

April 20, 1937.

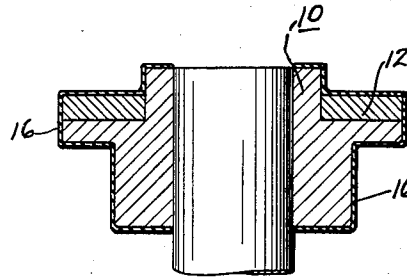
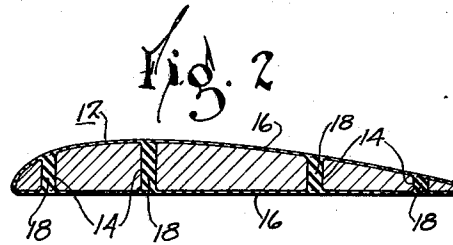
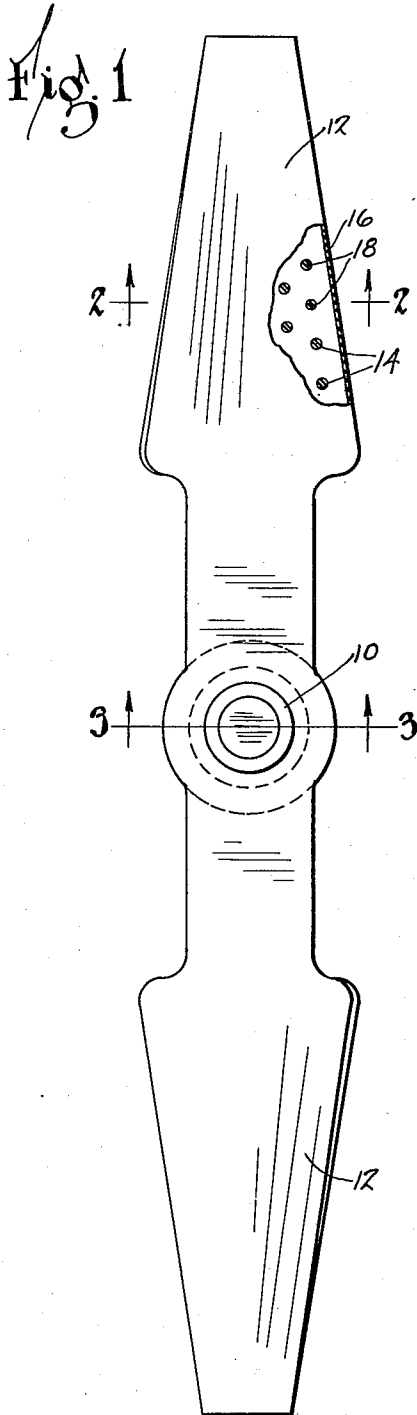
M. A. SMITH, JR

2,077,959

FAN BLADE

Filed Aug. 16, 1935

3 Sheets-Sheet 1



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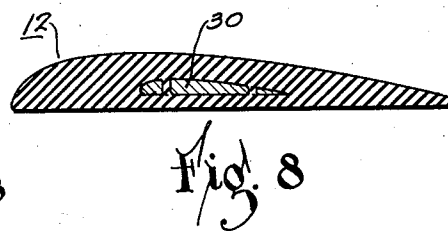
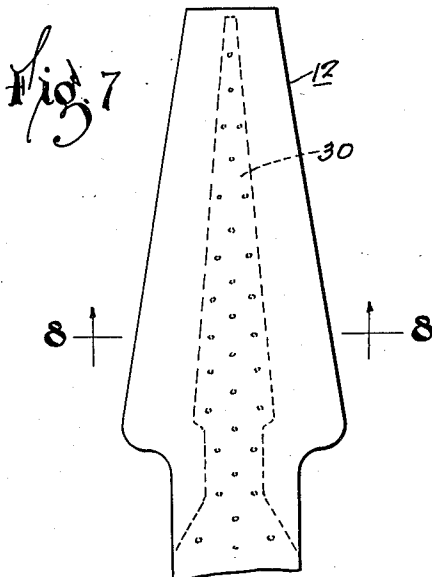
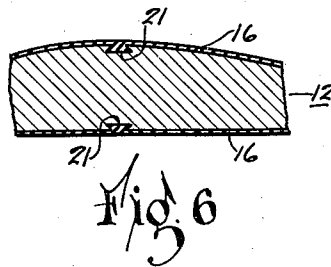
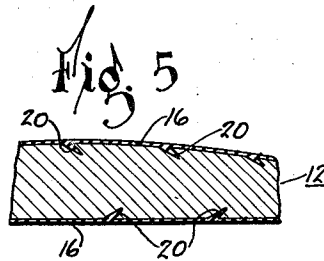
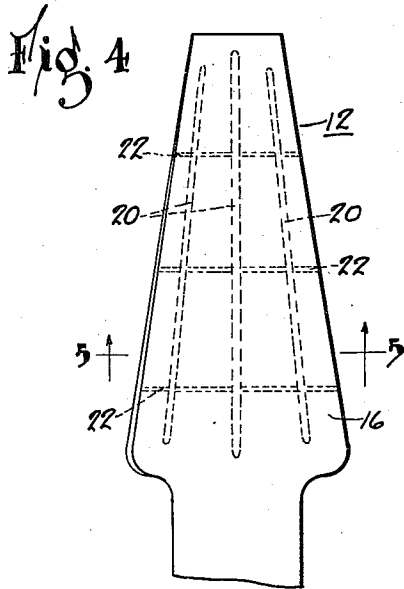
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3 Sheets-Sheet 2



