Oct. 18, 1932. N. F. T. SAUNDERS 1,882,961

FAN OR BLOWER

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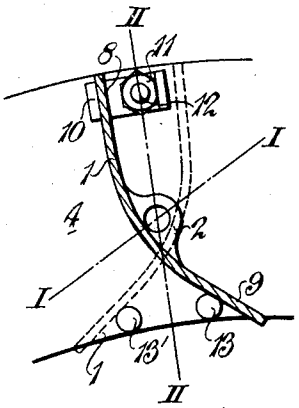

Fig. 1.

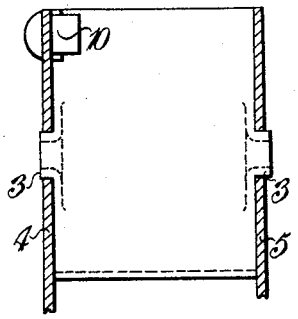

Fig. 2.

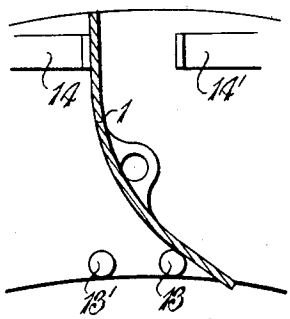

Fig. 4.

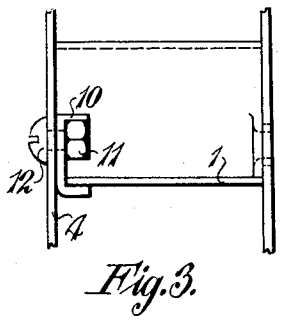

Fig. 3.

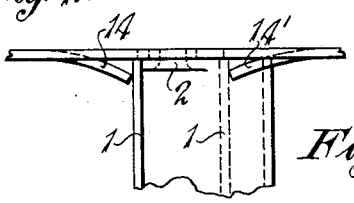

Fig. 5.

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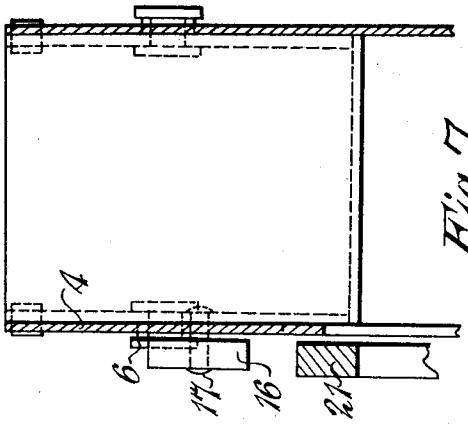

Fig. 7.

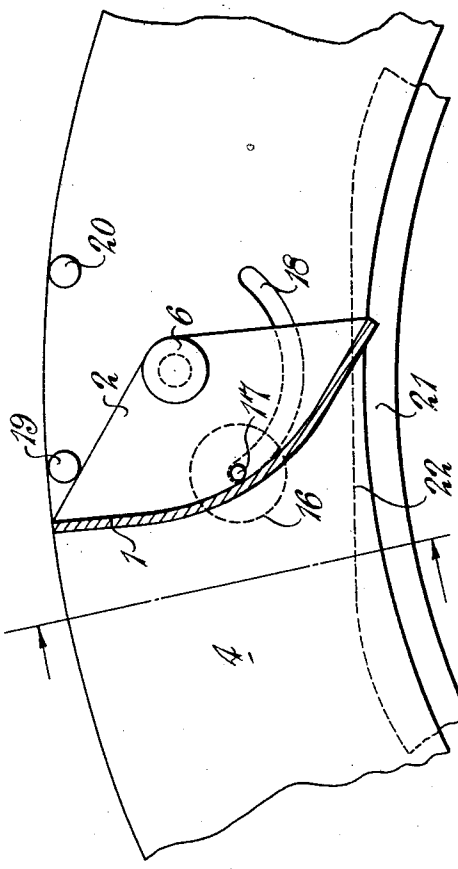

Fig. 6.

