Sept. 20, 1938. M. A. SMITH, JR 2,130,910

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FIG. 1

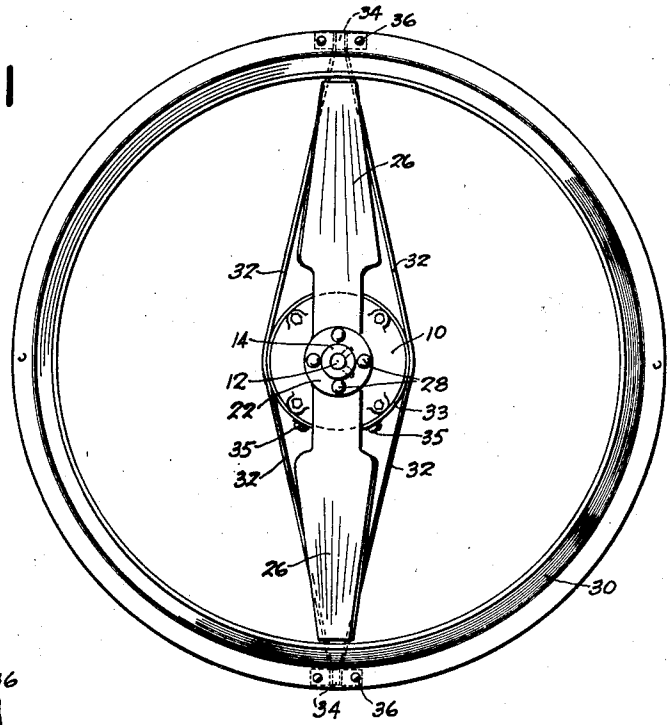
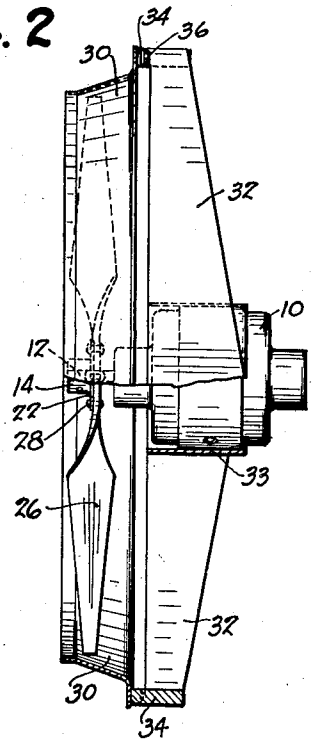


FIG. 2



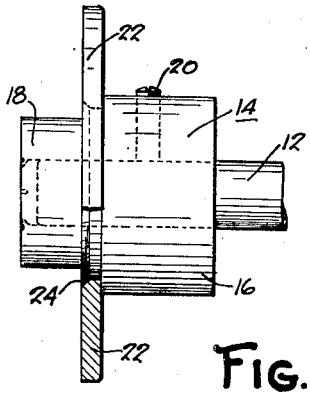


FIG. 3

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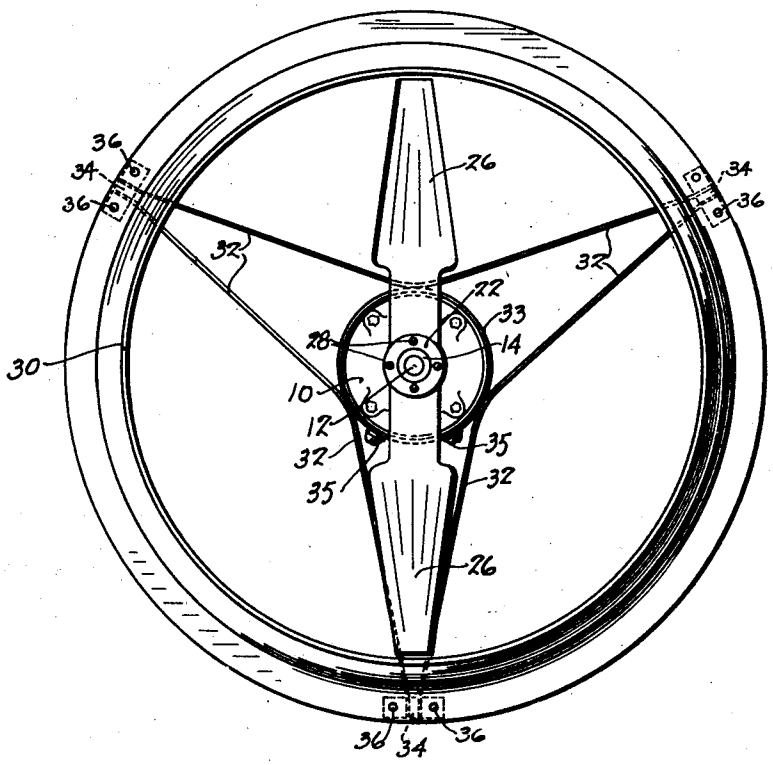