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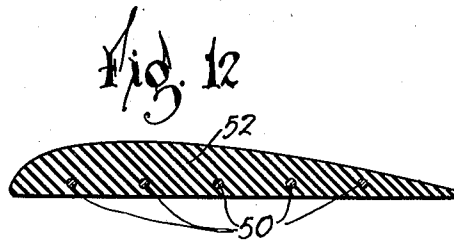
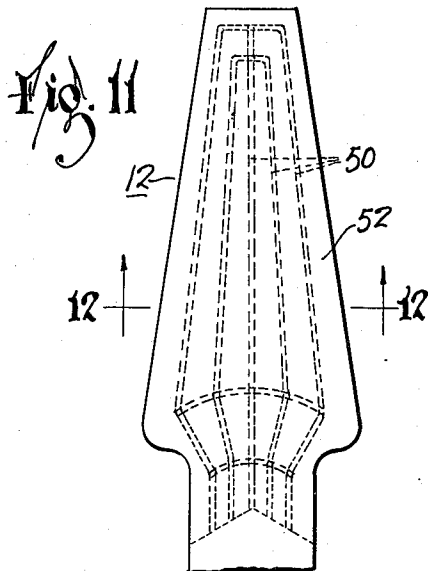
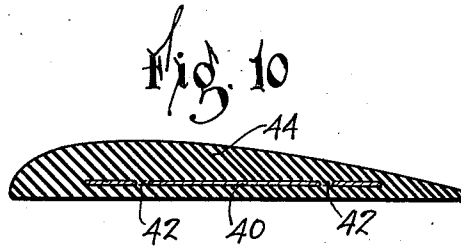
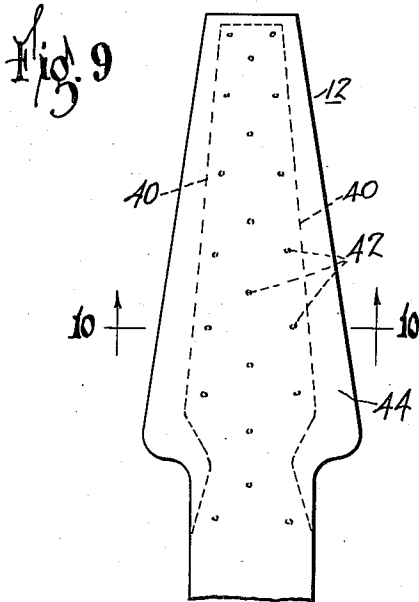
M. A. SMITH, JR

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FAN BLADE

Filed Aug. 16, 1935

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,077,959

FAN BLADE

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Application August 16, 1935, Serial No. 36,468

2 Claims. (Cl. 170-159)

This invention relates to ventilating fans of the type intended for use where the blades of a fan are subjected to severe abrasive or corrosive action.

It has been found that when ventilating fans are used in chemical laboratories and in other places where the blades are subjected to corrosive action the blades become pitted, thereby throwing the blades out of balance, and resulting in unevenness of operation and distortion of the entire structure.

It is therefore an object of this invention to provide a ventilating fan wherein the blades and hub of the fan are provided with a protective covering of rubber or other corrosive-resistant material.

Another object of the invention lies in the provision of a process by which a thin coating of corrosive-resistant material can be fastened to a fan blade by means of a process similar to the process by which certain metals are electroplated on other materials.

A still further object of the invention is to provide means whereby a thin coating of corrosive and abrasive resistant material can be securely attached to the blades and hub of a fan in such a manner that the coating material will become an integral part of the structure, thereby resisting the forces tending to remove the protective covering.

A further object of the invention is to provide a fan blade wherein a perforated core member of metal or other suitable material is employed to shape the blade structure, and a thin layer of insulating material is electroplated on the core member in such a manner that the insulating material flows through the core member to form insulating rivets extending through the core member to tie the insulating material securely to the fan blades on opposite sides thereof.

Another object of the invention is to provide a moulded fan blade wherein a small core member conforming to the shape of the finished fan blade, or formed of a metal stamping of any desired shape may be employed to reinforce the structure of the moulded fan blade.

