POWER-DRIVEN FAN

This invention relates to power-driven fans, and more particularly to electrically driven fans for use in exhaust systems handling acid fumes or gases.

The primary object of this invention is to provide an improved fan with its elements so constructed as not to be deleteriously affected by corrosive or metal injurious agents.

In accordance with one embodiment of this invention as applied to a rotary fan for use in exhaust systems for withdrawing acid fumes or gases from acid plating equipment, there is provided a fan structure wherein the inner portions thereof, within a fan chamber, which would be subject to attack from acid fumes or gases, comprise elements constructed of a phenolic condensation product which may be either molded from dust or fabricated from phenol fibre. Specifically, a rotary exhaust fan is provided which comprises separated hubs mounted upon and surrounding a rotary metal shaft, the hubs having radial arms which are interconnected by blades having at their outer ends radial reinforcing rings extending between the blades. A plurality of collars and the hubs serve to surround completely the shaft to which they are keyed and are held together as a unit by a plurality of metal bolts, the inner end of the shaft and the heads of the bolts being enclosed by a cap threaded onto the inner end collar, and the whole fan assemblage is mounted within a housing, providing the fan chamber, having inlet and outlet ports.

Other objects and advantages of this invention will more fully appear from the following detailed description, taken in connection with the accompanying drawing, wherein

Fig. 1 is a vertical sectional view, partly in elevation, of a rotary exhaust fan embodying the features of the present invention;

Fig. 2 is a vertical sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary view of an alternative method of securing the radial reinforcing rings to the blades and

Fig. 4 is an end view of Fig. 3.

Referring now to the drawing in detail, there is illustrated an exhaust fan comprising a rotary fan unit 10 and a housing 11 therefor having inlet and outlet ports 12 and 13, respectively. Unless otherwise specified, each of the elements of the fan unit 10 and its housing 11 to be hereinafter described in detail is composed of a phenolic condensation product either of the laminated or solid type. Preferably each of the elements is composed of a phenolic condensation product of the laminated type formed to a suitable contour and dimensions ready for assembling, from finished phenol fibre product comprising laminations of fibrous material, such as paper, cloth or fabric, the laminations thereof having been impregnated with a phenolic condensation product or other binder which will harden. The assemblage of impregnated phenol fibre laminations comprising the product are united and completely cured or finished by the application of heat and pressure to produce a product of an incompressible, infusible and insoluble character having great strength, and which is not subject to attack by acid fumes or gases.

Referring particularly to Figs. 1 and 2, the fan unit 10 is secured to the end of a rotary steel shaft 16 which extends through an aperture in one side of the housing 11. The other end of the shaft 16, which has been omitted for the sake of brevity, may be mounted in journals and is connected to a suitable source of power (not shown), for instance an electric motor. Upon the shaft 16 are a pair of spiders or hubs 17 having radial arms 18, the hubs being separated by a spacing collar 19. Abutting the outer ends of the hubs 17 are collars 20 and 21 and abutting the outer end of the collar 21 is a collar 24 partly within the housing 11, the outer end thereof extending outside the housing, being held with its peripheral edge reinforced by a steel ring 25 fitting a shoulder in the collar and suitably secured thereto. A steel key 26 is provided in aligned keyways formed in the shaft 16, hubs 17, collars 19, 20, 21 and 24 to secure the hubs and collars to the shaft for rotation therewith. A plurality of equally spaced metal bolts 28 extend through apertures provided in the hubs 17 and the collars 19, 20, 21 and 24 and are provided at their ends with...
nuts mounted in depressions formed in the outer end face of the collar 24 and at their inner ends with nuts abutting the outer end face of the collar 20, the bolts when drawn up tightly serving to hold the hubs and collars together as an integral unit upon the shaft 16. A metal set screw 29 (dotted outline Fig. 1) threaded into the collar 24 adjacent the end thereof outside the housing 11 and entered in a depression in the shaft serves to maintain the fan unit 10 from longitudinal movement upon the shaft. Threaded onto the collar 20 is a cap 31 which serves to enclose the inner end of the metal shaft 16 and the metal bolts 28 and the nuts threaded thereon.

The arms 18 of the hubs 17 are interconnected by suitably shaped impeller blades 32, which are secured to the arms by flatheaded screws 33 also composed of a phenolic condensation product. Secured to and interconnecting each of the blades 32 at their opposite ends, adjacent their outer edges, are flat radial reinforcing rings 34, the rings being set in notches flush with the end surfaces of the blades and secured thereto by flatheaded screws 33, also made from a phenolic condensation product.

The housing 11 comprises side plates 37 and 38 with a curved plate 39 therebetween, the three plates forming the walls of the housing. The edges of the curved plate are mortised as indicated at 40 into the opposed inner surfaces of the side plates at a point inside the outer edges thereof. A collar 41 having flat outer surfaces 42 disposed parallel to the opposed inner surfaces of the side plates 37 and 38 is mortised thereto as indicated at 43, the collar being aligned with the outlet port 13. The side plates 37 and 38 with the curved plate 39 and the collar 41 arranged therebetween, as just described, are held together as an integral unit by a plurality of metal bolts 45 arranged at spaced points adjacent the outer edges of the plates outside the outer surface of the curve plate 39. Upon the outer surfaces of the side plates 37 and 38 along the outer edges thereof are reinforcing flat steel apertured plates 46 following the line of the bolts 45. The bolts 45 extend through the plates 46 and the nuts are drawn up thereagainst in clamping the elements of the housing 11 together.

