April 16, 1963 R. F. SCHWEGLER 3,085,632

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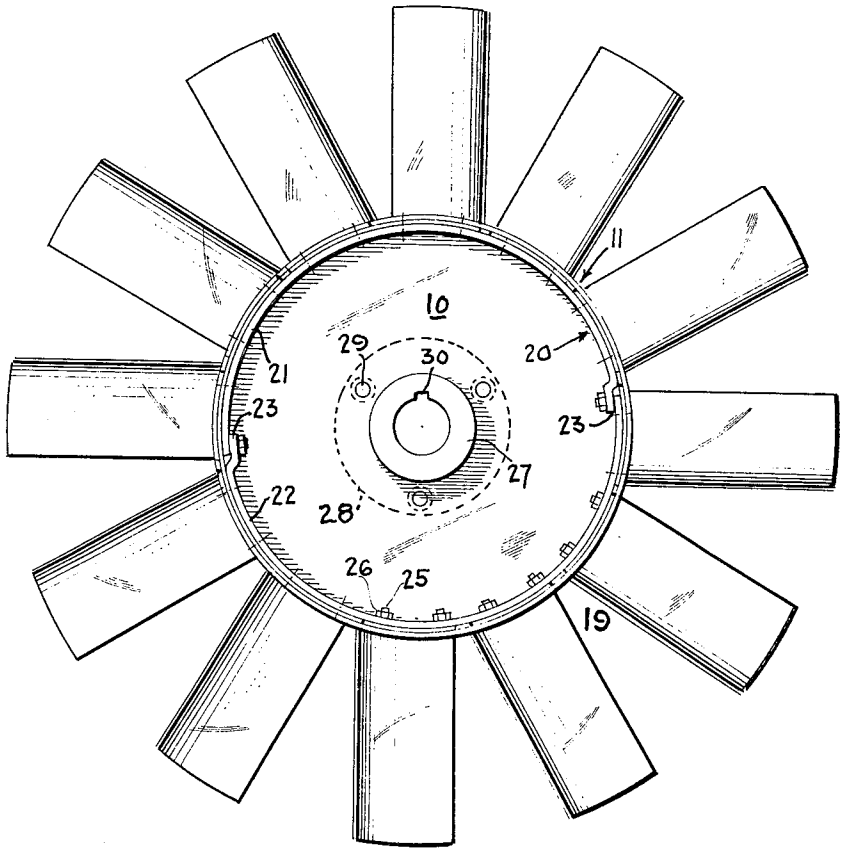


