March 5, 1940. J. H. COHEN 2,192,811

FAN

Filed July 26, 1937 2 Sheets-Sheet 1

Fig. 1

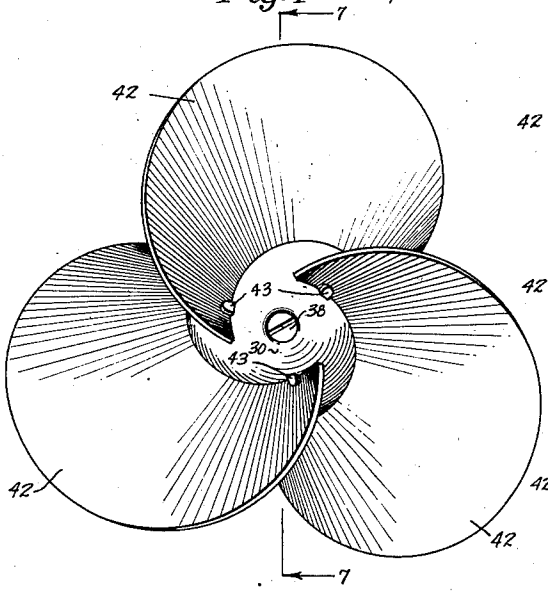


Fig. 2

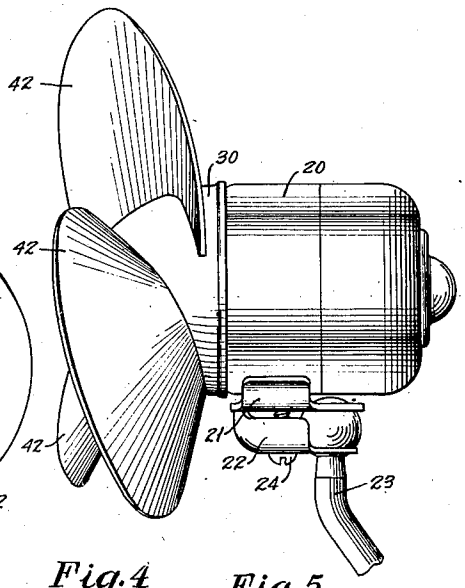


Fig. 3

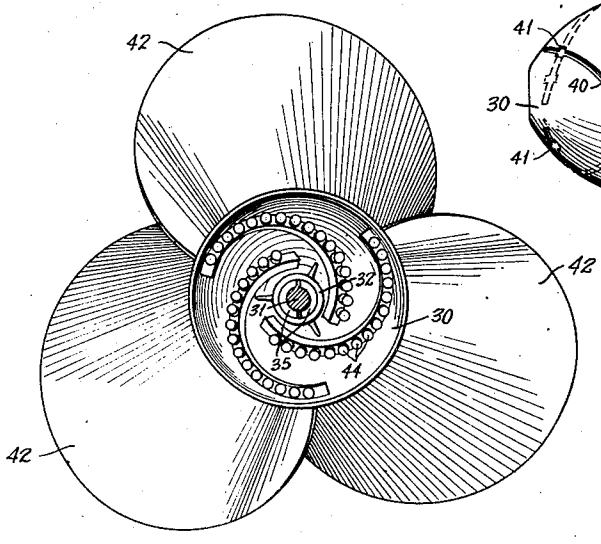


Fig. 4

Fig. 5

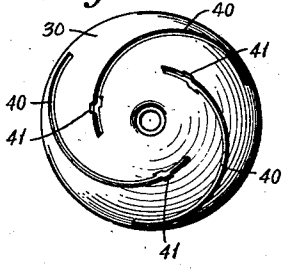
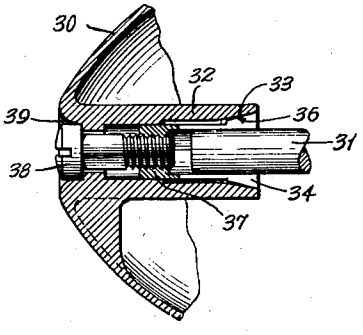


