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My invention relates to a rotateable and flexible-bladed fan member particularly suited for use in household types of electric fans, and in some of its major aspects aims to provide an improvement, both in appearance and effectiveness over the pin-wheel type flexible-bladed fan member included in my co-pending application No. 97,318, filed August 22nd, 1936.

In my said application I disclosed a fan member including a flexible sheet divided into blade-forming wings by radial slits, which wings have counterpart strap end portions extending across the axis of the fan member when the wings are bent after the manner of those of a toy pin-wheel so that these strap portions overlap one another. In practice, this type has been found to present the following shortcomings, at least with some proportions of the diameter of the complete fan to other parts:

To form the blade-affording blank from a minimum size of blank, the strap portions must be of such limited length that their extension across the axis of the bent-up blank bends the blade members to a greater extent than is often desirable, namely so as to tilt the blades too much with respect to a plane at right angles to the said axis. Furthermore, the disposing of a square-ended spacer between the center of the flexible blade-affording member and the overlapping strap portions obliges these portions to extend in planes diametric of the axis of the fan, thereby further increasing the tilt of each blade and also somewhat retarding the flow of air under the arches formed by the straps.

In addition, the assembly of any succeeding application exposes too much of the central portion of the blade-affording member that the fan lacks the ornamental appearance desired by many, and this member may need to be of undesirably thin rubber to allow the flexibility of the blades to compensate for the variations in curvature (due to the overlapping of the said strap portions) sufficiently for automatically balancing the fan.

My present invention aims to obviate these shortcomings by providing a pin-wheel type fan in which substantially similar strap portions of the wings do not extend across the axis of the fan; in which the strap ends of all of the wings will be at a common distance forward of the central portion of the flexible blade-affording member; in which each such strap end can be tilted out of parallelism to the said central sheet portion to decrease the effective tilting of the main blade portion; and in which the central portion of this member will be concealed by a part of the strap-anchoring means so as to enhance the appearance of the fan.

Illustrative of the manner in which I accomplish the above as well as other objects, Fig. 1 is a front elevation of a flexible bladed pin-wheel type fan member embodying my invention, and Fig. 2 is a side elevation of the same, both taken when the fan member is stationary.

Fig. 3 is a rear view of the same, drawn on a reduced scale.

Fig. 4 is an enlarged diametrical section, taken along the line 4—4 of Fig. 1 through the central portion of my fan member.

Fig. 5 is a plan view of the blank from which the flexible and bladed part of my fan member is formed, drawn on a scale intermediate that of Figs. 1 and 3.

Fig. 6 is a front elevation of the dome-shaped strap-anchoring part, drawn on the same scale as Fig. 4, and Fig. 7 is a side elevation of the same.

Fig. 8 is a section allied to Fig. 4 but taken before the said dome-shaped part has been forced rearwardly to clamp the strap tips against the disk behind them.

In constructing my fan member for an illustrative shaping of four blades, I first cut a blank shaped as in Fig. 5 from a sheet of suitably flexible rubber or the like. This blank B has a central perforation and has the part outside a central area (namely outside the dotted circle A in Fig. 5) divided into four counterpart wings by radial slits Or.

Each of these wings has its leading edge L disposed at one of the said slits and generally straight but roundedly merging (at the tip of the wing) into a curved trailing edge T, the latter being here shown as somewhat more than a quarter arc of a circle. This trailing edge merges curvedly into the inner edge of a strap S which has its other strap edge disposed at the next rotationally rearward slit. The maximum width of this strap desirably is a quite small fraction of the distance from the center of the blank to the tip t of the wing, as for example one-eighth of that distance, and the strap has its tip S' reduced in width to present shoulders 4 at each side of the inner end of this strap tip.

The rotationally rearward edge of the said strap proper desirably includes a straight portion extending radially inward of the blank from the corresponding shoulder s, and a relatively longer concaved edge portion 3 which desirably merges into a U-shaped notch N leading to the inner end of the leading edge L of the adjacent blade wing. With each wing thus shaped, the relatively narrow width of each strap readily allows that strap to be recurred forwardly and thereafter toward the axis of the blank for forwardly concaving the main wing portion, and the concaving of the edge portion 3 cooperates in facilitating this, so that all wings of the blank can readily be curved after the general manner of the rotating member of a toy pin-wheel.
To support and rotate such a pin-wheel-like fan blade element I first provide a stem member having intermediate its ends a circular flange against which the central part of the rubber blank can bear, and having its rearward portion constructed for attaching it to a rotating shaft. In Fig. 4 this stem member includes a stem 8 having an axial bore b in its rear end for receiving the end of a rotating shaft 6, and having a lateral set-screw 7 threaded into it for gripping this shaft.

