Aug. 11, 1942. G. F. BAHR 2,292,346

FAN

Filed April 5, 1940

Fig. 1

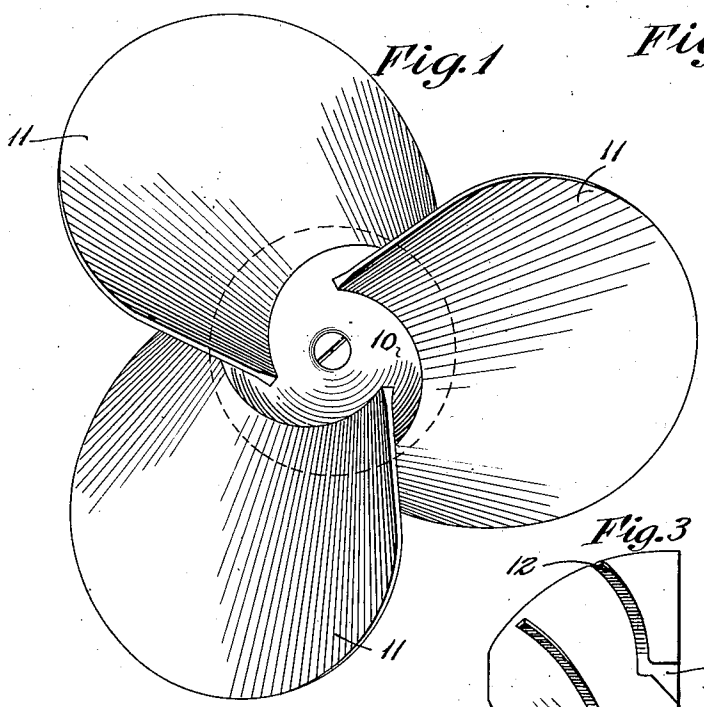


Fig. 2

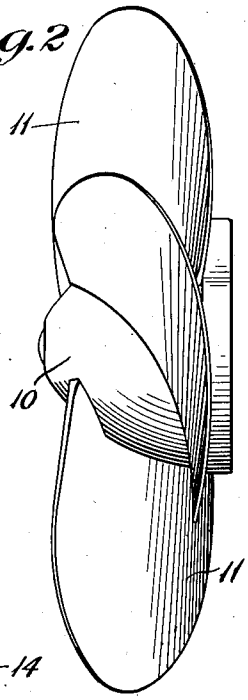


Fig. 3

Fig. 4

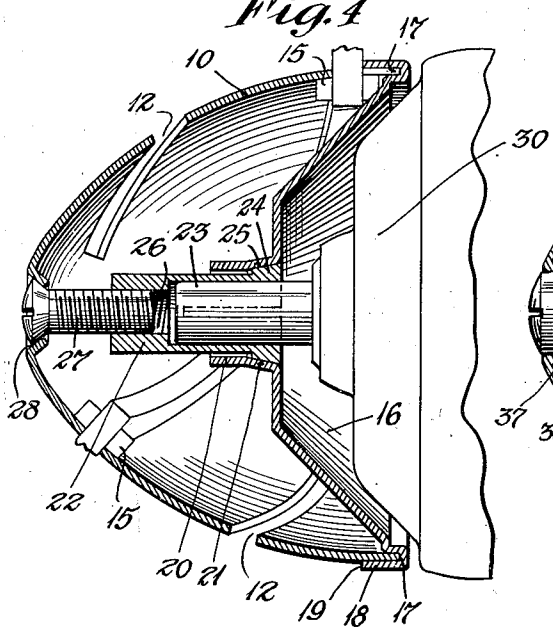
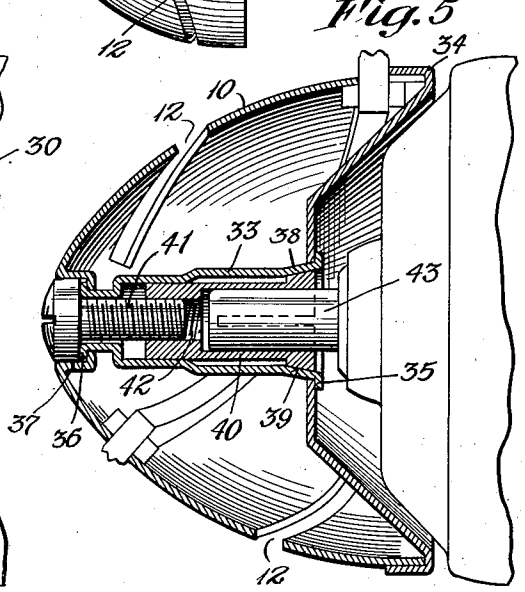


