March 31, 1936. H. C. HUEGLIN 2,035,479

FAN

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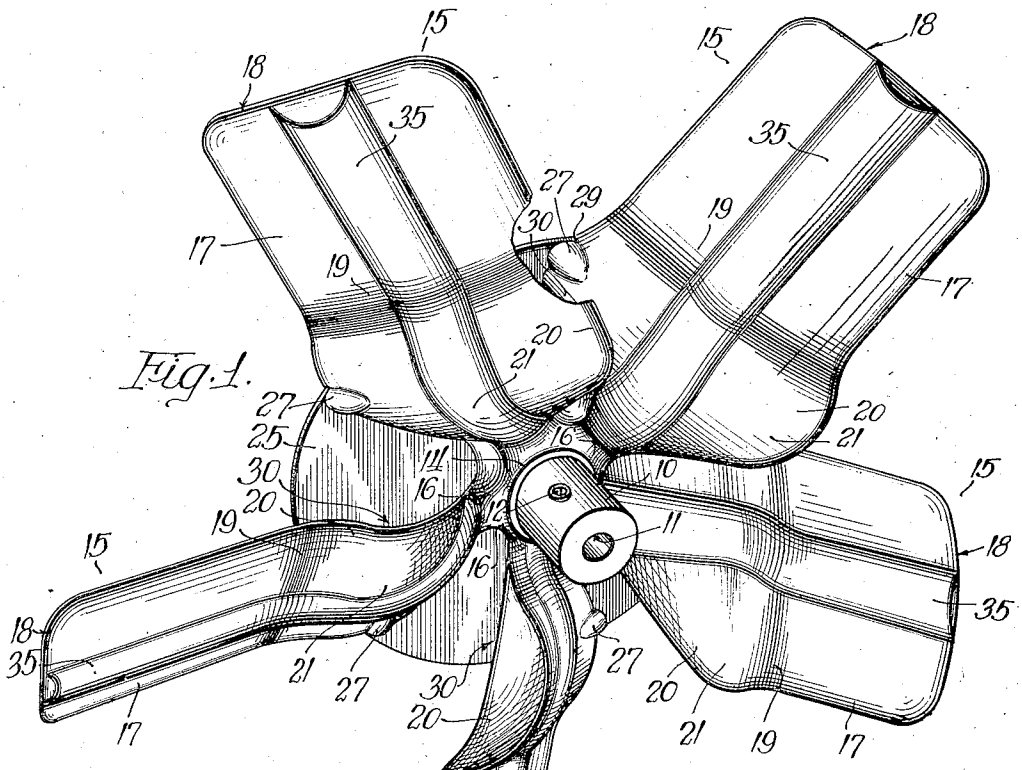


Fig. 1.

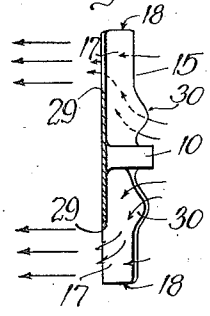


Fig. 3

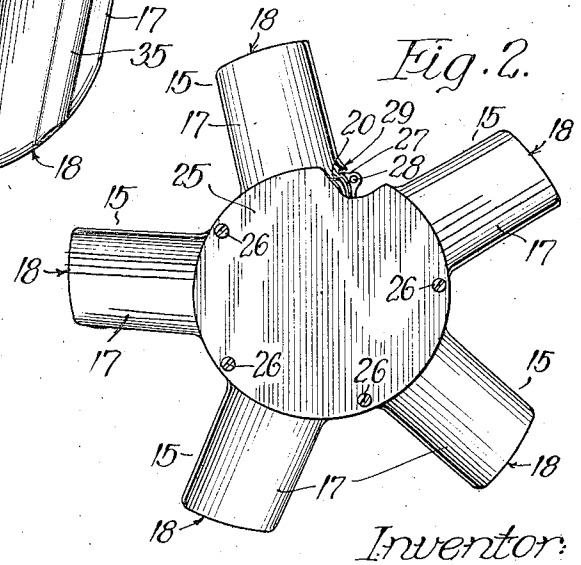


Fig. 2.

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FAN

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Application May 9, 1935, Serial No. 20,520

4 Claims. (Cl. 230—261)

This invention relates to fans, and particularly to fans for use in circulating air as, for example, in ventilators and the like.

It is to be understood, however, that the fan of the present invention is not limited to use in ventilators, nor to operation on air, but may be employed elsewhere as suitable or desired.

Where the fan is used in a ventilator, the ventilator may comprise a fan and a driving motor provided with a bracket for mounting the fan and motor in a panel, which panel may, in turn, be adapted for mounting in or over a window or other opening, or the fan may be used in connection with a stand or pedestal such as that shown in my copending application, Serial No. 17,562, filed April 22, 1935, or otherwise as suitable or desired.