In addition, the stem member includes a smaller diameter forward stem portion 5a connected to the rearward stem portion by a forwardly-facing annular shoulder 6, and a circular metal flange F which is slid rearwardly over the forward stem portion and which bears rearwardly against the said shoulder. The forward stem portion 5a desirably is of the same diameter as the central perforation 1 in the rubber blank, while the flange F desirably is of approximately the diameter of the central portion (within the dotted circle A of Fig. 5) of the blank.

The forward stem portion 5a also has an axial and threaded bore 9 extending rearwardly into it for receiving a clamping screw 10, and has its forward tip reduced in diameter to fit the bore of a detachable circular washer or inner clamping member W. To cooperate with this washer, I provide a hollow metal dome D, desirably of a diameter slightly less than the said flange F and having a central bore through which the screw 10 can slidably extend. This dome is of greater axial height than the distance between the flange F and the forward face of the washer W and is provided with four equally spaced and circumferentially extending slots 11, all disposed at an equal distance from the plane of the base, namely, a distance somewhat greater than the spacing of that plane from the frontal face of the washer W. Each of these slots corresponds substantially in length and width to the thickness of one of the strap tips 4, such that each such strap tip can readily be slid through one of the said slots until the sliding is halted by the engagement of the strap shoulders 4 with the exterior of the dome.

In assembling my unit, I first slip the rigid flange F rearwardly over the forward stem part 5a until it engages the stop shoulder 6, and then slide the same stem part forward through the central perforation 1 in the rubber blank until this blank seats on the said flange. Next I fit the detachable washer or inner clamping member W on the forward tip of the stem part 5a, slip the hollow dome D over this washer, and thread the screw 10 into the said stem to an extent sufficient for clamping the dome against the rubber blank part behind it, thereby leaving the dome centered by the said screw but spaced forwardly from the central part of the rubber blank, as shown in Fig. 8.

With the dome thus temporarily positioned, each of the four strap tips can readily be inserted through the slot which faces that strap, so as to dispose the major portion of that strap tip in front of the clamping washer W, as in Fig. 8. When the screw 10 is then screwed farther into the stem part it forces the dome rearwardly, thereby bending the strap tip portion within the dome to a shape such as that shown in Fig. 4, so as to clamp the strap tip between the said washer and the inner face of the dome.

Since the stop shoulders a on the straps readily enable the assembler to insert each strap tip to an equal extent into the dome, and with the slots 11 equally spaced, each of the four rubber wings is bent to an equal extent when the assembly is completed. Moreover, by suitably proportioning the height of the dome, I also enable this to have the rear end of this dome to seat firmly on the central portion of the dome and also to prevent the part of the rubber blank facing this interior from being bent.

With my fan member thus assembled, the extent to which the main blade portion of each wing is curved obviously depends on such a length of the straps, namely the distance from the center of the rubber blank to the shoulders 4 in Fig. 5. Consequently, I can readily vary the extent of this curvature by varying this effective strap length, according to the desired wing curvature and the flexibility of the rubber. So I can considerably vary the position of the frontal exposed portion of each strap by varying the direction in which the longitudinal axes of the slots extend, with respect to a plane parallel to the faces of the washer W and the flange F. In practice, I have found it desirable to have each such slot spiral forwardly of the dome at a small angle, as shown for example in Fig. 7, so as to reduce the twisting stress on the straps. However, this angle can be varied considerably, as for example from zero to about 20 degrees, according to the flexibility of the rubber and also according to the strap-arch curving desired for variously proportioned blade wings.

When my fan member is rotating, the exterior of the dome guides some of the forwardly drawn air toward the axis of the fan to prevent the creating of a partial vacuum, and the notch N at the inner end of the leading edge of each blade wing cooperates toward this, so that by suitably shaping and proportioning the blade wings in other respects (with due regard to the flexibility of the rubber or other flexible material used for the blank) I can enable my fan to project air in a solid conical stream.

The same notches N also permit each blade to be bent more readily during the assembling than would be the case without these notches. In addition, these notches make it easier for the main blade portion of any wing to be bent back by impact against any object, so that the fan can readily be halted by thrusting a hand against it, without injury to the hand. To reduce the chance of injury still further, I preferably form the central part D of the dome as part of a forwardly flaring conical surface and use a screw having a rearwardly tapering head which is substantially housed by the thus formed recess. Thus constructed, my fan member is particularly safe for use where children can reach it.

My fan member also has the commercial advantages that the same metal parts can be used interchangeably with blade flexible blanks affording wings of widely varying spreads and tilts, and that such a rubber part can readily be replaced if imperfect or damaged. Moreover, the metal dome adds decidedly to the appearance of the fan, particularly if it is chrome plated, and thus the dome effectively conceals the anchored strap tips.