Fig. 6



INVENTOR
Joseph H. Cohen
BY
ATTORNEY

March 5, 1940. J. H. COHEN 2,192,811

FAN

Filed July 26, 1937 2 Sheets-Sheet 2

Fig. 8

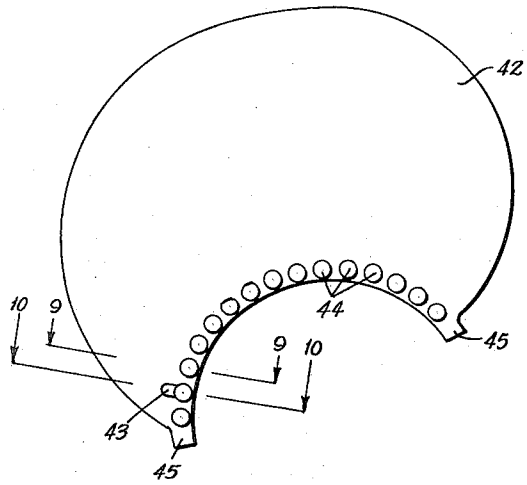


Fig. 11

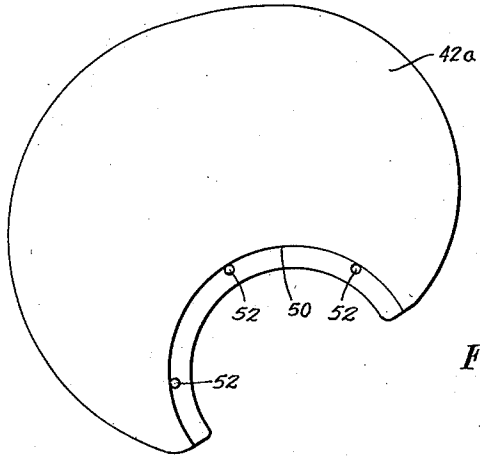


Fig. 7

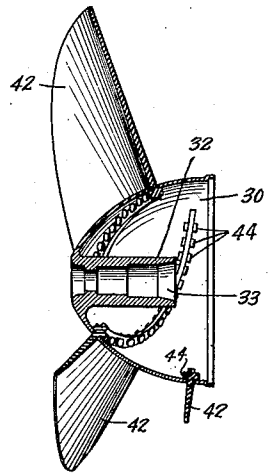


Fig. 9

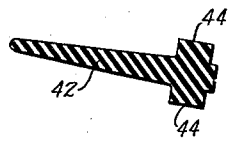


Fig. 10

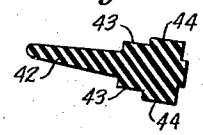
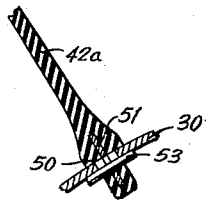


Fig. 12



INVENTOR
Joseph H. Cohen
BY
ATTORNEY

Patented Mar. 5, 1940

2,192,811

UNITED STATES PATENT OFFICE

2,192,811

FAN

Joseph H. Cohen, Bridgeport, Conn., assignor to Casco Products Corporation, Bridgeport, Conn., a corporation of Connecticut

Application July 26, 1937, Serial No. 155,673

15 Claims. (Cl. 170—173)

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

In making fans for circulating air, it is essential that the rotating elements be dynamically balanced so that there will not be any whipping action due to the uneven weight distribution when rotated at high speeds. Dynamic unbalance may be caused by several factors. One factor may be the mounting of the blades on the hub improperly and unsymmetrically with respect to the axis of rotation of the hub. Another factor may be the means for mounting the hub upon the drive shaft of the motor.

With respect to the first factor, when blades made of resilient material, such as rubber, are used, difficulty has been found in adequately securing them to the hub so as to withstand the strain due to centrifugal force when the hub is rapidly rotated. This presents a problem since the fan blades must be uniformly secured to the hub in precisely the same manner so that their weight is properly positioned about the axis of rotation.

Accordingly, the present invention provides blades which are adequately secured to the hub in such a manner as to be dynamically balanced and which are at the same time rigidly secured in place.

In the preferred form of the invention, the hub is provided with slots of uniform width into which flexible rubber blades are inserted from the back or inside of the hub. The slots adjacent their forward end have recesses on their edges and the blades are provided with projections on their side faces adapted to engage the recesses. This interlocking relation prevents the blades from slipping along the slots due to the rotating action of the fan and pressure of the air on the blades as the blades are rotated. On the inner edge of the blade a plurality of projections or lugs are provided and the blade, adjacent each end, is provided with an extension lying in a plane of the blade. These projections and extensions engage the undersurface of the hub adjacent the edges of the slot and hold the blade from flying radially from the hub due to centrifugal force.