FIG. 4

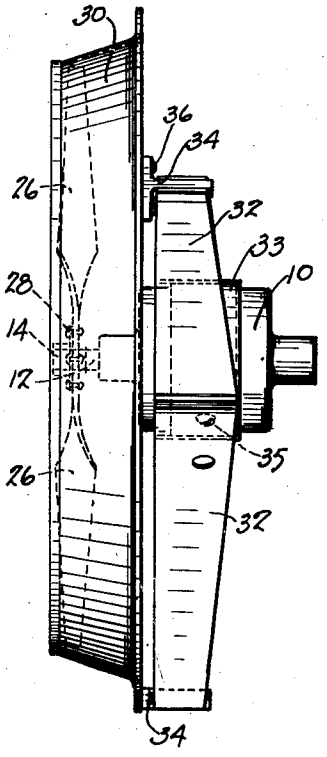


FIG. 5

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FIG. 6

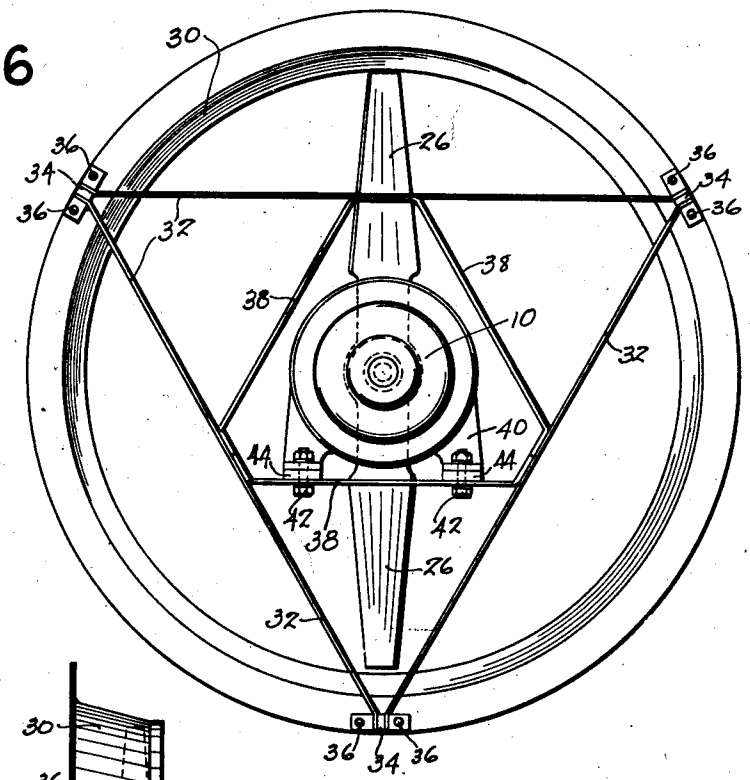
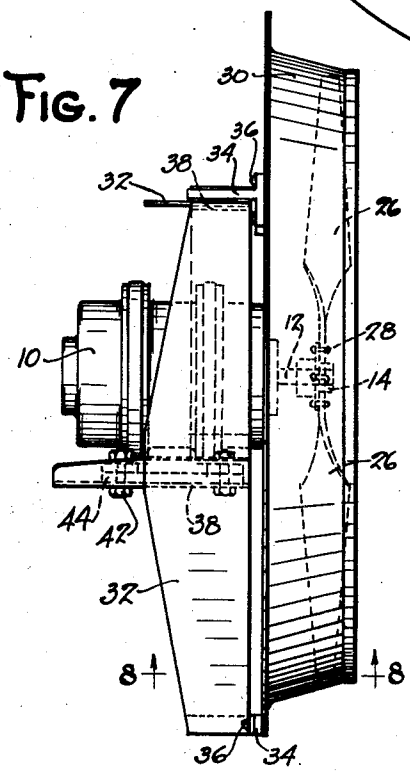


