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G. A. DEAN

3,083,893

CONTRA-ROTATING BLOWER

Filed June 2, 1960

FIG. 1

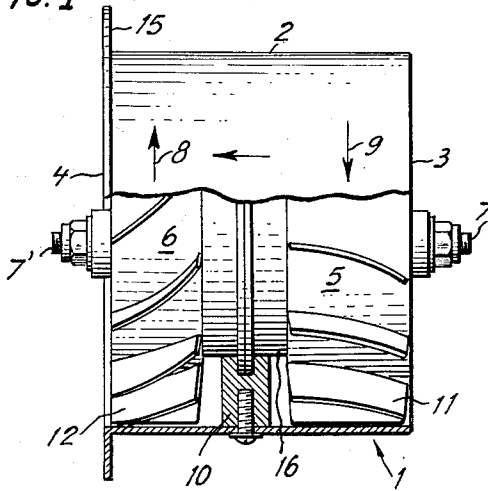


FIG. 2

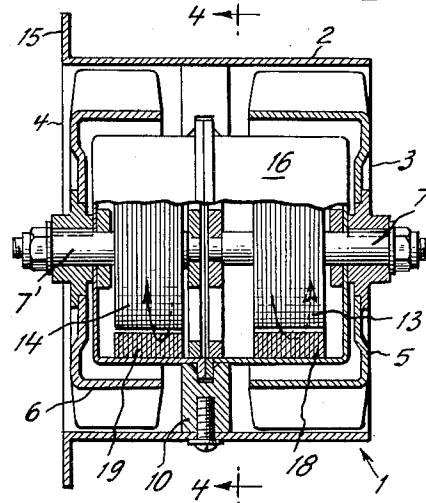


FIG. 3

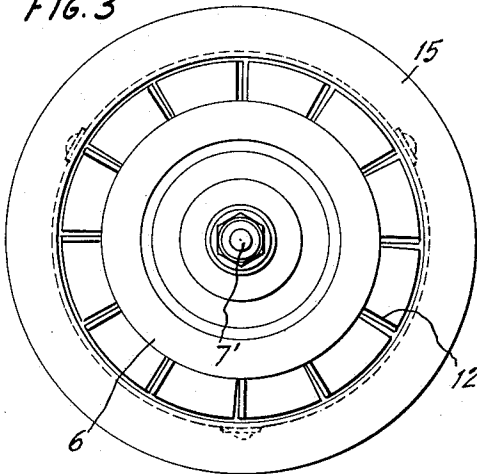
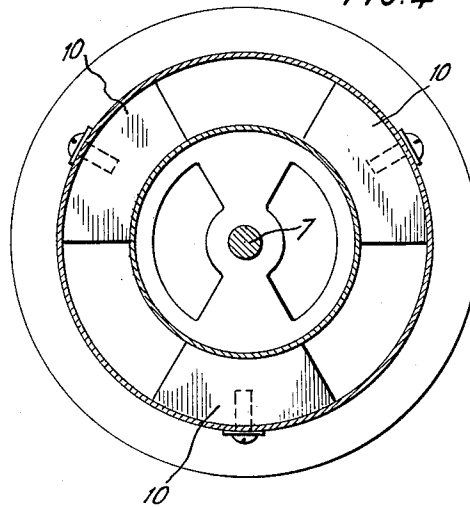


FIG. 4



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1

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CONTRA-ROTATING BLOWER

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2 Claims. (Cl. 230—117)

This invention is directed to means for causing a flow of air, and more particularly to an improved form of blower or pump which may also be used as a compressor.

In the past, many types of blowers and pumps have been known and operated under a wide variety of conditions. However, there has been a need for a small, efficient pump or blower which will operate quietly and move a maximum volume of fluid at high pressure with a minimum of noise and horsepower requirements.

It is, therefore, among the objects of this invention to provide a pump or blower which is of simple construction and hence very durable.

It is also among the objects of this invention to provide a pump or blower which is capable of moving a very substantial volume of fluid at high pressure with a minimum of noise.

It is further among the objects of this invention to provide a pump or blower which will yield the effect of a high speed operation but which actually operates at very moderate speeds.

It is still further among the objects of this invention to provide an efficient, quiet pump or blower of basically simple construction, suitable for a wide variety of uses.

