a streamlined inner fairing having a converging tail at its rear end, a propeller fan rotatably mounted in said duct coaxial with said inner fairing, a motor in said fairing for driving said propeller fan, a series of straightener vanes within said duct immediately behind said propeller fan, said inner fairing being provided behind the propeller fan with an air intake opening adapted for withdrawing air into said fairing from the inner layer of air flowing along the outer surface of the fairing, and means within said fairing for circulating air from the intake opening around the motcr and exhausting it through the end of said converging tail.

THEODOR H. TROLLER.