Fig. 1

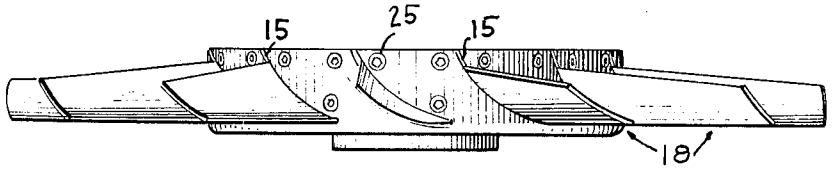


Fig. 2

INVENTOR
ROY F. SCHWEGLER
BY
Robertson & Smythe
ATTORNEYS

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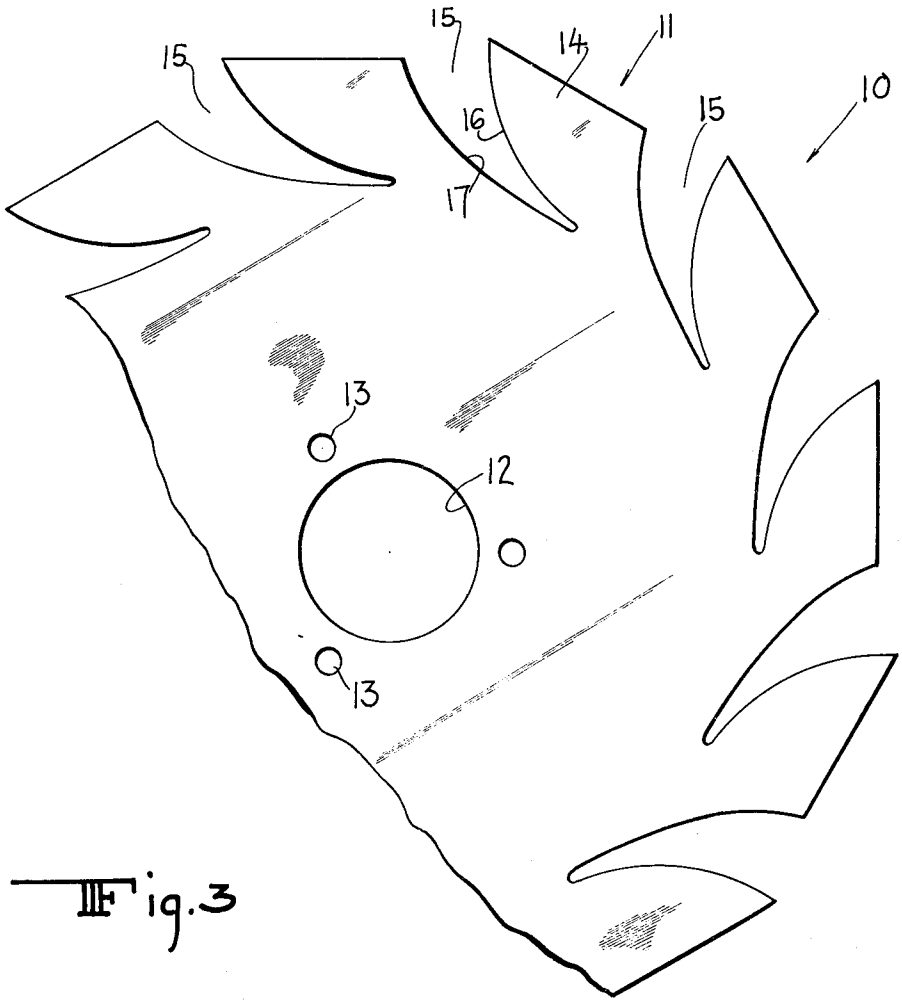


Fig. 3

INVENTOR
ROY F. SCHWEGLER
BY
Robertson & Smythe
ATTORNEYS

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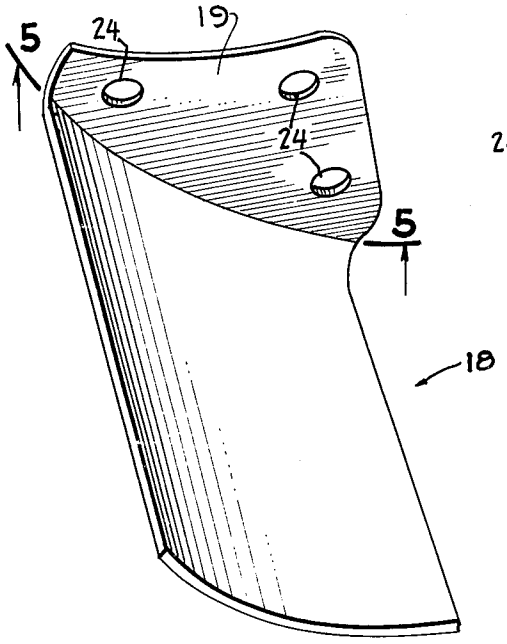