FIG. 7



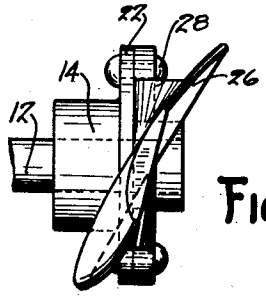


FIG. 8

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Patented Sept. 20, 1938

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UNITED STATES PATENT OFFICE

2,130,910

FAN

Marshall A. Smith, Jr., South Bend, Ind., assignor to Bendix Products Corporation, South Bend, Ind., a corporation of Indiana

Application February 9, 1935, Serial No. 5,691

2 Claims. (Cl. 230—120)

This invention relates to fans, and more particularly to ventilating fans.

The object of the invention is to increase the efficiency, and to decrease the manufacturing cost of ventilating fans by the use of certain novel constructional features hereinafter more fully described.

According to a preferred embodiment of the invention, a Venturi-shaped air intake ring formed in a unique manner is employed to produce smooth air flow past a novel fan designed to produce uniform air flow over its entire working area.

Other important features of the invention reside in the novel means employed to fix the driving motor to the air intake ring, and to the connection between the fan and the driving shaft of the motor.

Other important features of the invention will be apparent from the following detailed description together with the accompanying drawings submitted for purposes of illustration only, and not intended to define the scope of the invention, reference being had for that purpose to the subjoined claims.

In the drawings, wherein similar reference characters refer to similar parts throughout the several views:

Figure 1 is a front elevation of a fan embodying the present invention;

Figure 2 is a side elevation, partly in section, of the fan shown in Figure 1;

Figure 3 is a side elevation partly in section, of the hub employed to fix the fan to the driving motor;

Figure 4 is a front elevation similar to Figure 1 but showing a different embodiment of the invention;

Figure 5 is a side elevation of the fan shown in Figure 3;

Figure 6 is a rear elevation, similar to Figure 3, but showing a different embodiment of the invention;

Figure 7 is a side elevation of the fan shown in Figure 6; and

Figure 8 is an enlarged view, taken on the line 8—8 of Figure 7.

Referring to the drawings, and more particularly to Figure 1, there is shown a ventilating fan having a driving motor 10 and a driving shaft 12. A hub 14 having two sections of reduced outer diameter 16 and 18 is fixed to the driving shaft 12 by any suitable means such as the screws 20. A flange 22 is received over the section 16 of the hub 14 and is fixed thereto by shear-riveting a portion of the section 16 into a countersunk section 24 of the flange 22. A bladed fan 26 is received over the projection 18 of the hub 14, and is fixed to the flange 22 by any suitable means such as the rivets 28.

The blades of the fan 26 are designed to deliver air uniformly across their working length. The peripheral velocity of the portions of the blade closer to the hub is less than the peripheral velocity of points more distantly removed from the hub. It is therefore necessary to progressively increase either the angle of incidence or the effective width of the blade as the hub is approached in order to deliver a uniform quantity of air. It has been found that better results can be accomplished by progressively increasing both the effective width, and the angle of incidence of the blade as the peripheral velocity of the blade decreases as the hub is approached. In view of the fact that the peripheral velocity of the portions of the blade adjacent to the hub, commonly called the root of the blade, is very low, it has been found impractical to attempt to employ this section of the blade to drive air.

The portion of the blade having the highest angle of incidence is the portion of the working length closest to the hub. The root of the blade must be sufficiently strong to withstand considerable bending in order that the section of the working length of the blade closest to the hub can be carried at the necessary high angle of incidence. The root section of the blade is therefore made of uniform cross section in order to produce uniform torsional strength so that the blade may be easily bent or formed to the high angles necessary at the beginning of the working section, without danger of overstressing the material.

