Aug. 21, 1945. E. A. MADER 2,383,001

COMBINED IMPELLER AND CLOSURE

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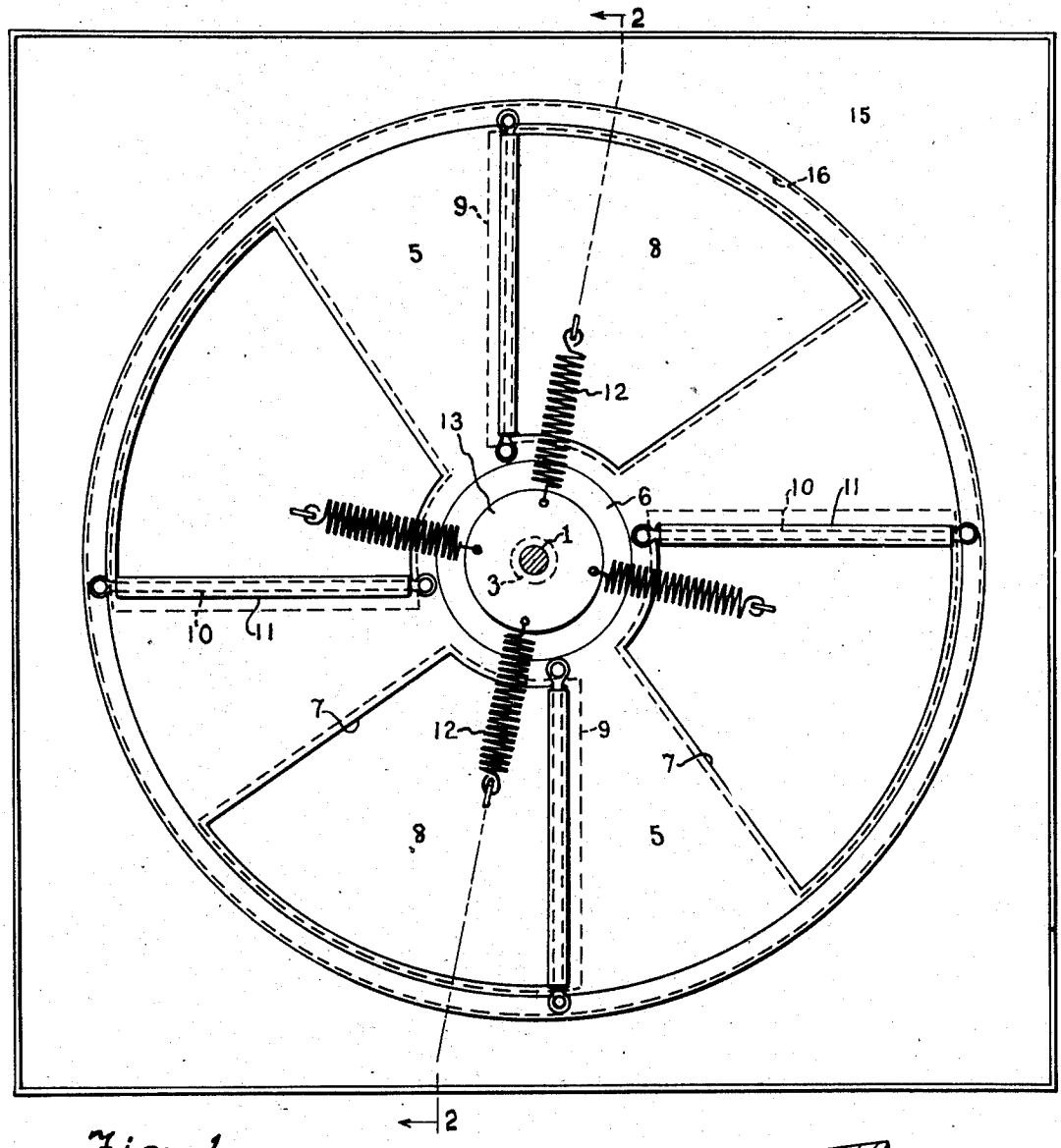


Fig. 1.