Fig. 5



INVENTOR
Gustave F. Bahr
BY Johnson, Kline and Smyth.
ATTORNEYS

Patented Aug. 11, 1942 2,292,346

UNITED STATES PATENT OFFICE

2,292,346

FAN

Gustave F. Bahr, Bridgeport, Conn., assignor to Casco Products Corporation, Bridgeport, Conn., a corporation of Connecticut

Application April 5, 1940, Serial No. 327,936

13 Claims. (Cl. 170—173)

This invention relates to fans, and, more particularly, to fans for circulating air.

The present invention is particularly adapted for fan constructions, wherein the blades thereof are formed of rubber or other flexible material, but, in the broader aspects of the invention, it is not limited to a flexible blade construction.

As previously proposed, rubber or flexible blades have been mounted to the cap or hub generally by forming an edge of the blade with a locking ridge or shoulder which could be slipped through an enlarged portion of a closed end slot substantially the width of the thickness of the blade or by forming the hub in two sections with meeting edges forming, when assembled together, a plurality of slots for clamping opposite faces of a blade member.

In assembling these constructions, many manipulations have been required, and it is an object of this invention to provide a fan construction which can be assembled with relatively few operations.

According to the present invention, the hub is formed as a single piece having formed therein a plurality of slots opening at the rear edge of the hub. The blades are assembled by merely sliding the same into the opened ends of the slots until they are properly positioned on the hub. This obviates the threading of the enlarged portion of the blade through the enlarged portion of a slot such as has been previously proposed. The hub furthermore being of one piece presents a more pleasing appearance than the two part hubs, as no line of jointure between the parts mars the appearance of the hub of the present invention.

The blades are held against radial movement of the hub by providing a plurality of projections or the like on that part of the blade received within the hub to engage the inner surface of the hub and hold the blade properly mounted in the slot.

The hub, as the blade-receiving slots open at the rear edge thereof, is somewhat flexible and accordingly the hub is reinforced at the rear edge by means also formed to hold the blades against sliding movement in the slots. This means preferably comprises a plate or disk having formed therein a circular groove having a diameter substantially that of the diameter of the hub at the rear edge. A flange carried by the plate or disk circumscribes the outer surface of the hub contiguous to the rear edge thereof and engages the trailing edges of the blades to hold the same against sliding movement in the slots.

The hub is mounted to the shaft of a motor by means positioned in the hub so as to extend longitudinally of the hub along its axis of rotation. In securing the hub to the shaft, in this manner, unbalance of the hub is avoided and the necessity of counterbalancing is removed for the hub is dynamically balanced. The means for securing the hub to the shaft comprises a clamping element sleeving the shaft and cooperating with the reinforcing disk to clamp the hub to the shaft as well as to clamp the reinforcing disk tightly against the rear of the hub to reinforce the same.

Other features and advantages will hereinafter appear.

In the accompanying drawing:

Figure 1 shows a front view of the hub and blade assembly.

Fig. 2 shows a side view of the same assembly.

Fig. 3 is a side view of the hub with the blades removed.

Fig. 4 is a sectional view of the hub showing one blade mounted in its slot and with the hub secured to the shaft of a motor of which only a fragmentary part is shown.

Fig. 5 is a view similar to Fig. 4, but showing a modified form of the invention.

As shown in the drawing, the fan of the present invention comprises a hub 10 having a plurality of blades 11 projecting therefrom and secured thereto to form a unit which is adapted to be mounted on the shaft of a motor or other driving means.

In the illustrated form of the invention, the hub 10 is provided with a plurality of slots 12 extending from the rear edge 13 forwardly of the hub. The slots preferably are formed so that they will impart to the blades, when the blades are mounted therein, a proper curvature for efficient displacements of air. To this end, the slots are helically shaped and extend forwardly and about the peripheral surface of the hub.