Secured to the side plate 37 (Fig. 2) in alignment with the inlet port 12 by a plurality of steel screws 47 is a collar 48, the abutting surfaces of the plate and the collar being formed with cooperating annular shouldersed surfaces 49 to provide a firm lock therebetween. The collars 41 and 48 are provided with annular shouldersed surfaces 52 and 33 to which are secured by metal screws 54, a coupling 55 and a mouthpiece 56, respectively, the latter being shown fragmentarily. The coupling 55 may be connected to a duct (not shown) for carrying off the acid fumes or gases drawn into the mouthpiece 56 and through the fan chamber from the acid platting equipment or other apparatus with which the exhaust fan may be associated.

Figs. 3 and 4 show an alternative method of securing the radial reinforcing rings 34 to the impeller blades 32 from that previously described and illustrated in Figs. 1 and 2, the blades and the rings in both embodiments being composed of a phenolic fibre product. In the alternative structure the reinforcing rings 34 at each of the blades 32 are formed to give a parallelogram in cross-section as indicated at 60 for only the width of the blades, the latter being correspondingly notched to receive the rings. To assemble the blades 32 and the rings 34 the blades are slipped into position upon the two reinforcing rings and then locked in place by securing the blades to the radial arms 18 of the hubs 17 by means of the screws 33. With this latter construction the screws 33 used in the structure illustrated in Figs. 1 and 2 may be omitted, there still being provided a structure of sufficient strength.

While preferably use is made of a phenolic condensation product of the laminated type employing phenol fibre for mechanical strength, it may be desirable in forming certain of the elements comprising the exhaust fan including its housing, for instance, the cap 31, the collars 41 and 48, the coupling 55, and the mouthpiece 56, to use a solid phenolic condensation product, molded or machined, or otherwise formed into the desired shape. Also instead of providing mechanical strength to the elements by employing phenol fibre, other reinforcing means may be used, particularly in a molded element, in which case metal reinforcing means may be embedded therein.

It will be apparent that inasmuch as all the elements of the hereinbefore described exhaust fan, including its housing, which ordinarily are exposed, when used in connection with acid platting equipment, to acid fumes or gases, are composed of a phenolic condensation product, an exhaust fan is provided in which maintenance thereof due to deleterious effects by acid fumes or gases is reduced to a minimum.

Although the invention has been disclosed and described in connection with a particular type of exhaust fan for withdrawing acid fumes or gases from acid platting equipment, it should be understood that its use may have a broader application, and furthermore it should not be limited to the particular construction shown, except as defined by the appended claims.

What is claimed is:

1. A fan adapted for use with metal-corroding fumes and gases including a plurality of spaced hubs having integral radial arms,
blades interconnecting the arms of the spaced hubs, screw means for securing the blades to the arms, a spacing member abutting the inner ends of the hubs, elements abutting the outer ends of the hubs, securing members extending through the hubs, the spacing member and the elements for securing them together as a unit, and a cap threaded to one of said elements for enclosing the adjacent ends of the securing members, each element, with the exception of said securing members, being formed previous to its assemblage into the fan from a finished phenolic condensation product.

2. A fan adapted for use with metal-corroding fumes and gases including a metal shaft, a plurality of spaced hubs having radial arms keyed on said shaft, blades interconnecting the arms of the spaced hubs, a spacing member surrounding the shaft and abutting the inner ends of the hubs, elements abutting the outer ends of the hubs and surrounding the shaft, metal bolting members extending through the hubs, the spacing member and the elements for securing them together as a unit upon the shaft, and a cap formed previous to its assemblage into the fan from a phenolic condensation product connected to the end of one of said elements for enclosing the adjacent ends of the metal shaft and the securing members.

3. An exhaust fan adapted for use with metal-corroding fumes and gases having in combination a housing provided with inlet and outlet ports, and a rotary fan unit supported at one end thereof within the housing including a plurality of spaced hubs having integral radial arms, blades interconnecting the arms of the spaced hubs, means for securing the blades to the arms, radial reinforcing rings interconnecting the ends of the blades, means for securing the blades to the arms and the reinforcing rings to the blades, a spacing collar abutting the inner ends of the hubs, collars abutting the outer ends of the hubs, members extending through the hubs, the spacing collar and the end collars for securing them together as a unit, and a cap threadedly connected to one of said collars for enclosing the inner ends of the securing members, each element of the fan unit and the housing, with the exception of said securing members for the fan unit, being formed previous to its assemblage into the exhaust fan from a finished laminated phenolic condensation product.

In witness whereof, I hereunto subscribe my name this 21st day of November A.D., 1930.

JAMES C. REISINGER.