A still further object of the invention is to provide a reinforced fan blade, wherein tension members such as strands of wire are moulded in the fan blade to absorb the centrifugal and torsional forces to which the fan blade is subjected.

Other desirable features and combinations of this invention relate to forming longitudinally and transversely extending grooves in the sur-

face of the core of the fan blade to aid in securing the insulating material to the fan; forming a plurality of apertures through the core member to which the insulating material is secured to form insulating rivets extending through the core member to securely tie the insulating material to the fan blade on opposite sides thereof; and to provide an insulated fan blade wherein the skin friction of the blade is minimized.

Other objects and advantages of this invention will be apparent from the following detailed description, considered in connection 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 plan view of a fan blade and hub, partly in section showing the construction of the blade;

Figure 2 is a view taken on the line 2-2 of Figure 1;

Figure 3 is a view taken on the line 3-3 of Figure 1;

Figure 4 is a view of a portion of a fan blade, showing a modified form of the method of securing the insulating material to the fan blade;

Figure 5 is a cross section on the line 5-5 of Figure 4, showing one desirable manner of securing the insulating material to the metal core of the fan blades;

Figure 6 is a view similar to Figure 5 showing a modified form;

Figure 7 is a view similar to Figure 4 showing a moulded fan blade, wherein a small apertured metal core is employed;

Figure 8 is a view taken on the line 8-8 of Figure 7;

Figure 9 is a view similar to Figure 7, wherein an apertured metal stamping is employed as a rigidifying core;

Figure 10 is a view taken on the line 10-10 of Figure 9;

Figure 11 is a view similar to Figure 9, showing a moulded fan blade wherein a core member of drawn wire, or other suitable material is employed; and

Figure 12 is a view taken on the line 12-12 of Figure 11.

Referring more particularly to Figure 1, there is shown a fan blade of the general type disclosed in my copending application Serial No. 5,691, filed February 9, 1935. In this embodi-

ment of the invention there is shown a fan blade having a hub section 10, and a bladed section 12. The illustrated blade is of the constant velocity type wherein a uniform quantity of air is delivered over the entire working area of the fan blade. It will be understood, however, that this invention may be applied to other types of fan blades than the one illustrated. As shown the fan blade 12 is provided with a plurality of apertures 14, extending through the blade section.

In the preferred embodiment of the invention a thin layer of colloidal solution of latex 16 is fixed to the outer surface of the core and hub structure by means of a process similar to the process whereby certain metals are electroplated on the surface of other metals. To prepare the structure for latex electroplating process the hub and cores of the blades of the fan are assembled. The structure is then sand-blasted to remove all foreign matter from the surface of the core, and to roughen the surface of the cores and hub so that the electroplated solution may more securely grip and fuse with the core member to form an integral structure. After the structure has been sand-blasted it is placed in a drier, wherein it is subjected to a temperature of a suitable degree such as from 185° to 190° Fahrenheit for a suitable period to adequately dry the structure preparatory to the next operation. It has been found from experiment that approximately two hours is adequate to properly prepare the structure for the electroplating operation.

After the structure has been thus suitably prepared, it is placed in an electroplating tank, wherein a solution of a suitable consistency of a colloidal solution of latex is transferred from the negative or cathode terminal to the positive or anode terminal. It will be noted that in electroplating rubber, the article to be plated is positioned on the positive or anode terminal, whereas in electroplating metal, the article to be plated is positioned on the negative or cathode terminal. The structure to be treated is subjected to the electroplating process for a period of time dependent upon the desired thickness of the protective covering. It has been found from experiment that approximately $\frac{1}{2}$ of an inch of latex will be deposited upon the structure in approximately thirty minutes. The length of time during which the structure is subjected to the electroplating bath is therefore entirely dependent upon the desired thickness of the insulating material.

After the desired thickness of insulating material has been deposited, the structure is removed from the electroplating bath, and is subjected to a steam vulcanizing process wherein the structure is subjected to both pressure and temperature to dry the colloidal solution of latex, and to harden it to the desired degree. It has been found from experiment that a temperature of approximately 375° Fahrenheit, and a pressure of approximately 165 pounds will harden the colloidal solution of latex to a proper degree for certain types of work in approximately six to eight hours.

After the structure has been vulcanized it is removed from the vulcanizer, and is subjected to a buffing and polishing operation. A soft buffer or polisher is employed, and after the structure has been suitably polished it is waxed to decrease the skin friction of the blades and hub. It has been found that a fan blade prepared

in accordance with the process indicated above will possess a skin friction approximating that of the best metal blade structure now in use.