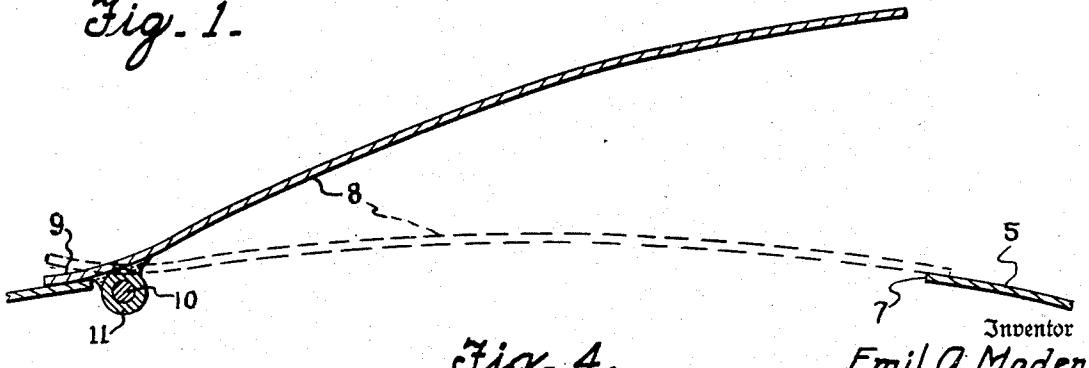


Fig. 4.

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Fig. 2.

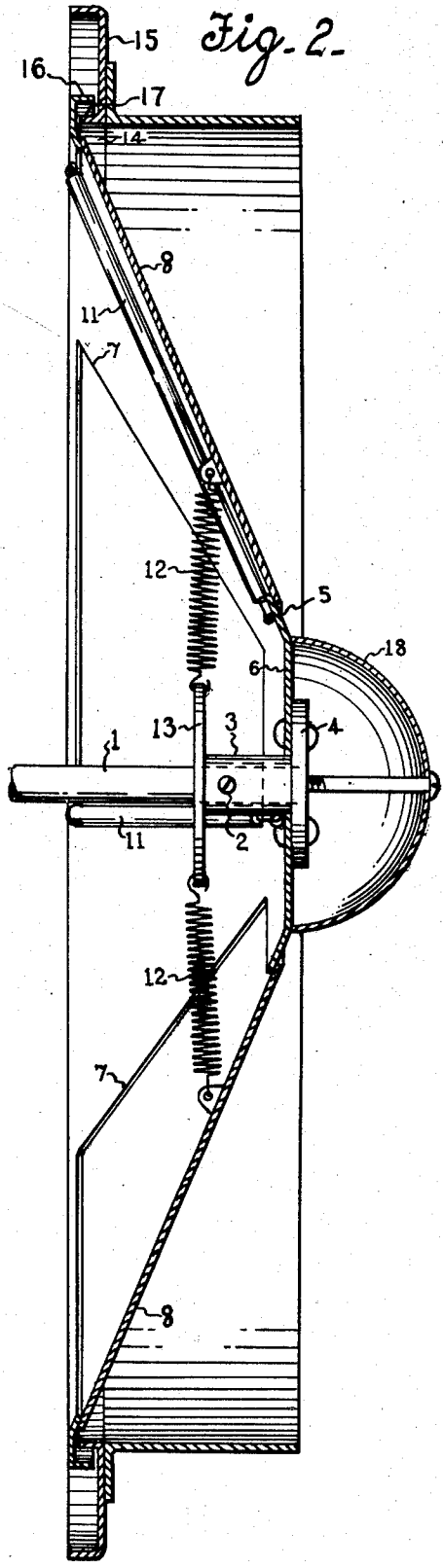
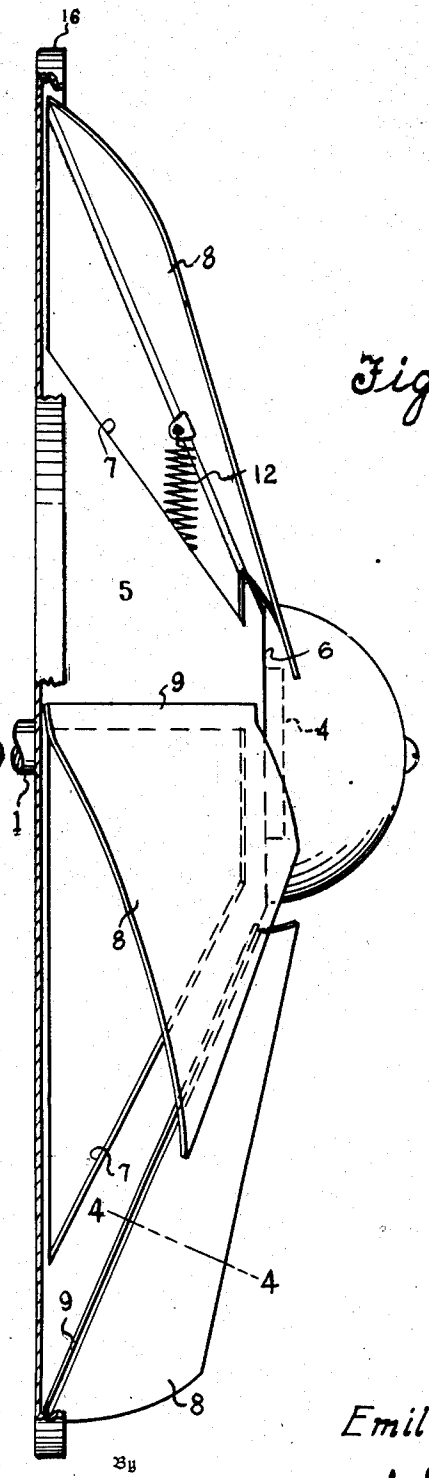