Fig. 4

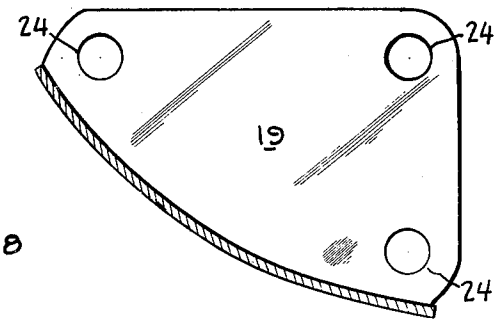


Fig. 5

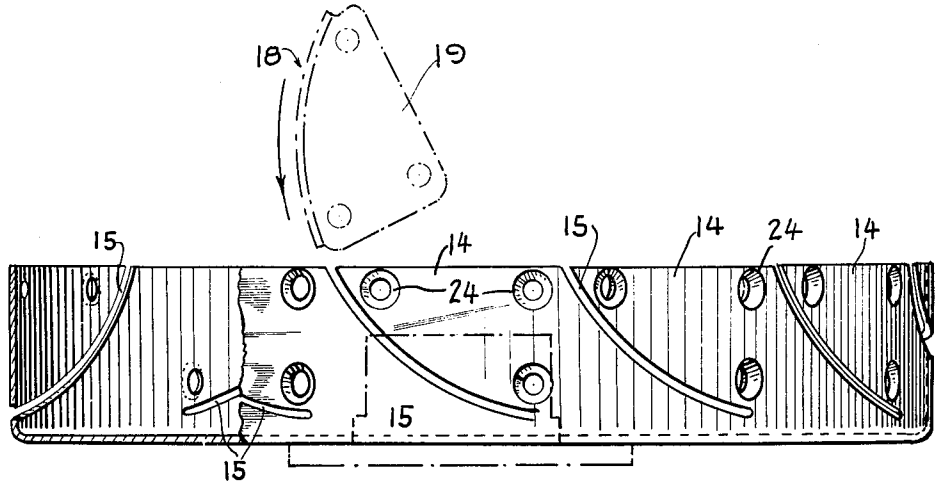


Fig. 6

INVENTOR
ROY F. SCHWEGLER
BY
Robertson & Smythe
ATTORNEYS

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Roy F. Schwegler, Davenport, Iowa, assignor to Ametek, Inc., New York, N.Y., a corporation of Delaware

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The present invention relates to fluid impelling devices, and more particularly to axial flow fans of multi-part construction in which the parts may be readily and easily fabricated and assembled, and to a method of making the same.

An object of this invention is to provide an axial flow fan which is rigid and rugged in its construction and in which the blades are mounted upon, and removably secured to, a centrally disposed blade supporting element such that the blades are in planes angularly disposed in respect to the plane of rotation of said supporting element.

Another object of this invention is to provide such a fan in which a supporting element is integrally attached to the root of the blades at right angles thereto and adapted to be removably bolted to a flanged periphery of a central disk in a manner to provide a smooth exterior of the flanged periphery.

Another object of this invention is to employ a central blade supporting disk having peripherally arranged flaps separated by curvilinear spaces such that when all of the flaps are bent at right angles to the disk, they form a circumferential flange having slots that conform to the curvilinear pitch of the blade.

Another object of the invention is to provide such an axial flow fan in which an integral blade supporting portion lies interiorly of, and between the disk flange and a reinforcing band that is also located interiorly of the flange and is bolted thereto.

In one aspect of the invention, a flanged disk may be formed from a substantially circular disk of sheet metal having equally spaced, peripherally arranged flaps. The flaps may be formed by removing equally spaced, peripherally arranged portions, each defined by two curvilinear edges that join each other at equally spaced points about a circle having a radius less than that of the circular disk by an amount equal to the width of the flange to be formed about the disk. By bending the flaps in the same direction and at right angles to the disk, a flanged disk is produced having equally spaced, peripherally arranged, curvilinear open end slots.

In another aspect of the invention, the fan blades may include a root-to-tip portion following generally an air foil cross section and a supporting portion at right angles to, and integral with the root of the blades. This supporting portion may have a curve in the direction of the blade width that generally conforms to the curve of the periphery of the flange of the central disk. Accordingly, a blade may be inserted within each slot about the periphery of the flanged disk in such fashion that the integral blade support may lie interiorly of the flange with the result that a smooth, uninterrupted flange exterior is provided from which radiate the fan blades.