Another feature of the invention resides in the arrangement of the blades on the hub. According to the present invention, three blades are positioned on the hub with their centers spaced 120° apart. The blades are of such length that they extend around the hub for approximately 180°. The blades are mounted so as to join the hub in a substantially helical path with the adjacent edges of the blades in spaced overlapping relation. This arrangement of the blades provides for an increased blade surface and permits the air drawn by this increased blade surface to flow freely through the fan so that more air is given for approximately the same expenditure of energy, or a smaller motor can be used to obtain the circulation heretofore obtained.

It will be seen, therefore, that with the blades all made of the same material and of the same shape and secured symmetrically about the hub that the rotating element will be in dynamic balance.

In another form of the invention the blade is molded so as to have a ridge adjacent to but spaced from the edge of the blade which is adapted to engage the hub. An insert of metal is molded in the blade along this edge to reinforce the same. The blade and insert are provided with holes positioned adjacent the ridge. Pins are provided to be inserted through the holes so as to engage the inner surface of the hub to prevent the blades from flying out because of centrifugal force. Since the blades are made and secured in identically the same manner, the rotating element will have a proper dynamic balance.

The second factor mentioned above for causing dynamic unbalance of the rotary elements resides in the manner in which the hub is secured to the shaft of the motor. If, for example, a set screw is used, it is difficult to get to for adjustment since a hole must be provided in the hub through which an instrument can be inserted to turn the screw. Both the screw and hole in the hub will alter the weight of the hub so that some provision must be made to counterbalance the same.

According to the present invention, the securing means is positioned in the hub so as to extend longitudinally of the hub along its axis of rotation. In this manner, unbalance of the hub is avoided and the necessity of counterbalancing is removed.

Another feature of the present invention resides in the mounting of the adjusting means for the clamping element so that it may be readily accessible from the outside without having to provide a separate aperture for the insertion of the tool. In the present invention the bolt which moves the clamping elements into gripping relation is mounted in the nose of the hub and extends along the axis of rotation of the hub. By turning this bolt, the clamping elements are moved into gripping position to securely hold the hub to the drive shaft of the motor.

Other features and advantages will be apparent from the specification taken in connection with the drawings, in which:

Figure 1 is a front elevation.

Fig. 2 is a side elevation.

Fig. 3 is a rear view showing the hub and blades.

Fig. 4 is a side elevation of the hub.

Fig. 5 is a front view of the hub showing the arrangement of the slots.

Fig. 6 is a detailed section of the clamping means.

Fig. 7 is a sectional view of hub and blades, taken along line 7—7 of Fig. 1.

Fig. 8 is a plan view of one of the blades.

Fig. 9 is a section of the blade taken along line 9—9 of Fig. 8.

Fig. 10 is a section of the blade taken along line 10—10 of Fig. 8.

Fig. 11 is a plan view of another form of blade,

Fig. 12 is a section of the blade shown in Fig. 11 with it in position on the hub.

According to the present invention, a fan motor 20 has secured to its bottom surface a plate 21 having a socket therein. The plate 21 may be secured to the motor housing in any desired manner, preferably by welding. Mounted to pivot on the plate is a clamping member 22 adapted to extend into cooperative relation with the socket in the plate to receive a supporting member 23 which is herein shown as having a ball fitting in the socket whereby the motor may be universally adjusted. A screw 24 is threaded into the plate and extends through the clamping member to lock the motor in adjusted position. This motor mounting is specifically described and claimed in my divisional application Serial No. 276,059, filed May 27, 1939.

A hollow cup-shaped hub 30 is mounted at the forward end of the motor, and, as shown in Fig. 2, is shaped to slightly overlap the forward edge of the motor housing and tapers into a nose at the front of the fan. Difficulty has been experienced in mounting such hollow hubs on the drive shaft of the motor so as not to destroy the dynamic balance of the rotating element. Accordingly, the hub is provided with an inwardly-extending sleeve 32, extending axially of the hub and concentric with the axis of rotation of the hub. This sleeve may be formed integrally with the hub or may be separately made and secured thereto. The sleeve has a camming surface 33 formed in its bore. Mounted to slide in the bore of the sleeve 32 is a clamping sleeve 34 having a bore of sufficient size to receive a motor shaft 31. The end of the sleeve, adapted to receive the motor shaft, is split so as to form a plurality of clamping elements 35. These clamping elements have camming surfaces 36 thereon, adapted to engage and cooperate with the camming surface 33 within the sleeve when moved relatively thereto. The other end of the clamping sleeve is provided with a wall having threads 37 therein which are adapted to cooperate with a bolt 38 mounted in a recess 39 at the nose of the hub so as to lie below the surface of the hub. The bolt extends along the axis of the hub and upon being rotated slides the clamping sleeve relative to the sleeve 32 whereby the camming surface will move the clamping elements into clamping relation with the end of the motor shaft. Since all the elements are symmetrically positioned with respect to the axis of rotation of the hub, the hub will always be dynamically balanced.