The present invention has for one of its objects the provision of a fan having means for preventing the fan from drawing air in centrally from the discharge side.

Another object is to form pockets for the air which is thrown off the blades by the centrifugal motion, the tips of the blades beyond the pockets throwing the air forward and, with the present improvement, providing a much greater velocity of air at the outside margins of the pockets.

Another and more specific object is to form the pockets above referred to and prevent the fan from drawing air in centrally from the discharge side by the simple expedient of a disc centrally disposed and secured in place to the discharge side of the fan, and, still more specifically, by means of a disc centrally disposed and secured in place to the discharge side of a fan having blades with inner scooped or bucket-shaped portions behind the disc and outer blade portions extending outwardly from the periphery of the disc and adapted for throwing the air forward.

Further objects and the advantages and details of the illustrated embodiment of the invention will appear from the following detailed description, taken in connection with the accompanying drawing, in which:

Figure 1 is a perspective view of a fan embodying the present invention;

Figure 2 is an elevational view of the discharge side of the fan, with the centrally disposed disc secured thereto partially broken away to reveal the means on one of the blades for attachment of the disc thereto; and

Figure 3 is a more or less diagrammatic longitudinal section showing how the fan is prevented from drawing air in centrally from the discharge side and how the air is pocketed centrally, moved outwardly, and then forward by the blade portions beyond the periphery of the disc.

Referring to the drawing, the fan selected for illustration comprises a collar or hub portion 10 which is substantially cylindrical in form and which is bored centrally thereof, as shown in Figure 1, to form a cylindrical bearing portion 11 adapted to receive a rotating shaft or the like to which the fan is secured.

A set screw 12 is threaded into the collar 10 radially thereof and is provided with a polygonal recessed head opening for insertion of a suitable tool to thread the set screw with respect to the shaft to secure the fan firmly to the shaft for rotation therewith. Integral with the forward end of the hub 10 is the hub or central portion 14 of the fan proper, which hub portion 14 has the integral fan blades 15 extending radially outwardly therefrom. The fan shown has five blades, but it is to be understood that the number of blades may be varied within the scope of the present invention.

The structure of the fan proper is similar to the structure of the fan shown in my copending application, Serial No. 704,826, filed January 2, 1934. The blades 15 are integrally connected to the hub portion 14 by means of the relatively small angularly extending tapered portions 16 of the blades, which produces a hub of relatively small area and also reduces the quantity of metal required. Substantially the entire outer portion 17 of each blade 15 from the tip 18 to the section indicated at 19 is of the same curvature and pitch. These outer blade portions 17 may be of relatively slight forwardly directed concave formation from one radial edge of each blade 15 to the other edge of the blade, or the concavity may be decreased to such an extent as to provide substantially planar surfaces if desired. In the illustrated embodiment of the invention, all sections of each blade 15 between the tip 18 and the section 19 are substantially identical, and the outer portion of each blade is thus rendered uniform in pitch and curvature throughout its entire length.

The remainder or inner portion 20 of each blade 15, between the section 19 and the tapered connecting portion 16, is of scooped or bucket-shaped formation. From the section 19, the blade is hollowed out inwardly and reaches its greatest concavity at the section 21 approximately midway between the section 19 and the outer end of the tapered connecting portion 16 between the blade and the hub of the fan. The pitch

angle of this scooped or bucket-shaped inner portion **20** of the blade inwardly of the section **19** is preferably increased so that the blade has a slightly warped effect at this point. This pitch angle preferably continues to increase and is preferably increased to the maximum just outwardly of the outer end of the tapered connecting portion **16**.

At about the section **21** the blade **15** also preferably has its greatest concavity in a transverse direction, as shown. It is thus apparent that from the section **19** to the section **16**, the blade is hollowed out to give it a great concavity and, at the same time, is slightly warped to increase the pitch thereof. At the section **16**, connecting the blade to the hub, the pitch angle has increased to approximately 75°, whereas the pitch angle of the outer portion **17** of the blade is approximately only 35° and remains at this angle from the outer tip **18** until the section **19** is reached. From this point or section **19**, there is a progressive increase in pitch, with a maximum concavity at the section **21**, and a decreasing concavity from there to the section **16**.

At the point **16**, where the blade joins the hub, the blade is of relatively small lateral extent. However, the metal is preferably thickened at this point to provide the necessary support and rigidity for the blade, but the surface adjacent the hub has been, to a large extent, eliminated by increasing the pitch angle and decreasing the lateral extent of the blade at the same time, there being a sharp taper from the section **20** to the section **16**, as shown. The blade **15** has its greatest lateral extent adjacent the section **21**, which is the bottom or concave portion of the bucket-shaped inner portion of the blade.

