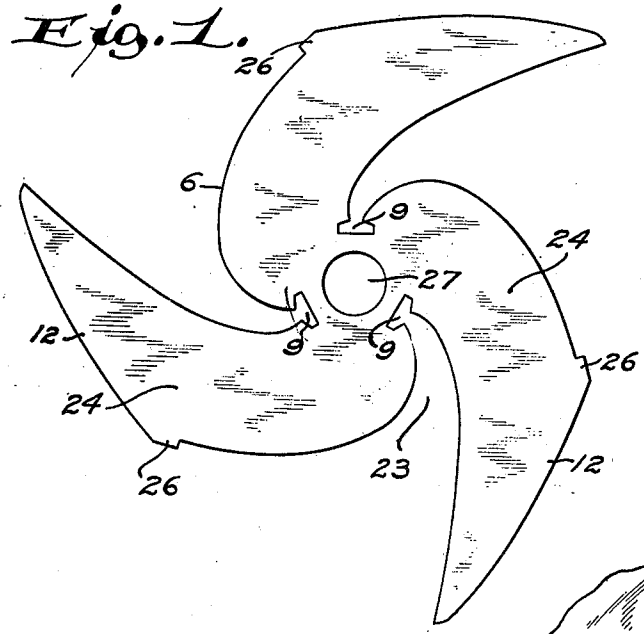
Nov. 16, 1943. J. R. THORP 2,334,456

METHOD OF PRODUCING FAN HUBS

Filed May 19, 1941

Fig. 1.



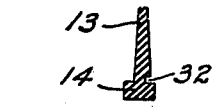


Fig. 4.

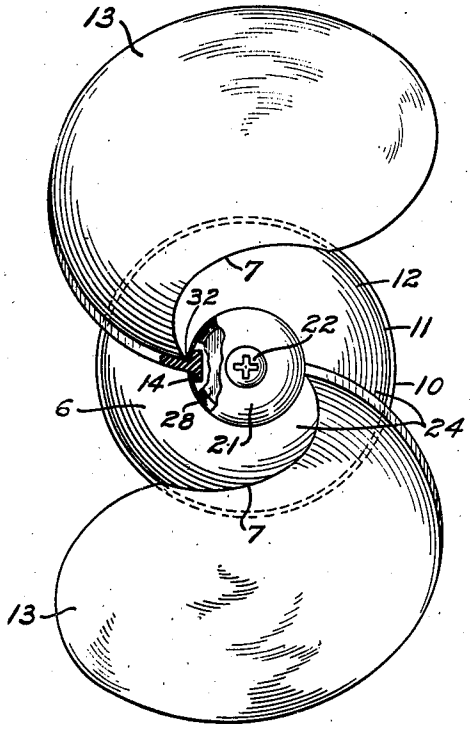


Fig. 3.

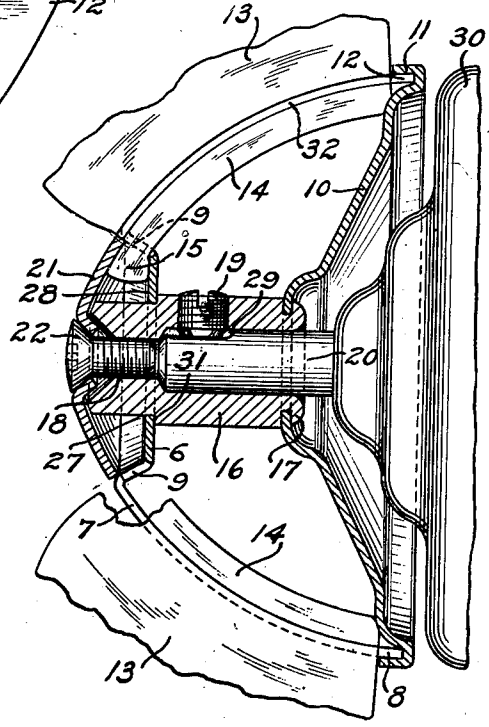


Fig. 2.

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METHOD OF PRODUCING FAN HUBS

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Application May 19, 1941, Serial No. 394,083

5 Claims. (Cl. 113—116)

This invention relates to improvements in fans, and is directed more particularly to improvements in the construction and operation of fan assemblages having blades formed of pliable material such as rubber.