In the preferred form of the invention the blades are formed of flexible rubber or material having similar properties.

Three such blades are used, and, according to the present invention, have their centers spaced about the hub at 120° apart. The blades extend around the hub for approximately 180° and have their adjacent edges in spaced overlapping relation. By using three blades and positioning them in the manner shown in the drawing, a greater

circulation of air is produced than heretofore obtained with approximately the same expenditures of energy. The blades are sufficiently separated to permit the air to freely flow through the fan and have sufficient surface to bite into and draw through a large amount of air without undue resistance.

The blades are adapted to be inserted in the hub by sliding them into the slots opening at the rear edge 13 of the hub. The slots 12 preferably are enlarged as at 14 to facilitate the insertion of the base edge of the blades therein.

The blades may be secured in the slots in any convenient manner. In the preferred form of the invention, the edge positioned within the hub is provided with a plurality of lugs 15 projecting from opposite sides of the blade. The lugs 15 engage the inner surface of the hub adjacent the slots and prevent the blades from radial movement outwardly of the hub.

In forming the edge with such projecting lugs, a much greater flexibility is imparted to the blades than if the series of lugs were made into a solid rib. A solid rib may be used, however, when such flexibility is not required.

As shown in Fig. 3, the hub, as the slots 12 open at the rear edge thereof, is quite flexible, and, to impart the desired rigidity to the hub so as not to be drawn out of dynamic balance upon rotation, the present invention provides means for reinforcing the rear edge of the hub. For this purpose, there is provided a disk 16 formed with an annular groove 17 having a diameter equal to the diameter of the rear edge of the hub.

The disk, as in the form of the invention shown in Fig. 4, is mounted to the hub with the rear edge 13 disposed in the groove 17. It will be seen that the disk 16, when mounted to the rear edge of the hub will reinforce the rear edge of the same and impart the desired rigidity thereto.

The disk is provided with a flange 18 which engages the outer surface of the hub adjacent the rear edge 13 thereof and is of such size and shape as to overlie and cover the enlarged portions 14 of the slots 12 so that the appearance of the hub is not marred by these enlarged portions. The forward edge of the flange engages the trailing edge of the blades 11 and will hold the blade from sliding in the slot when the fan is in operation.

To mount the fan and hub assembly to the shaft of a motor or other driving means, the disk 16 is provided with a sleeve 20 extending axially of the hub and concentric with the axis of rotation of the hub. The sleeve 20 has a camming surface 21 formed in its bore. Mounted to slide in the bore of the sleeve 20 is a sleeve 22 having a bore of sufficient size to receive a motor shaft 23. The end of the sleeve 22 adapted to receive the motor shaft is split so as to form a plurality of clamping elements 24.

The clamping elements 24 are provided with camming surfaces 25 on their exterior adapted to engage and cooperate with the camming surface 21 formed in the bore of the sleeve 20. The other end of the sleeve 22 is provided with a threaded socket 26 adapted to receive a threaded bolt 27 mounted in a recess 28 at the nose of the hub so as to lie below the surface of the same.

The bolt extends along the axis of the hub, and, upon being threaded into the socket 26, draws the sleeve 22 outwardly toward the nose of the hub to cause the camming surfaces 21 in cooperation with the camming surfaces 25 to cam the clamping elements 24 to move into clamping relation with the end of the motor shaft. The action of the camming surfaces also will cause the disk 16 to be pulled inwardly of the hub and tightly against the rear edge 13 of the hub. The disk 16 is dished somewhat to accommodate the end of a motor casing 30.

As all the elements of the assembly are symmetrically positioned with respect to the axis of rotation of the hub, the hub always will be dynamically balanced. It will be noted that the head of the bolt 27 is easily accessible so that the hub may be quickly removed from the shaft of the driving means if desired.

There is shown in Fig. 5, a modified form of the present invention, particularly the means by which the hub and blades are mounted to the shaft of the driving means. In this form of the invention, the hub is identical with the hub shown in the previously referred to figures and the blades are likewise identical and mounted and secured to the hub in the same manner as are the blades of that form of the invention shown in Figs. 1 to 4 inclusive.