In still another aspect of the invention, flange reinforcing means may be provided and it may take the form of a hoop or band means of rigid construction that may be located interiorly of the flange of the blade supporting disk such that the right angular supporting portion of the blades lies between the reinforcing band means and the flange of the disk. A plurality of bolts may extend through each flap, each right angular blade support and the band means, so that the assembly provides a rigid axial flow fan in which each blade may be removed independently of each other and a smooth, uninterrupted,

cylindrical surface may be provided from which the blades extend radially.

In still another aspect of the invention, a flanged hub may be bolted or otherwise fastened to the walls of the flanged disk such that said hub extends through a central hole within said disk.

The above, other objects and novel features of the new and improved axial flow fan will become apparent from the following specification and accompanying drawings which are merely exemplary.

In the drawings:

FIG. 1 is an elevational view of an axial flow fan to which the principles of the invention have been applied;

FIG. 2 is a side view of the fan shown in FIG. 1;

FIG. 3 is a plan view of a blank from which the flanged disk for supporting the fan blades is made;

FIG. 4 is a perspective view of a blade of the fan shown in FIG. 1;

FIG. 5 is a sectional view taken substantially along line 5—5 of FIG. 4; and

FIG. 6 is a side view of the flanged disk, showing the method of assembling a fan blade thereto.

Referring to the drawings, and particularly to FIG. 1, the principles of the invention are shown as applied to an axial flow fan comprising a disk **10** having a flange **11** integral therewith. Referring to FIG. 3, the flanged disk **10** may be made from a substantially circular piece of sheet metal or the like having a central hole **12** therein, and a plurality of holes **13** surrounding the hole **12** for a purpose to be described later. Flaps **14** may be formed about the periphery of the piece of sheet metal by providing equally spaced recesses **15** about the circular piece of sheet metal. The recesses may comprise two similar curvilinear edges **16** and **17** that substantially intersect each other at a point on a circle of a diameter less than the diameter of the circular piece of sheet metal by an amount equal to the desired width of the flange to be formed. The edges **16** and **17** diverge outwardly from their intersecting point and terminate at points a substantial distance apart at the periphery of the circular piece of sheet metal. These recesses **15** may be cut from the piece of sheet metal, or may be blanked out with a die in a known manner.

By bending all of the flaps **14** in the same direction at right angles to the main body of the piece of sheet metal, a flange is formed about the disk **10** having equally spaced curvilinear slots **15** about the periphery of the flange **11** (FIG. 6) which slots have a constant thickness.

Referring to FIGS. 4 and 5, blades **18** may comprise supporting plates **19** having a convex contour, looking from the tip of a blade toward its root, which convexity may have a radius equal to that of the flange **11**. The blade **18** may have an air foil cross section of a design best suited for the desired characteristics of the fan. The curvature of the slots **15** (FIG. 6) may be identical with the curvature of the blades **18** so that in assembling the blades **18** to the flange **11**, the blades can slide into the slots **15** with the plates **19** thereof located inwardly of the flange **11** and adapted to fit tightly against the inner periphery of the flange **11**, with the outer convex surface of the plates mating with the inner concave surface of the flange **11**.

Referring to FIG. 1, a band **20** may be provided for strengthening the assembly, and in the embodiment disclosed, it may comprise two sections **21** and **22**. The width of the band **20** may be equal to the width of the flange **11**, and each section **21** and **22** may have a deflected end portion **23** that overlaps the one end of the other section to complete a circular shape.

Referring to FIGS. 1, 4, 5 and 6, aligned holes **24** may extend through the flaps **14**, the plates **19** and the

band sections 21 and 22. The holes 24 in the flaps 14 may be countersunk in order that the heads of bolts 25 (FIGS. 1 and 2) will be flush with the outer periphery of the flange 11. Nuts 26 may be screwed onto the bolts 25 so as to be located on the inner peripheral surfaces of the band sections 21 and 22.