An object of the invention is to provide an improved method of producing ovoid fan hubs or the like, from sheet metal or similar material.

Rubber bladed fans, wherein two or more blades formed of relatively soft and pliable rubber adapted to deflect upon striking an extraneous object during rapid revolution of the fan rotor are utilized, have become quite popular for various air circulating purposes. In constructing fans of this type, it has heretofore been common practice to provide each rubber blade with an enlarged inner end or base portion adapted to be inserted within a spiral-helical slot formed in a metal ovoid zone shaped hub, and to firmly secure the hub in some manner to the fan supporting shaft of the propelling motor. In small fan assemblages, the blade supporting hubs were usually formed as die-castings requiring rather expensive equipment in their formation, and also necessitating the use of special metal which is rather costly and difficult to obtain. The use of these die-castings was however advantageous because it obviated difficulties in producing proper shape of the spiral-helical blade receiving slots formed in the ovoid hubs, which slots could not heretofore be readily formed in sheet metal hub assemblages without the aid of complicated and expensive dies.

It is therefore an object of my present invention to provide an improved method of forming the slotted hubs for rubber bladed fans or the like, of relatively inexpensive material and with the aid of comparatively simple equipment.

Another specific object of the present invention is to provide an improved mode of producing sheet metal ovoid-shaped fan hubs provided with two or more spiral-helical blade receiving and retaining slots.

A further specific object of my invention is to provide a method of making a new and useful fan hub assembly which can be readily constructed, assembled and dismantled, and in which the blades are easily insertible and firmly retained.

Still another specific object of the invention is to provide a method of making an improved fan hub structure formed of relatively few durable parts, and which presents a neat and attractive appearance when finally assembled.

An additional specific object of this invention is to provide a method of making a sturdy dynamically balanced sheet metal fan hub, which can be positively attached to a driving shaft, and which may also be produced in relatively small sizes and at moderate cost.

These and other specific objects and advantages will be apparent from the following detailed description.

A clear conception of the several features constituting the present improvement, and of the mode of constructing and of assembling fan rotors built in accordance with the invention, may be had by referring to the drawing accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a plan view of one of the improved sheet metal blanks used in forming the hub of a three blade fan;

Fig. 2 is an enlarged longitudinal section through a two blade fan hub assembly embodying the invention, showing fragments only of the blades and of the propelling motor;

Fig. 3 is a reduced front elevation of the two blade fan assemblage, portions having been broken away to show the blade attachment; and

Fig. 4 is a transverse section through the inner or base portion of one of the rubber blades.

While the invention has been shown and described herein as being specifically embodied in rubber bladed fans having semi-ovoid hubs adapted to support either two or three flexible blades, it is not desired to thereby unnecessarily limit or restrict the scope or utility of the improvement which may obviously be applied to fans having more than three blades.

The improved fan hub assemblage may be used in fans having two or more individual blades, and as illustrated in Figs. 2 and 3, this assemblage comprises a semi-ovoid shaped hub member 6 provided with two or more spiral-helical blade receiving slots 7 the outer ends of which terminate in splits 8 while the inner ends are open and terminate in transverse openings 9; a ring member or hub closure plate 10 having a continuous annular peripheral groove 11 coacting with the peripheral outer edge 12 of the member 6 to provide a firm union at the splits 8; a plurality of pliable rubber blades 13 each having an enlarged base portion 14 fitting one of the slots 7, and being provided with a projection 15 extending through the adjacent opening 9; a central supporting sleeve 16 rigidly attached at one end 17 to the center of the plate 10, and having

its opposite end provided with a threaded socket 18; a set screw 19 for positively securing the sleeve 16 to a driving shaft 20 coacting with the bore of the sleeve 16; a front nose cap 21 adapted to coact with the hub member 6 adjacent to the open ends of the slots 7, and to also engage the blade projections 15; and a clamping screw 22 coacting with the cap 21 and with the sleeve socket 18, to clamp the hub in assembled condition.