The reinforcing disk, in this form of the invention, does not have an integral sleeve, but, as shown, a separate sleeve 33 is centrally carried by the disk 34. The sleeve 33 is provided with an annular flange 35 at the one end thereof which engages the one face of the disk 34 and prevents the sleeve from being pulled through the aperture in the disk 34 through which the sleeve projects. The opposite end of the sleeve is peened over to form a retaining head 36 lying within a recess 37 formed at the nose of the hub. The sleeve 33 is formed with a camming surface 38 cooperating with camming surfaces 39 formed on a sleeve 40 identical with sleeve 22 in the first described form of the invention.

The threaded bolt 41 received within the threaded socket 42 of the sleeve 40 draws the latter outwardly of the shaft 43 until the action of the camming surfaces 38 and 39 clamp the split end thereof into clamping engagement with the end of the shaft 43. It will be seen again that all elements are symmetrically positioned with respect to the axis of rotation of the hub and the hub will again always be dynamically balanced.

In this form of the invention, the disk 34 reinforcing the rear edge of the hub will be held against the rear edge partially by the sleeve 33, the opposite ends of which are secured to the hub and disk, and partially by the action of the camming surfaces as in the form of the invention shown in Fig. 4.

Variations and modifications may be made within the scope of this invention and portions of the improvements may be used without others.

I claim:

1. In a fan, a hollow hub provided with a plurality of slots having entrance portions at the rear of said hub; blades mounted in said slots; and means disposed about the rear edge of said hub for holding the rear edge of the hub against movement in either direction transverse to the axis thereof, said means closing said entrance portions and holding the blades in the slots.

2. In a fan, a hollow substantially conical shaped hub having slots formed therein and opening at the rear thereof; blades mounted in said slots; and means disposed about the rear edge of said hub for reinforcing the rear edge of the hub and for holding the blades in the slots, said means including a disk provided with a circular groove of the same diameter as the

rear edge of said hub, the walls of said groove holding the rear edge of said hub against movement in either direction transverse to the longitudinal axis thereof.

3. In a fan, a hollow hub having slots formed therein and opening at the rear thereof; blades mounted in said slots; and means disposed about the rear edge of said hub for reinforcing the rear edge of the hub and for holding the blades in the slots, said means including a disk provided with a circular groove of the same diameter as the rear edge of said hub and having an annular flange engaging the outer surfaces of said hub contiguous to the rear edge thereof, said flange engaging the trailing edges of the blades and holding the latter against sliding movement in the slots.

4. In a fan, a hollow hub having slots formed therein and opening at the rear thereof; blades mounted in said slots, said slots being widened at the rear edge of said hub to facilitate the insertion of the blades therein, said blades being inserted in said slots by sliding movement; and means disposed about the rear edge of said hub for reinforcing the rear edge of said hub and holding the blades in the slots, said means including a disk provided with a circular groove of the same diameter as the rear edge of said hub and having an annular flange engaging the outer surface of said hub contiguous to the rear edge thereof and covering the widened portion of said slots, the forward edge of said flange engaging the trailing edges of the blades and holding the same against sliding movement in the slots.

5. In a fan, a hollow hub having slots formed therein and opening at the rear thereof; blades mounted in said slots; means disposed at the rear of said hub for reinforcing the rear edge of the hub and for holding the blades in the slots; a drive shaft having the end thereof disposed within said hub; and common clamp means actuated by a single operation for securing the hub to said shaft and the reinforcing means to the rear edge of said hub.

6. In a fan, a hollow hub presenting at the rear thereof a substantially circular edge, said hub formed with a plurality of slots opening at said edge; a plurality of blades mounted in said slots; means for reinforcing said edge and closing said slots; a shaft; means within said hub for clamping said reinforcing means against the rear edge of said hub and for securing the hub to said shaft; and means carried exteriorly of said hub for causing said last-named means to simultaneously clamp the reinforcing means against said edge and secure the hub to said shaft.