Fig. 3.



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COMBINED IMPELLER AND CLOSURE

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Application May 3, 1943, Serial No. 485,532

4 Claims. (Cl. 230—114)

This invention relates to impellers and particularly impellers delivering fluid through an opening which is automatically opened or closed according as the impeller is driven or idle.

An object of the invention is to pivotally mount the blades of an impeller so that they may exercise a closure function when idle and will respond centrifugally to impeller rotation in assuming their impelling position.

Another object is to provide an impeller comprising blades pivoted to turn about conically convergent axes, said blades being yieldably urged to a closure-forming position and centrifugally responding to impeller rotation when the impeller is driven to establish their impelling position.

Another object is to provide an impeller comprising blades pivoted on a substantitally conical rotary carrier and yieldably urged to a position in which they close openings in said carrier, rotation of the impeller serving to centrifugally swing the blades to uncover said openings and impart a pitch to the blades effective to induce a fluid flow through the openings.

Another object is to provide means on said blades for definitely limiting their centrifugal action.

Another object is to provide improved means at the periphery of an impeller coacting with the margin of an opening wherein the impeller rotates to substantially prevent fluid flow between said periphery and margin.

These and various other objects are attained by the construction hereinafter described and illustrated in the accompanying drawings wherein:

Fig. 1 is an elevational view of the impeller, as viewed from the end at which a drive is applied, the blades being shown in their closure-forming position.

Fig. 2 is a cross sectional view of the same taken on the line 2—2 of Fig. 1.

Fig. 3 is a side elevational view of the impeller, showing its blades in impelling position.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3, showing on a larger scale, the impelling position of one of the blades.

In these views, the reference character 1 designates a shaft rotatively driven by an electric or other motor (not shown). Fixed on such shaft by a set-screw 2 or the like is a sleeve 3 fixedly carrying an impeller hub 4. Riveted or otherwise rigidly mounted on such hub is a sheet metal blade carrier 5 forming the frustum of a cone coaxial with the shaft. Said carrier at its smaller end forms a disk 6 transverse to the shaft and engaging the hub 4. The conical face of the carrier is formed with a plurality of equally spaced openings 7, substantially sector-shaped and a set of sheet metal blades 8 are pivoted on the carrier at corresponding margins of said openings to alternatively occupy a closure position for said openings and a fluid impelling position of acute divergency to said conical face. Said blades conform substantially to the conical curvature of the carrier and in their closure positions slightly overlap the margins of the openings 7, substantially sealing the latter. The pivotal margins 9 of the blades are extended slightly beyond the pivotal axes and are diverged acutely to the conical face of the carrier so as to act as stops establishing a desired blade pitch by seating against said coned face (see Fig. 4). Pivot pins 10 for the blades are fixed on the carrier and engage hinge barrels 11 welded or otherwise fixed upon the blades, said pins and barrels extending adjacent to corresponding margins of the openings 7 and preferably within said openings. The ends of the pins 10 underlap the inner and outer margins of said openings and are riveted or otherwise suitably rigidly mounted on the carrier.

To yieldably urge the blades to their closure position, coiled springs 12 are extended from the inner faces of the blades to a disk 13 mounted on the shaft 1 and stressed by said springs against the inner end of the sleeve 3.