One of the greatest difficulties encountered in electroplating insulating material on fan blades is to secure the insulating material to the fan blades in such a manner that centrifugal and torsional forces will not cause it to crack or slip on the fan blades. The upper surface of the blade as viewed in Figure 2 is subjected to the greatest stress because of the fact that the upper surface of the blades is subjected to negative pressure developed in the normal operation of the fan. The lower surface of the blades of the fan is subjected to pressure which tends to urge the covering material 16 toward the blades 12. In the embodiment of the invention illustrated in Figures 1 and 2 a plurality of apertures 14 extend through the blade section. When the insulating material 16 is electroplated on the blade structure it flows through the apertures 14 to form, in effect, rubber rivets 18 joining the insulating material 16 on opposite sides to the blade section 10.

Other expedients may be resorted to to securely tie the insulating material 16 to the core member 12 of the blades. Figures 4 to 6 illustrate other desirable embodiments wherein longitudinally extending grooves or slots 20 are formed in the surface of blade structure 12 so that the electroplated material may flow into the grooves to securely lock the insulating material to the blades. Transversely extending grooves 22 may also be positioned in the blades to relieve against centrifugal forces to which the blade is subjected.

In the embodiment illustrated in Figure 5, it will be observed that the longitudinally extending grooves 20 are tapered, pointing toward the trailing edge of the blade, and that the transversely extending grooves are also tapered and are pointed toward the outer end of the blade section. This disposition of the grooves tends to cause the insulating material 16 to cling more tightly to the core member 12 to the centrifugal, torsional and frictional forces acting on the blade during normal operation thereof.

In the embodiment of Figure 6, the grooves 21 are formed in the shape of ways which cause the insulating material 16 to become securely locked in the core member 12.

The embodiment of the invention illustrated in Figures 7 and 8 shows a moulded blade structure wherein a small rigidifying core 30 of airfoil cross section is employed to stiffen and strengthen the blades. In this embodiment of the invention, a moulded blade structure of a composition of rubber or other suitable material is provided. The blade structure is formed with a suitable airfoil shaped core member having apertures formed therein to permit the moulded material to flow through the core member, thereby forming insulating rivets extending through the core structure to securely tie the insulating material together on opposite sides of the core member. In this embodiment of the invention an insulating material of suitable consistency is moulded upon the core member at a temperature and pressure to produce a blade structure of the proper hardness consistent with the requirements of the finished product. After the structure has been moulded it is removed from the mould and subjected to a polishing and waxing operation to obtain the desired friction coefficient.

In the embodiment illustrated in Figures 9 and 10, a core member 40 formed of a metal 75

stamping or other suitable material is positioned in the mould. It will be observed that in this design it is not necessary that the core member 40 conform to the airfoil section of the finished product. In this embodiment of the invention apertures 42 extend through the core member 40 to securely tie the insulating material together on opposite sides of the core member. Insulating material 44 of rubber or other suitable composition is moulded around the core member 40 in a manner similar to that discussed in connection with the embodiment illustrated in Figures 7 and 8.

In the embodiment illustrated in Figures 11 and 12, the core structure comprises several strands of drawn wire 50 interposed within the moulded material 52 of the fan blade. The core structure may extend through both blades of the fan, passing around the hub structure to securely tie the blades together, and to aid in absorbing centrifugal and other forces to which the blades are subjected during normal operation.

In the embodiments of the invention illustrated in Figures 7 to 12, the moulded material may be moulded to the core member direct. In order to secure a more perfect bond between the insulating material and the core member, however, I prefer to electroplate a thin coating of insulating material to the core member before it is subjected to the moulding operation.

It will be observed that this invention provides a fan blade wherein insulating material is securely fixed to or formed integral with the core structure, to form a fan structure adapted to resist corrosive action, and to minimize abrasion, where the fan is employed in industrial or chemi-

cal plants, or in places where dust or grit is mixed with the air driven by the fan, which would impede the operation of the fan, and injure a conventional metal fan.

While the invention has been described with particular reference to certain preferred embodiments thereof, it is understood that the scope of the invention is not limited to the details illustrated and described nor otherwise than by the terms of the following claims.

I claim:

1. A metal fan blade having a plurality of longitudinally and transversely extending undercut grooves formed in the surface of the metal blade, the pointed ends of the grooves projecting toward the trailing and tip ends of the blade respectively, a protective covering of a colloidal solution of latex electroplated on the metal blade and engaging in the grooves to securely tie the protective covering to the blade and to cause it to cling more tightly thereto during normal operation of the fan when the blade is subjected to centrifugal, torsional and frictional forces.

2. A metal fan blade having a plurality of longitudinally extending undercut grooves formed in the surface of the metal blade, the pointed ends of the grooves projecting toward the trailing edge of the blade, a protective covering of a colloidal solution of latex electroplated on the metal blade and engaging the grooves to securely lock the protective covering to the blade and to cause it to cling thereto during normal operation of the fan when the blade is subjected to centrifugal, torsional and frictional forces.

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