7. In a fan, a hollow hub having slots formed therein and opening at the rear thereof; blades mounted in said slots; means for reinforcing the rear edge of said hub and for holding said blades in said slots; a shaft having an end thereof disposed within said hub; means for clamping the hub to the shaft comprising camming surfaces and cooperating clamping elements extending axially of the hub and positioned to engage the shaft for a substantial area thereof; and means extending axially of the hub for moving the clamping elements relative to the camming means and laterally with respect to the shaft into clamping relation with the shaft to lock the hub thereto and the reinforcing means to the rear edge of said hub.

8. In an electric fan, a hollow hub having a plurality of slots formed therein and opening at the rear thereof; blades mounted in said slots; a disk disposed at the rear of said hub and having an annular groove receiving the rear edge of said hub; a sleeve carried by said disk and extending axially of the hub; camming surfaces formed in the bore of said sleeve; and a clamping sleeve slidable in said bore and having one end slit so as to form clamping elements adapted to cooperate with the camming surface in the bore and the other end threaded to engage a bolt mounted in the hub to extend axially of the same, whereby when the bolt is turned the clamping sleeve will slide and move the clamping elements laterally into gripping relation with the shaft, movement of the clamping sleeve causing the disk to be securely clamped against the rear edge of the hub.

9. In a fan, a hollow hub having a plurality of slots formed therein and opening at the rear thereof; blades mounted in said slots; a disk having an annular groove receiving the rear edge of said hub; an annular flange carried by said disk engaging the outer surface of said hub contiguous to said rear edge and engaging the trailing edges of said blades to prevent sliding movements of the blades in the slots; a sleeve carried by said disk extending inwardly thereof along the axis of the hub; a drive shaft having the end thereof disposed within the sleeve; and means within the sleeve and coaxial with the shaft for gripping the sides of the shaft with a radial pressure and for clamping the bottom wall of said groove against the rear edge of the hub.

10. In a fan, a hollow hub having a plurality of slots formed therein and opening at the rear edge thereof; a plurality of blades mounted in said slots; a disk disposed at the rear of said hub having an annular groove receiving the rear edge of said hub and holding said edge against movement in either direction transverse to the longitudinal axis thereof; a sleeve carried by said disk and extending inwardly thereof along the axis of the hub; a shaft having the end thereof disposed within the sleeve; means within the sleeve and coaxial with the shaft for gripping the end of the shaft and for clamping the bottom wall of said groove against the rear edge of the hub; and means for operating said first-named means to hold the hub on said shaft and against relative rotation with respect thereto when the fan is under load.

11. In a fan, a hollow substantially conical shaped hub having a plurality of slots formed therein and opening at the rear thereof; blades of resilient flexible material mounted in said slots to project from the outer surface of the hub; means on the edge of the blade within the hub engaging the interior surface of the hub for holding the blade against movement radially of the hub; and means closing the open end of said hub and including means disposed on opposite sides of the rear edge of the hub for reinforcing the same, said means closing said slots and holding the blades against sliding movement in the slots.

12. In a fan, a hollow substantially conical shaped hub provided with a plurality of slots having entrance portions at the rear thereof; blades of resilient flexible material mounted in said slots to project from the outer surface of the hub; a pluraliy of projections extending transversely of the blade along the edge of the blade and adapted to engage the interior surface of the hub to hold the blades against movement radially of the hub; a disk formed with an annular groove receiving the rear edge of the

hub to reinforce the same; and an annular flange carried by said disk engaging the outer surface of the hub adjacent the rear edge thereof and closing the entrance portions of said slots, said flange engaging the trailing edges of the blades for preventing sliding movement of the blades in the slots.

13. In a fan, a hollow hub having a plurality of slots formed therein and opening at the rear edge thereof; a pluraliy of blades mounted in said slots; a disk having an annular groove receiving the rear edge of said hub and closing the open end of said slots; a sleeve having one end secured to the nose of said hub and the other end secured to said disk and securely holding the disk against the rear edge of said hub; a camming surface provided in the bore of said sleeve; clamping elements mounted to slide in the sleeve and having parts adapted to engage the camming surface; and means for sliding the clamping elements to move them relative to the camming surface of the sleeve to cause them to move laterally to clamp the drive shaft and hold the hub thereon against relative movement.

GUSTAVE F. BAHR.