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FAN OR BLOWER

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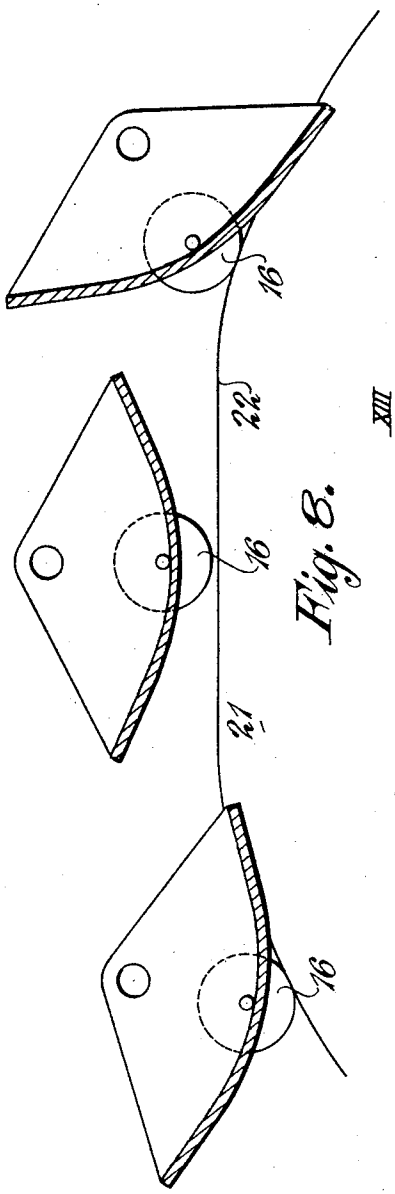

Fig. 8.

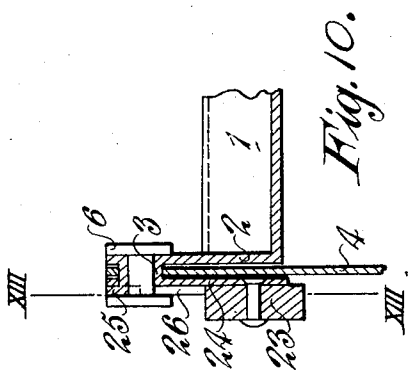

Fig. 10.

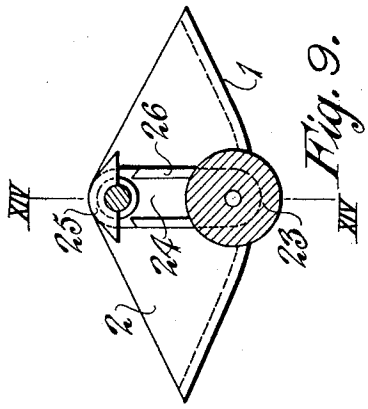

Fig. 9.

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Patented Oct. 18, 1932 1,882,961

UNITED STATES PATENT OFFICE

NORMAN FRANK TILBURY SAUNDERS, OF NEWPORT PAGNELL, ENGLAND, ASSIGNOR TO ASSOCIATED ELECTRICAL INDUSTRIES LIMITED, A COMPANY OF GREAT BRITAIN

FAN OR BLOWER

Application filed November 1, 1929, Serial No. 403,972, and in Great Britain November 2, 1928.

The invention relates to fans or blowers, its object being to provide improved constructions or arrangements of the blading thereof which will be particularly advantageous in cases where the fan or blower may be required to operate in both directions of rotation, as for example in the case of the ventilation fans for reversible types of dynamo electric machines.

For such machines it is usual to employ fans or impellers comprising a number of blades disposed more or less radially between a pair of shrouds, one of which may be in the form of a disc secured to the rotor shaft while the other may take the form of an annulus or spider. The air is drawn in through the centre or eye of the annular shroud and impelled outwardly by the blades. If the blades are truly radial, the efficiency of the impeller will be the same for both directions of rotation, whereas by curving the blades a higher efficiency may be obtained for one direction of rotation, but not for the other direction.

According to the present invention a fan or blower is provided with blades the inlet and/or leaving edges of which are disposed at an angle to the radial direction, the mounting of the blades in the impeller being such that said angle can be reversed from one side to the other of the radial direction. The blades are preferably mounted upon the shrouds so as to be capable of pivoting, when permitted to do so, about axes substantially parallel to the axis of the impeller and substantially equidistant from the ends of the appurtenant blades, the latter each being curved to a form which is symmetrical about an axis normal to the centre of the blade surface and passing through the pivotal axis aforesaid. The reversal of the blades when desired is thus effected by a pivotal movement.

The blades may be movable individually or as a whole, while pivotal movement thereof may be effected by hand or automatically upon reversal of the direction of rotation of the impeller. Automatic movement of the blades into the position appropriate to the direction of rotation may be adapted to be effected by inertia forces which are set up upon rotation of the impeller and in some cases cam devices may be provided to effect or to assist in the movement of the blades, when necessary, into the appropriate position.