Referring again to FIG. 1, a hub portion 27 may extend through the hole 12 (FIG. 3) and may include a flange 28 having holes 29 therein that align with the holes 13 surrounding the hole 12 in the piece of sheet metal from which the flanged disk 10 is made. Bolts may pass through the holes 29 and 13 for rigidly fastening the hub 27 to the flanged disk 10. A keyway 30 may be provided within the hub 27 for securing the assembled fan to a drive shaft.

Although the various features of the new and improved axial flow fan have been shown and described in detail to fully disclose one embodiment of the invention, it will be evident that numerous changes may be made in such details and certain features may be used without others without departing from the principles of the invention.

What is claimed is:

1. In an axial flow fan, a flanged disk; a plurality of open end slots at equally spaced intervals about the periphery of the flange of said disk; fan blades including supporting plates integrally connected to said blades at the roots thereof, said plates having a curvature corresponding to the peripheral curvature of said flange, the configuration of said slots corresponding to the transverse configuration of said blades whereby said blades may fit within said slots and said blade supporting plates may fit against the inner periphery of said flange; reinforcing band means within said flange and adapted to bear against the exposed surfaces of said blade supporting plates; and fastening means extending through said flange, blade supporting plates and band means for locking the assembly together.

2. In an axial flow fan, a flanged disk; a plurality of open end slots at equally spaced intervals about the periphery of the flange of said disk; fan blades including supporting plates integrally connected to said blades at the roots thereof, said plates having a curvature corresponding to the peripheral curvature of said flange, the configuration of said slots corresponding to the transverse configuration of said blades whereby said blades may fit within said slots and said blade supporting plates may fit against the inner periphery of said flange; overlapping multi-section band means within said flange and adapted to bear against the exposed surfaces of said blade supporting plates; and fastening means extending through said flange, blade supporting plates and band sections for locking the assembly together.

3. In an axial flow fan having blades with a transverse curvilinear section, a flanged disk having curved open end slots equally spaced about the periphery of the flange, the curvature of said slots corresponding to the curvature of the transverse section of said blades; supporting plates integral with and extending at right angles from the root of said blades, said plates having a curvature corresponding to the peripheral curvature of said flange whereby said blades may fit within said slots and said plates may fit against the inner periphery of said flange; and means for removably attaching said plates to said flange.

4. In an axial flow fan having blades with a transverse curvilinear section, a flanged disk having curved open end slots equally spaced about the periphery of the flange, the curvature of said slots corresponding to the curvature of the transverse section of said blades; supporting plates integral with and extending at right angles from the root of said blades, said plates having a curvature corresponding to the peripheral curvature of said flange whereby said blades may fit within said slots and said plates may fit against the inner periphery of said flange; reinforcing band means within said flange and adapted to bear against the exposed surfaces of said blade supporting plates; and fastening means extending through said flange, plates and band means for locking the assembly together.

5. In an axial flow fan, a flanged disk; a plurality of open end slots at spaced intervals about the periphery of the flange of said disk; fan blades each of uniform thickness for sliding within and lengthwise of a corresponding one of said slots upon assembly and disassembly of said blades, a supporting plate integrally connected to each of said blades at the root thereof, said plates each having an outer surface corresponding to an inner surface portion of said flange, the transverse configuration of each blade corresponding to the configuration of its slot, and means for removably fixing said plates to said flange, whereby said blades in a secured position within their slots form a rigid fan construction.

6. In an axial flow fan, a flanged disk; a plurality of curved open end slots at spaced intervals about the periphery of the flange of said disk; fan blades each of uniform thickness for sliding within and lengthwise of a corresponding one of said slots upon assembly and disassembly of said blades, a supporting plate integrally connected to each of said blades at the root thereof, said plates each having an outer surface corresponding to an inner surface portion of said flange, the transverse configuration of each blade corresponding to the configuration of its slot, and means for removably fixing said plates to said flange, whereby said blades in a secured position within their slots form a rigid fan construction.

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