The fan 26 is surrounded by a Venturi-shaped air intake ring 30 designed to produce smooth air flow and to prevent eddies in the air before it is acted upon by the propeller 26.

The ring 30 is formed in a novel manner by butt-welding a strip of material to form a hollow cylinder of proper diameter to form the desired ring. The cylinder is then passed between a pair of rolls which deform it to give it the proper Venturi shape. The cylinder is then removed from the forming rolls and placed in a squeezer. The squeezer is so designed as to place equal pressure on all points about the periphery of the cylinder. The squeezing operation is continued until the material of the cylinder is stressed beyond its elastic limit, and when so stressed it will retain its shape permanently.

Two Venturi-shaped rings may be formed to-

gether channel-shaped and then split to separate them after the squeezing operation, or one may be formed at a time, as desired. The rings may be formed of any desired material such as aluminum or steel.

Means are provided to fix the driving motor 10 to the ring 30. Motor support struts 32 formed of seamless tubing or rectangular strip metal of very thin cross section, (having the dimension parallel to air flow many times greater than the dimension perpendicular to air flow) are spot-welded to a retaining ring 33, fixed to the driving motor 10 by the screws 35, and extend to the ring 30. The motor support struts 32 are preferably spot-welded to a T-shaped member 34 fixed to the ring 30 in any suitable manner, as by rivets 36. The support struts 32 are so proportioned that the dimension parallel to air flow is many times greater than the dimension perpendicular to air flow.

In the smaller type fans illustrated in Figures 1 and 2, four motor support struts arranged as shown in Figure 1 may be sufficient to support the driving motor 10 and the fan 26. In the larger types of fans it has been found desirable to employ six motor support struts 32 arranged as shown in Figure 4.

To support the largest types of fans it has been found advisable to use a triangulated structure as shown in Figure 6. In this structure the motor support struts 32 welded to the T-shaped members 34 form a triangular-shaped framework across the ring 30. Reinforcing members 38 strengthen the framework and form a support to which the feet 40 of the motor 10 may be fastened by any suitable means, such as the bolts 42. If desired resilient washers 44 formed of rubber or other suitable material may be interposed between the feet 40 of the motor and the motor support, to damp out vibration.

In the devices shown in Figures 1–5 the thrust and torque of the fan 26 are transmitted through the motor retaining ring 33 to the motor support struts 32.

In the device shown in Figures 6 and 7 the thrust and torque of the fan 26 are transmitted through the feet 40 bolted to the reinforcing members 38. The members 38 may if desired be formed of a single strip bent to form a triangle having flat apexes suitable to be welded to the support struts 32. In this embodiment the reinforcing members 38 form the counterpart of the motor retaining ring 33.

The design of the fan is such that the majority of the joints may if desired be spot welded, although other means may be employed to fix the members together.

Although the invention has been described with particular reference to certain specific embodiments, it is not intended to limit the scope of the invention to the embodiments shown, nor otherwise than by the terms of the following claims.

I claim:

1. A ventilating fan comprising a driving motor including a shaft and a housing, a bladed fan having a working area designed to deliver air at uniform velocity, a generally conical shaped air flow directing ring and an air outlet passage of substantially the same diameter as the fan, and means including a plurality of thin relatively wide brace members fixed to the flanged section of the air flow directing ring and extending across said ring to form a generally triangular shaped framework to receive the housing of the driving motor to hold the ends of the blades of the fan adjacent and rearwardly of the section of the ring of substantially the same diameter as the fan.

2. In a ventilating fan, a driving motor including a housing and a driving shaft, a hub fixed to the driving shaft, a flange riveted to the hub, a bladed fan fixed to the flange, said blades having working sections designed to deliver air at uniform velocity over the working area of said blades and a root section of uniform cross section to resist the concentration of bending stresses developed in the fan, a Venturi-shaped ring surrounding the fan, and means including thin relatively long supports extending across the Venturi-shaped ring fixed to the housing of the driving motor to hold the outer ends of the fan blades adjacent the restricted section of the Venturi-shaped ring.

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