The inclination of the blades for each direction of rotation may have a predetermined preferred value or may be adjustable, and according to a further feature of the invention the blades may be weighted and pivoted in such a manner that the inclination of the blades may be varied by centrifugal action according to the speed of rotation of the impeller.

In order that the invention may be clearly understood and readily carried into effect a number of constructions according thereto are hereinafter described with reference to the accompanying drawings, wherein—

Figs. 1, 2 and 3 are respectively a sectional elevation, cross section and plan showing a portion of an impeller and blade arranged according to one constructional form of the invention.

Figs. 4 and 5 are respectively a sectional elevation and plan showing a modified construction.

Figs. 6 and 7 are respectively a sectional elevation and cross section showing a construction in which the blades are automatically reversible upon reversal of the direction of rotation of the impeller.

Fig. 8 is a diagrammatic view illustrating certain of the blades of an impeller such as shown in Fig. 6, in the positions which they occupy when the impeller is at rest, and

Fig. 9 is a sectional elevation on line XIII—XIII of Fig. 10, and Fig. 10 is a cross section on line XIV—XIV of Fig. 9, showing a further modified construction according to the invention.

Similar parts are indicated by similar reference numerals in all the figures.

The blades 1 in the examples illustrated are of a curved form, advantageously pressed from sheet metal with lugs 2 at each side from which bearing sleeve portions 3 are extruded. The blades are pivotally mounted in the shroud rings 4, 5 of the impeller

in any suitable manner, for example as indicated in Fig. 2, or with the addition of studs 6 as indicated in Fig. 7.

In all cases the curved form of the blade is symmetrical about an axis such as I—I (Fig. 1) normal to the centre of the blade surface and passing through the axis about which the blade is rotatable, which axis it will be observed is parallel to the axis of rotation of the impeller. In the examples shown the outer or leaving edge 8 of the blade is disposed substantially radially of the impeller when in the normal or operative position, while the inner or inlet edge 9 forms a substantial angle with the radial direction. The forms or angles of the inlet and leaving edges of the blades may obviously be otherwise shaped and arranged as may be preferred according to the well known principles of design as applied to the conditions under which the impeller is required to operate.

In the construction shown in Figs. 1, 2 and 3, the blade 1 is held in operative position by means of a U-shaped member 10 secured to the shroud 4 by a nut 11 and bolt 12, one limb of the U-member forming an abutment for the back or convex side of the blade near the leaving edge, while the other limb coacts with the side of the nut 11 to lock same. The inner or inlet edge portion 9 of the blade 1 rests with its back or convex side against an abutment pin 13 secured to the shroud 4, and is pressed firmly against said pin when the bolt 12 is tightened.

The blade when in the position shown in Fig. 1 is adapted for clockwise rotation of the impeller. If it is desired to rotate the impeller in the opposite direction the blade should be reversed into the position indicated by dotted lines. This may be accomplished by slackening the bolt 12 to permit the U-member 10 to be removed, whereupon the blade 1 may be rotated until the portion 8 which previously constituted the leaving edge rests with its back against a second abutment pin 13^1. The U-member 10 may then be reapplied so that one limb engages the convex side of the outer portion of the blade in its new position. It will be observed that in this arrangement the centre of the bolt 12 is in a position to be intersected by a radius II—II of the impeller passing through the pivotal axis of the blade, while the pins 13, 13^1 are equally spaced on either side of such radius.

Figs. 4 and 5 show a construction substantially similar to that shown in Fig. 1, but in which tongues, 14, 14^1 pressed out of the material of the shroud 4 are provided instead of the U-member 10 of Fig. 1. In order to reverse the blade from the position shown in Fig. 4, it is only necessary to depress the tongue 14 and to rotate the blade in the anticlockwise direction until it is engaged by the tongue 14^1, as indicated by dotted lines in Fig. 5. The tongues 14, 14^1 are preferably resilient.

With constructions such as described above with reference to Figs. 1–5 it is necessary to reverse each blade individually by hand. Such an arrangement has the advantage of simplicity of construction and would generally be used in cases where the impeller is required to operate with a constant direction of rotation, which direction is however unknown at the time the impeller is constructed. In cases where the impeller may be required to undergo frequent changes of direction however, it is preferred to employ a construction whereby all the blades may be automatically reversed or simultaneously reversed by a simple operation.

Constructions may be provided according to the invention whereby the blades may be automatically reversed upon reversal of the direction of rotation of the impeller. The inertia of the blades or of suitable weights connected thereto may be utilized for this purpose, and in some cases cam devices may be provided to assist in the reversal. The blades may be held in position by centrifugal action when the impeller is in operation.