The described impeller is disposed within and coaxial with an opening 14 formed in a sheet metal plate 15 which may be installed in a wall, or within a duct or in some other suitable location. Preferably the carrier 5 peripherally overlaps the margin of said opening, being annularly bent as indicated at 16 into close proximity to said plate, the latter being annularly bent at said margin to closely approach the carrier as indicated at 17. The annuli 16 and 17 jointly form a seal to prevent material fluid flow past the periphery of the impeller.

In use of the described construction, the springs establish and maintain the closure positions of the blades when the impeller is idle, and also prevent the blades from rattling. Thus the impeller exercises a check valve function, when idle, preventing flow reverse to that induced when the impeller operates. In case the impeller is mounted for ventilating purposes in a building wall, it serves when idle to prevent air from flowing into or out of the building and further prevents entry of rain, snow, or dust through the ventilating opening.

When the impeller is driven its blades centrifugally swing out, so far as permitted by their stops 9, the resultant pitch of the blades being predeterminedly such as to most effectively deliver air as indicated by the arrows in Fig. 3, such air being drawn through the openings 7. Centrifugal force exerted must be sufficient to overcome the pressure imposed on the blades by the fluid they impel and to further overcome the springs 13. The factors determining the applied centrifugal force are impeller velocity, the mass of each blade, and the rotational radius of the blades as measured to the shaft axis from their centers of gravity. Extent to which the blades tend to swing under centrifugal force depends on the conical convergency of their hinge axes, such tendency increasing as the angle between the base and inclined wall of the cone is increased. It is believed the most effective range for such angle lies between 15 degrees and 30 degrees.

In present practice it is common to subject a set of pivotal louvers to the blast of a fan, said louvers being yieldably urged to a closed position and opening responsive to the fan-induced air pressure. The construction now described eliminates necessity for such a louver arrangement, effecting a considerable economy in cost of such arrangement and labor of installing same. Furthermore, the described impeller is considerably more compact than any arrangement of fan and louvers suited to accomplish a like purpose.

While there has been shown and described a provision, namely stops 9, for limiting response of the blades to centrifugal force, such provision may be eliminated in most installations, since the blades cannot further respond to such force when their centers of gravity have been outwardly shifted relative to the impeller axis as far as permitted by location of the hinge axes. The blades therefore will, in absence of stops, assume definite impelling positions determined by conical inclination of the hinge axes, and these may and in most installations will be the preferred impelling positions.

The hemispherical cap 18 which is mounted centrally on the carrier 5 encloses and protects the fastenings by which the carrier is fixedly mounted on the hub 4 and further serves to reduce materially the tendency toward fluid backflow along the impeller axis.

What I claim is:

1. The combination with an impeller comprising an approximately conical rotary carrier having radially elongated portions and a plurality of openings for fluid flow between such portions and having an annulus rigidly joining the outer ends of said elongated portions, said openings being in part defined by said annulus, a plurality of blades forming closures for said openings and lapping said annulus when the impeller is idle, means pivotally mounting the blades on the carrier to turn about axes extending outwardly from the mid portion of the impeller and inclined to conform to the conical form of the carrier, whereby centrifugal force tends to swing the blades about said axes upon impeller rotation to establish a fluid impelling position of the blades, and means yieldably urging the blades to their closure-forming position, of means fixed with respect to rotation of the impeller and correlated with said annulus to provide a seal against fluid flow across the periphery of the impeller.

2. The combination set forth in claim 1, said fixed means being a member having an opening wherein the impeller rotates, said member and said annulus having oppositely projecting adjacent lapped flanges providing said seal.

3. An impeller comprising an approximately conical rotary carrier formed of sheet metal and having a plurality of circumferentially spaced openings for fluid flow and having substantially imperforate portions between said openings, a plurality of blades forming closures for said openings, means pivoting the blades on the carrier adjacent to corresponding margins of said openings about axes extending outwardly from the mid portion of the carrier and conforming to the conical inclination of the carrier, whereby centrifugal force tends to swing the blades about said axes upon impeller rotation to establish a fluid-impelling position of the blades, and means yieldably urging the blades to their closure-forming position.

4. An impeller as set forth in claim 3, the blades having portions projecting beyond their pivotal axes and overlapping the adjacent margins of said openings and coacting with said margins to predeterminedly limit centrifugal swinging of the blades.

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