A thin sheet-metal disc **25** of a diameter to cover the outer sides of the inner concave or bucket-shaped portions **20** of the blades **15** is disposed centrally of the fan and secured in place to the forward or discharge side of the fan, as by means of screws **26**, or in any other suitable or preferred manner. In the illustrated embodiment of the invention, the forward or leading edge of each blade is thickened slightly or provided with a boss, as shown at **27**, adjacent the outer end of the scooped portion **20**, and these thickened portions or bosses **27** have tapped openings **28** into which screws **26** are threaded to secure the disc **25** in centered position on the discharge side of the fan. The blades **15** are preferably undercut, as shown at **29** (Figures 2 and 3), so that the disc **25** lies flush with the forward or leading edges of the blades **15** at the discharge side of the fan.

The outer periphery of the disc **25** lies substantially along the sections **19** where the inner ends of the outer blade portions **17** of constant pitch and curvature meet the outer ends of the inner scooped or bucket-shaped blade portions **21**. With this disc **25** thus arranged, the fan is prevented from drawing air in centrally from the discharge side. And, at the same time, pockets **30** are formed behind the disc **25**, there being one of such pockets **30** between the disc **25** and each inner scooped or bucket-shaped blade portion **21**.

These pockets **30** catch or scoop up the air or other fluid which is thrown outwardly of the inner scooped or bucket-shaped portions **21**, and to the outer blade portions **17** by the centrifugal motion. The outer blade portions **17** extend beyond the disc **25** and throw the air or other fluid forwardly. The present improvement provides a much greater velocity of the air at the outside edge of the disc **25**, in addition to preventing the fan from drawing air in centrally from the discharge side thereof. And this is all accomplished by the simple expedient of the disc **25** centrally disposed and secured in place to the discharge side of the fan and, in its more specific aspects, by the combination of this disc with the blade structure illustrated and described. The disc **25** is also adapted for closing the opening through the hub **14** on the discharge side of the fan, so that this opening may extend entirely through the hub **14** without exposing the same at the discharge side of the fan.

The thickness of each blade **15** may be progressively increased from the outer tip **18** to the point **16** where the blade is joined to the hub, as disclosed in my last mentioned copending application. As explained therein, this serves to provide the proper proportioning of the blade and disposes the center of gravity at the hub, reducing the inertia and producing less centrifugal force.

Each blade **15** may be provided on its back side and substantially centrally between its leading and trailing edges with a thickened strengthening rib **35** extending from the tip of the blade to the section **16** which connects the blade to the hub of the fan. These ribs **35** conform to the formation of the backs of the blades and impart the desired strength and rigidity to the blades which, otherwise, may be relatively thin.

I do not intend to be limited to the precise details shown or described, except as set forth in the appended claims.

I claim:

1. A fan comprising a hub, a plurality of blades extending from said hub, each of said blades having an outer portion of substantially constant pitch and curvature and an inner generally scooped portion, and means secured to the fan adjacent one side of said inner scooped portions of the blades and covering only the inner scooped portions of said blades at the discharge side of the fan and of a radial extent to leave the outer blade portions of constant pitch and curvature open at the discharge side of the fan, said inner scooped portions extending laterally to said covering means.

2. A fan comprising a hub, a plurality of blades extending from said hub, each of said blades having an outer portion of substantially constant pitch and curvature and an inner generally scooped portion, a disc covering only the inner scooped portions of said blades at the discharge side of the fan and of a radial extent to leave the outer blade portions of constant pitch and curvature open at the discharge side of the fan, and means securing said disc peripherally to the leading edges of the blades adjacent one side of the inner scooped portions of the blades, said inner scooped portions extending laterally to said disc.

3. A fan comprising a hub, a plurality of blades extending from said hub, each of said blades having an outer portion of substantially constant pitch and curvature and an inner generally scooped portion, a disc covering only the inner scooped portions of said blades at the discharge side of the fan and of a radial extent to leave the outer blade portions of constant pitch and curvature open at the discharge side of the fan, and means securing said disc peripherally to the leading edges of the blades adjacent one side of the inner scooped portions of the blades, the blades being undercut so that the disc lies flush with the leading edges of the blades, said inner

scooped portions extending laterally to said disc.

4. A fan comprising a hub, a plurality of blades extending from said hub, each of said blades having an outer portion of substantially constant pitch extending from the tip of the blade to a point substantially midway between the tip of the blade and the axis of the fan, an inner blade portion of scooped formation inwardly of each of said outer blade portions, connecting portions between the inner ends of said scooped blade portions and the hub, and a disc secured to the fan adjacent one side of the inner scooped portions of the blades and covering only the inner scooped and connecting portions of the blades and the hub at the discharge side of the fan and terminating peripherally at approximately the inner ends of the outer blade portions of substantially constant pitch, said inner scooped portions extending laterally to said covering means.

HERMAN C. HUEGLIN.