Figs. 6–8 show an arrangement in which each blade has connected to it a weight 16. The weight is carried by a pin 17 which passes through a slot 18 in the shroud 4, and is spaced at a suitable radius from the pivot 6. Abutment pins 19, 20 on the shroud 4 coact with the bent-up sides 2 of the blade 1 to limit the inclination of the blade. It will be evident that upon rotation of the impeller in either direction, the weight 16 and the mass of the blade will tend to take up a position on the side of the pivot 6 away from the direction of rotation, and the centrifugal force of the weight 16 when the impeller is speeded up will tend to turn the blade still further about its pivot and thus urge the blade into contact with the limiting abutment pin 19 or 20 as the case may be. For clockwise rotation of the impeller, the parts will occupy positions as shown in Fig. 6.

If desired a cam device may be provided to effect positive reversal of the blade, for example a ring member such as indicated at 21 (Figs. 6–8) may be secured to a stationary portion of the impeller casing, said ring being flattened somewhat at the top as shown at 22 in Figs. 6 and 8. The weights 16 are preferably rotatable about their pins 17 and the arrangement is such that if the impeller is rotated very slowly so that centrifugal and inertia forces are negligible, the blades will be caused by gravity to fall into positions such as indicated in Fig. 8 as they come to the top of the impeller, the direction of rotation being assumed to be in the clockwise direction. The weights will roll on the cam rail 21 as they approach and recede from

the uppermost position, but will hang freely suspended when opposite to the flattened portion 22. Thus, as a blade passes from the uppermost position either to one side or the other according to the direction of rotation, it will be positively turned as its weight 16 comes into contact with the surface of the cam 21, the weight being moved rearwardly with respect to the direction of rotation. Each blade will be similarly moved in the appropriate direction during a complete rotation of the impeller, and will be further turned into the required operative position by centrifugal action as the speed of the impeller increases.

If the blades are themselves sufficiently heavy, the roller weights 16 may be dispensed with, a projection on the blade serving instead to effect the reversal by making contact with a guide or the like during starting periods.

It is not necessary that the weights employed to ensure the desired positioning of the blades be secured directly to the blades. Figs. 9 and 10 show by way of example a construction in which a weight 23 is carried by an arm 24 pivotally mounted externally on the shroud 4 upon the sleeve portion 3 of the blade 1 which passes through and is journalled in the shroud. The sleeve portion 3 is formed with a flange 25, the lower part of which is cut away, while the upper part is shaped to provide stops adapted to coact with upstanding portions 26 of the arm 24 so as to limit the angular movement of the arm relatively to the blade 1. The action of the device is substantially similar to that of the weighted blades previously described above, the arrangement being however preferably such that when the blade is forced by the weight into contact with the stops on the shroud in the limiting position of the blade, the arm and weight are disposed substantially at right angles to a radius of the impeller passing through the pivotal axis of the blade. In this way the effect of the centrifugal force upon the weight may be utilized to a maximum. With such a construction it is also not necessary to form slots in the shrouds such as may reduce the efficiency of the impeller.

Constructions such as above described with reference to Figs. 6–10 may be employed for the purpose of providing an impeller wherein the blades take up various different angular positions at different speeds of the impeller and thereby cause considerable variation in the quantity or velocity of the air or other fluid passing through the impeller. That is to say the impeller may be adapted to deliver different predetermined quantities of air or the like at different speeds, which quantities may vary to a greater extent than would be possible merely by varying the speed in a similar manner when using blades of fixed angular position. For this purpose it is only necessary to select a suitable weight for the pivoted blade and to dispose same so that a balance is effected between the centrifugal force upon the blade and the force exerted thereon by the air passing through the impeller at the various inclined positions of the blades and the corresponding speeds of rotation.

From the foregoing it will be appreciated that the invention provides a fan or blower which may be operated with good efficiency for either direction of rotation, and that the invention may be carried out in a variety of constructions which may be subject to various modifications in addition to those more specifically referred to above, without departing from the scope thereof.

I claim:

A fan for delivering air radially thereof comprising a plurality of shroud rings, a plurality of curved blower elements pivotally mounted between the shroud rings with the axis of the elements parallel to the axis of the fan, said elements being curved symmetrically with respect to the axis thereof, stops on the shroud for maintaining the blower elements in either of two positions, a weight member attached to each of said blower elements and a cam member cooperating with said weight members for reversing the blower elements upon reversal of the direction of rotation of the fan.

In testimony whereof I have hereunto subscribed my name this 14th day of October, 1929.

NORMAN FRANK TILBURY SAUNDERS.