However, while I have described my fan blade member in connection with a four bladed embodiment, many changes might obviously be made without departing either from the spirit of my invention or from the appended claims.
I claim as my invention:

1. A pin-wheel type fan member comprising a blade-affording member formed from a sheet of flexible material and presenting counterpart wings symmetrically disposed about the center of the said member; a supporting stem including a circular flange coaxial with and bearing forwardly flatwise against the central portion of the blade-affording member; a forwardly convexed hollow dome coaxial with the said flange and having its mouth end engaging the forward face of the said central portion of the blade-affording member, the dome being having the said dome slots equally spaced and similarly spirally slots, equal in number to the said wings and at a common distance from the mouth end of the dome; each wing being recurved forwardly and thereafter toward the axis of the dome, and having the tip portion of the wing part adjacent to its trailing edge extending into one of the said slots; an inner clamping member detachably mounted on the said supporting stem and disposed within the dome and bearing rearwardly against each of the said wing portions; and threaded means extending axially into the dome and supported by the said stem for pressing the dome rearwardly to cause the dome to clamp all of the said tips against the said clamping member.

2. A pin-wheel type fan member as per claim 1, in which the dome is of such axial height that the said rearward pressing of the dome also clamp the said central portion of the blade-affording member against the said circular flange.

3. A flexible-bladed fan member as per claim 1, in which each of the said wings is formed to present a shoulder spaced from its extreme end, which shoulder engages the exterior of the said dome to limit the extent to which the said wing tip is inserted through the corresponding slot in the dome.

4. A flexible-bladed fan member as per claim 1, in which each of the said wings is formed to present two shoulders, respectively adjacent to the opposite side edges of the inner end of the tip of the strap, the said shoulders engaging the exterior of the dome to limit the insertion of the said tip through the corresponding slot in the dome.

5. A flexible-bladed fan member as per claim 1, in which the trailing edge of each wing of the blade-affording member includes a concaved portion and a straight portion radially outward of the said concaved portion, the said straight portion extending along a slat of the said member before the wing is curved as recited.

6. A flexible-bladed fan member comprising a stem member having a circular flange spaced from its forward end; a blade-affording member formed from a flexible sheet and having a central portion through which the stem member part forward of the said flange extends; the flexible sheet being divided by consecutively equally diverging slits into counterpart wings and having its central portion bearing rearwardly against the said flange, and the part of each wing adjacent extending its trailing edge being recurved forwardly and thereafter part way toward the axis of the stem member; a forwardly convexed, rigid and centrally perforated hollow dome bearing rearwardly against the said central portion of the blade-affording member and having peripherally extending slots through each of which the tip of the strap part of one of the wings extends into the dome; an inner clamping member detachably mounted on the forward end of the stem member and disposed within the said dome and being forwardly and bearing rearwardly against the said strap tips; and a screw extending through the central perforation in the dome and threaded into the forward end of the stem member and having its head in rearward engagement with the said dome to clamp the said strap tips against the presser member.

7. A flexible-bladed fan member as per claim 6, in which the trailing edge of each wing of the blade-affording member includes a concaved portion and a straight portion radially outward of the said concaved portion, in which the said portion having the said straight-edges portion is a parallel-sided strap, and in which each wing includes a main blade forming portion having its outer edge merging curvedly with the inner end of the strap at the opposite side from the said straight-edge portion.

8. A flexible-bladed fan member as per claim 6, in which the dome has a central perforation bordered by a rearwardly tapering frusto-conical portion, and in which the said clamping means include a screw extending rearwardly through the said dome perforation and threaded into the stem member, the screw having a rearwardly tapering head bearing rearwardly against and substantially housed by the said frusto-conical portion of the dome; and in which the clamping means also include an inner clamping member detachably mounted on the stem member and being forwardly and bearing rearwardly against and bearing forwardly against the portions of the strap tips which extend into the dome.

9. A flexible-bladed fan member comprising a stem member having a circular flange intermediate its ends; a blade-affording member formed from a flexible sheet and having a central perforation through which the stem member part forward of the said flange extends; the last named member being divided by consecutively equally diverging slits into counterpart wings and having its central portion bearing rearwardly against the said flange, each wing having a part thereof adjacent to its trailing edge forward as a strap, and having the said part recurved forwardly and thereafter part way toward the axis of the stem member; a forwardly convexed, rigid and centrally perforated hollow dome bearing rearwardly against the said central portion of the blade-affording member and having peripherally extending slots through each of which the tip of the strap part of one of the wings extends into the dome; an inner clamping member detachably mounted on the forward end of the stem member and disposed within the said dome and bearing rearwardly against the said strap tips; and a screw extending through the central perforation in the dome and threaded into the forward end of the stem member and having its head in rearward engagement with the said dome to clamp the said strap tips against the presser member.

10. A bladed member for a rotating fan comprising a horizontal supporting stem member having a circular flange; a centrally perforated flexible rubber member formed and bent after the general manner of a toy pin-wheel to present forwardly curved wings having their tips directed toward the axis of the stem member; and means mounted on the stem member for rigidly holding the said tips at an equal forward spacing from the said flange and the said member including a hollow member co-axial with the stem member and having slots through which the said wing tips respectively extend.

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