The hub member 6, the closure plate 10, and the clamping cap 21 may all be formed of sheet metal with the aid of punches and dies, and the formation of the semi-ovoid hub member 6 of sheet metal, constitutes an important feature of the present invention. As shown in Fig. 1, the member 6 may be produced from a flat blank of sheet metal formed symmetrical with respect to a central axis, and having a series of equally spaced radiating spiral sector shaped cut-outs 23 separated by similar intervening lobes 24. The inner ends of the cut-outs 23 terminate in the transverse openings 9, and the corresponding outer portions of the lobes 24 have integral lateral projections 26, while the center of the blank is provided with a circular hole 27. The blank is of such shape, that when it is distorted into the desired semi-ovoid shape with the aid of suitable dies, the adjacent side edges of the successive lobes 24 will form the parallel sided blade receiving slots 7, and the projections 26 will be located at the splits 8 thus producing slots of proper and uniform width. The outer peripheral edge 12 of the formed blank will lie in a common plane perpendicular to the hub axis and will be ready for snug disposition within the ring groove 11, while the inner ends of the blade confining slots 7 will be open by virtue of the inward dishing of the central portion 28 of the blank so as to position the openings 9 in planes perpendicular to the slots 7.

The end closure plate 10 may likewise be formed of a single sheet of metal with the aid of punches and dies, and as previously indicated, the annular recess or groove 11 is shaped to snugly engage the end or outer edge 12 of the member 6. The closure plate 10 may be dished inwardly as shown in Fig. 2, in order to stiffen the same, and the mounting sleeve 16 may be rigidly attached to the plate 10 at the sleeve end 17 by riveting, welding, or otherwise. The opposite end of the sleeve 16 adjacent to the threaded socket 18 may be tapered as shown in order to guide the clamping screw 22 and to prevent direct coaction between the nose cap 21 and the sleeve 16; and the set screw 19 which is carried by and penetrates the supporting sleeve, coacts with a flattened portion 29 on the driving shaft 20 so as to positively prevent the hub from rotating on the shaft. The shaft 20 may be driven by an electric motor 30 or other power means, and the opening or hole 27 formed in the central hub portion 28 is adapted to snugly fit the reduced front portion of the sleeve 16 and to coact with a shoulder 31 thereon. The nose cap 21 which may also be formed of sheet metal with the aid of punches and dies, is adapted to snugly engage the hub member 6 adjacent to the transverse openings 9, to thereby close the forward or inner ends of the slots 7, and the periphery of this cap 21 is also adapted to snugly engage all of the blade projections 15. The blades 13 may be formed of pliable material such as soft rubber, and the base portions 14 thereof are preferably enlarged as shown in Fig. 4, and are provided with side grooves 32 adapted to coact with the adjacent side edges of the lobes 24.

When the various elements of one of the improved hub structures have been properly formed and constructed as above described, it is a simple matter to assemble one of the improved fans. The plate 10 with its supporting sleeve 16 rigidly attached thereto, may first be applied to the driving shaft 20, whereupon the attaching set screw 19 may be driven against the flattened portion 29 of the shaft, thereby positively locking the sleeve 16 to the shaft 20. The several flexible blades 13 may then be inserted within the spiral-helical slots 7 of the hub member 6, with the blade enlargements or base portions 18 disposed within this member, and the projections 15 extending forwardly and outwardly of the slots 7 through the openings 9. The blade and hub member assembly may then be slipped over the forward end of the sleeve 16 and the peripheral edge portion 12 of the hub member 6 may be caused to enter the groove 11 of the closure plate 10. As a final step in the assembling operation, the front nose cap 21 may be applied to the blade projections 15 and the clamping screw 22 may be driven home, thereby not only forcing the cap 21 against the projections 15, but also driving the hub member 6 into the continuous groove 11 of the plate 10. The fan assemblage may thereafter be operated without danger of having the parts become loose, and since the structure is dynamically balanced, smooth rotation of the fan will always result.