A further feature of the invention resides in the accessibility of the bolt 38 whereby the hub may be clamped to the motor shaft. In prior practice it has been customary to provide the hub with a sleeve similar to the present sleeve 32 and have a set screw therein adapted to be moved into engagement with the motor shaft. The hollow hub had to be provided with an aperture through which a tool could be extended to engage and adjust the set screw. Aside from destroying the balance of the hub, the set screw was very difficult to reach when it was desired to attach or remove the hub from the shaft. According to the present invention, however, the head of the bolt is open to view and easy access since it is positioned adjacent the outer surface of the hub and may be readily operated to lock the hub to the shaft or remove the same therefrom.

This novel mounting for the hub is described and claimed in my divisional application Serial No. 212,862, filed June 10, 1938.

As shown in Figs. 4 and 5, the hub is provided with three symmetrically arranged slots 40. These slots are uniform in width and extend from the base of the hub forwardly toward the nose thereof in a substantially helical path. Adjacent their forward ends the slots 40 are provided with a pair of recesses 41 on their side edges. These slots are adapted to receive the fan blades of the fan. The fan blades of the present invention, only one of each form being described, are made of resilient material, preferably rubber, and are tapered in cross-section as shown in Figs. 9, 10 and 12.

In the preferred form of the invention, a blade 42 is made of flexible rubber and is adapted to be inserted from the inside of the hub. Adjacent its forward end or that end nearest the nose of the hub, the blade has a projection 43 extending from each face of the blade to engage the recesses 41 in the slot to hold the blade from sliding in the slot due to the pressure of the air on the blade when in operation. This effectively prevents shifting of the blade and thereby the weight distribution of the blade about the axis of the hub and maintains the rotating element in dynamic balance.

The blade may be secured in the slots in any convenient manner. In the preferred form of the invention shown in Figs. 8, 9 and 10, the edge positioned within the hub is provided with a plurality of separate projecting elements or lugs 44. 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. At each end of the engaging edge of the blade, a projection or wing 45 is formed in the plane of the blade and extends to engage the inner surface of the wall to further prevent the blade from being thrown outwardly through the slot by centrifugal force when the blade is set in motion.

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 drawings, 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.

In another form of the invention shown in Figs. 11 and 12, a blade 42a is formed of resilient material, preferably of rubber-like material, and is molded so as to have an outwardly-extending ridge 50 adjacent to but spaced from the edge engaging the hub. In the form disclosed, a metal insert 51 is molded in the blade in the hub-engaging section to reinforce the blade, although this is not essential as the blade is stiff enough, and a plurality of holes 52 are drilled or punched through the plate and blade adjacent the ridge. The blade is mounted in the slot from the outside so that the ridge engages the outer surface of the hub. A pin 53 is inserted through each of the holes and is adapted to engage the inner surface of the hub to hold the blade in position. Preferably, the blade is pressed inwardly through the slot to slightly compress the resilient ridges and the holes in the blades are designed so that the pin may be readily inserted when the blades are held in such position. After the pins have been inserted, the blades are released and the resiliency of the blade forces the blades outwardly through the slot which will pull the pins into firm engagement with the inner surface of the hub and securely hold the pins therein against movement.

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 an electric fan, a hub provided with a plurality of blade-receiving slots of uniform width, the edges of the slots adjacent the forward end of the same being provided with recesses; blades mounted in the slots having projections adjacent their forward edges adapted to engage the recesses in the slot whereby the blade is prevented from sliding in the slot when in operation; and means for holding the blades on the hub.

2. In an electric fan, a hub provided with blade-receiving slots; blades of flexible material mounted in the slots; means for locking the blades to the hub without affecting the flexibility of the same comprising a plurality of independent projections extending around the edge of the blade and adapted to engage the inside surface of the hub to hold the blade thereon.

3. In an electric fan, a hub provided with blade-receiving slots; blades of resilient rubber-like material mounted in the slots; means for locking the blades to the hub without impairing the resiliency of said blades comprising a plurality of pin-like projections extending transversely of the blade around the edge of the blade and adapted to engage the inside surface of the hub to hold the blade thereon.