From the foregoing detailed description, it will be apparent that my present invention not only provides an improved fan hub assemblage which is simple, light and durable in construction, but also provides a new and useful method of producing and of assembling the fan structures. The various elements of the assemblage can be readily produced at moderate cost, with the aid of simple machinery such as punches, dies and screw machines, and the entire hub structure is effectively clamped and retained in assembled condition with the aid of but a single assembly screw. The improved hub assemblage may be positively locked to the supporting and driving shaft by means of a single set screw which is normally concealed within the hub, and the formation of the slots 7 in the semi-ovoid hub member 6 facilitates application of the blades to the hub and insures firm retention thereof in proper position without permitting creeping of the blade bases along these slots. The nose cap at the forward end of the hub assemblage, performs the dual function of locking the blades in place and of clamping the plate 10 and the cap against the opposite ends of the hub member 6, and the axial clamping screw can be readily manipulated to effect rapid assembly and dismantling of the structure. By virtue of the improved formation of the hub member 6, the blade receiving slots 7 may be accurately produced with smooth opposite side edges which will not interfere with free introduction of the blades.

It should be understood that it is not desired to limit the invention to the exact details of construction, or to the precise mode of forming the hub structures, herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

I claim:

1. The method of producing an ovoid fan hub, which comprises, forming a flat sheet-material blank symmetrical with respect to a central axis

and having spiral sector shaped cut-outs each provided with a transverse terminal opening at the extreme inner end thereof nearest said axis, dishing the central portion of the blank to cause said openings to lie in a frusto-conical annulus and to assume similar angular positions with respect to the plane central portion of the blank, and reversely dishing the spiral lobes of the blank between said cut-outs into semi-ovoid shape to provide spiral-helical blade receiving slots at the cut-outs the inner ends of which terminate at the corresponding openings and are directed approximately perpendicular to the planes of the adjoining openings.

2. The method of producing an ovoid fan hub, which comprises, forming a flat sheet-material blank symmetrical with respect to a central axis and having outwardly extending spiral lobes each provided with a lateral outer projection and adjacent lobes being separated by spiral sector shaped cut-outs each provided with a transverse terminal opening at the extreme inner end thereof nearest said axis, dishing the central portion of the blank to cause said openings to lie in a frusto-conical annulus and to assume similar angular positions with respect to the plane central portion of the blank, and reversely dishing the spiral lobes of the blank into semi-ovoid shape to cause said cut-outs to contract into spiral-helical blade receiving slot formations the widths of which are determined by engagement of said projections with the adjacent lobes and the inner ends of which terminate at the corresponding openings and are directed approximately perpendicular to the planes of the adjoining openings.

3. The method of producing an ovoid fan hub, which comprises, forming a flat sheet-material blank having spiral lobes radiating from a central axis and separated by spiral sector shaped cut-outs the inner end of each of which terminates in a transverse opening, dishing the central portion of the blank in one direction to cause all of said openings to lie in a frusto-conical annulus and to assume similar angular positions with respect to the original plane central portion of the blank, and dishing the lobes in the opposite direction to contract said cut-outs into spiral-helical slots the inner end of each of which terminates in one of said openings and is directed approximately perpendicular to the plane of the adjoining opening.

4. The method of producing an ovoid fan hub, which comprises, forming a flat sheet-material blank having spiral lobes radiating from a central axis each provided with a lateral outer projection and being separated by spiral sector shaped cut-outs the inner end of each of which terminates in a transverse opening, dishing the central portion of the blank in one direction to cause all of said openings to lie in a frusto-conical annulus and to assume similar angular positions with respect to the original plane central portion of the blank, and dishing the lobes in the opposite direction to contract said cut-outs into spiral-helical slots of uniform transverse width as determined by engagement of said projections with the adjacent lobes and the inner end of each of which terminates in one of said openings and is directed approximately perpendicular to the plane of the adjoining opening.

5. The method of producing an ovoid fan hub, which comprises, forming a flat sheet-material blank having spiral lobes radiating from a central axis each provided with a lateral outer projection and being separated by spiral sector shaped cut-outs the inner end of each of which terminates in a transverse opening, dishing the central portion of the blank in one direction to cause all of said openings to lie in a frusto-conical annulus and to assume similar angular positions with respect to the original plane central portion of the blank, dishing the lobes in the opposite direction to contract said cut-outs into spiral-helical slots of uniform transverse width as determined by engagement of said projections with the adjacent lobes and the inner end of each of which terminates in one of said openings and is directed approximately perpendicular to the plane of the adjoining opening, and confining the outer lobe ends and said projections in a solid ring.

JOEL R. THORP.