4. In an electric fan, a hub provided with blade-receiving slots of predetermined fixed length; blades mounted in the slots; means for locking the blades to the hub, said means including a projection at each end of the blade extending in the plane of the same, the distance between the free ends of said projections being greater than the fixed length of the slots so that said projections when the blades are mounted in said slots engage the underside surface of the hub adjacent each end of the slot to hold the blade thereon.

5. In an electric fan, a hub provided with blade-receiving slots; blades mounted in the slots and having a ridge molded thereon adjacent to but spaced from the edge thereof and adapted to engage the hub; a metal insert molded in the blade, the blade having holes positioned adjacent the ridge and extending through the blade and metal insert; and pins adapted to be inserted through the holes when the blades are in assembled relation to engage the inner surface of the hub to hold the blades to the hub.

6. In an electric fan, a hub provided with blade-receiving slots; blades of resilient material mounted in the slots and having a ridge molded adjacent to but spaced from the edge thereof and adapted to engage the outer surface of the hub; a metal insert molded in the blade; the blade having holes positioned adjacent the ridge and extending through the blade and metal insert; and pins adapted to be inserted through the holes when the blades are in assembled relation to engage the inner surface of the hub, the resiliency of the blades holding the pins in firm engagement with the hub.

7. In an electric fan, a hub provided with blade-receiving slots; flexible rubber-like blades mounted in the slots and having a ridge molded thereon adjacent to but spaced from the edge thereof and adapted to engage the outer surface of the hub, the blade having holes positioned between the ridge and the edge; and pins adapted to be inserted through the holes when the blades are in assembled relation to engage the inner surface of the hub to hold the blades to the hub.

8. In an electric fan, a hub provided with blade-receiving slots; flexible rubber-like blades mounted in the slots and having a continuous ridge molded thereon adjacent to but spaced from the edge thereof and adapted to engage the outer surface of the hub; and separable means adapted to be mounted along the edge of the blade in contact with the inner surface of the hub to lock the blade to the hub.

9. In an electric fan, a hub having slots extending helically therealong; flexible rubber blades mounted in said slots; and flexible means for securing said blades in said slots without affecting the flexibility of said blades comprising a plurality of projections spaced along a thin edge of the blade.

10. In an electric fan, a hollow hub having blade-receiving slots therein; blades of flexible rubber-like material mounted in said slots, the edge of the blades engaging the hub being relatively thin, whereby the blade is very flexible and can be readily inserted in the slots from within the hub; and means adjacent said edge extending perpendicularly to the face of the blade at spaced intervals therealong for engaging the hub to lock the blade in the slot without impairing the flexibility of the blades.

11. In an electric fan, a hub having blade-receiving slots therein; blades of flexible rubber-like material mounted in said slots, the blades having a hub engaging edge which is a continuation of the cross-section of the blade; and means on the edge of the blade engaging the interior of the hub for holding the blade in the slot without impairing the flexibility of the blades.

12. In an electric fan, a hub provided with blade-receiving slots; rubber blades mounted in the slots and having a continuous ridge molded thereon adjacent to but spaced from the edge thereof and adapted to engage the outer surface of the hub; and means adapted to be mounted along the edge of the blade in contact with the inner surface of the hub to lock the blade to the slot, the resiliency of the rubber blade drawing the separable means into firm engagement with the inner surface of the hub.

13. In an electric fan, a hub provided with a plurality of blade-receiving slots of uniform width, at least one edge of each slot adjacent the forward end of the same being provided with a recess; blades mounted in the slots having at least a projection adjacent their forward edge to engage the recess in the slot, whereby the blade is prevented from sliding in the slot when in operation; and means for holding the blades around the hub.

14. In an electric fan, a hub provided with blade-receiving slots; blades of resilient flexible material mounted in said slots to project from the outer surface of the hub; and means for holding the blades in the slots without affecting the flexibility of the same, including a plurality of pin-like projections extending transversely of the blade, said projections being disposed along at least a portion of the edge of the blade to engage the inner surface of the hub to hold the blade thereon.

15. In an electric fan, a hub provided with blade-receiving slots; blades of resilient flexible rubber-like material having a ridge formed thereon and providing an abutment for engaging the outer surface of the hub; and means for holding the blades in the slot without affecting the flexibility of the same, including a plurality of pin-like elements extending transversely of the blades and disposed along at least a portion of the edge for engaging the inner surface of the hub to hold the blade thereon.

JOSEPH H. COHEN.