In practicing this invention there is provided a cylindrical casing having an inlet and an outlet at the opposite ends thereof. A rotor is mounted near the inlet and an impeller is mounted near the outlet. Both the rotor and impeller are rotatable about an axis which is the axis of the casing and they are provided with a plurality of blades radially disposed and preferably around the peripheries of the rotor and impeller. Means is provided for causing the rotation of the rotor in one direction and rotation of the impeller in the opposite direction so that relative to each other, the rotor and impeller are contra rotating.

In the preferred form of the invention a compound electric motor is mounted in the cylindrical casing between the rotor and the impeller. This compound motor consists in its simplest form of two electric motors placed back to back within a single housing. One of the motors is adapted to cause a clockwise rotation of its shaft and the other is adapted to cause counter-clockwise rotation of its shaft. The fluid (such as air) will in this case flow through the annular space between the inside of the casing and the electric motor housing or rotor, and the impeller peripheries.

It has also been found preferable to provide blades on the rotor of substantially high pitch which, therefore, impart a very substantial circumferential velocity to the fluid, with a comparatively small axial velocity. The impeller, on the other hand, is provided with blades of a fairly flat pitch, which tends to impart very little circumferential velocity to the fluid and a very substantial axial velocity.

It has also been found desirable in this form of the invention to support the motor housing by means of a plurality of ribs fixed between the inner wall of the casing and the outer wall of the housing. These ribs most desirably will consist of substantially flat strips set at an appropriate angle to the axis of the casing so as to offer a minimum of resistance to the flow of fluid thereacross.

In the accompanying drawings constituting a part hereof, in which like reference characters indicate like parts,

2

FIG. 1 is a side view of the pump or blower with the casing partially cut away;

FIG. 2 is a view similar to that of FIG. 1, with some parts in section and others broken away for clarity;

FIG. 3 is an end view as seen from the left side of FIG. 1; and

FIG. 4 is a sectional view along the line 4—4 of FIG. 2.

Pump 1 comprises casing 2 having inlet 3 and outlet 4. Mounted in said casing on shafts 7 and 7' are rotor 5 and impeller 6, respectively. Rotor 5 is adapted for motion as indicated by arrow 9 in FIG. 1 and impeller 6 moves as indicated by arrow 8 in the same figure.

A compound electric motor in housing 16 is secured in casing 2 by ribs 10. The electric motor consists of two halves, one having revolving element 13 and the other having revolving element 14, which are secured respectively to rotor 5 and impeller 6. Coacting therewith are stators 18 and 19, respectively, all as shown in FIG. 2. Shafts 7 and 7' project from the appropriate side of housing 16 and carry rotor 5 and impeller 6, respectively.

The pitch of blades 11 on rotor 5 is substantially high while the pitch of blades 12 on impeller 6 is quite flat. Thus in operation, the fluid enters inlet 3 and is immediately given a very substantial circumferential motion by virtue of the movement of rotor 5 in the direction indicated by arrow 9, coupled with the angle of blades 11. Upon emerging from the influence of rotor 5 and its associated parts, the fluid has a small axial component of motion and a very large circumferential velocity. The fluid then comes into contact with impeller 6, rotating in a direction opposite from that of rotor 5, as indicated by arrow 8.

The structure is rendered compact by the arrangement of the rotor 5 and the impeller 6 with respect to the motor housing 16. That is to say, both the rotor and impeller are substantially cup-shaped so that the same fit around the outside of the housing 16, as clearly shown in FIG. 2.

In operation, air enters the rotor 5 and the energy of the motor 13 imparts a radial velocity to the air. If the energy were left radial it would dissipate itself radially, and thus the air would not raise substantially in pressure. However, in this case, the impeller 6 straightens the radial component and converts this radial energy to the axial flow, thus actually increasing the pressure level of the system. By putting the additional energy of the impeller motor into the air which raises the overall pressure level, more than twice that which would be obtained from the conventional rotor and stator system. In other words, the impeller does two things: it reclaims the radial energy of the rotor and also imparts the additional energy of its own motor and, by the selection of the correct angles on both the rotor and the impeller, axial flow results at the exit.

The high pressure air leaves the blower through outlet 4. Thus the fluid enters inlet 3 in a straight line and leaves outlet 4 with substantially the same motion. This is desirable to avoid creating excessive turbulence in the system, and it reduces the noise even though the air is at high pressure.

While only one specific embodiment of this invention has been described, such changes as would be obvious to one skilled in the art may be made without departing therefrom. For example, the rotor and impeller may be driven by an external motor having a shaft at right angles to the axis of the casing and connected to the rotor and impeller by a set of bevel gears. This alternative possesses the advantage of having considerably less obstruction in the casing to the flow of fluid therethrough. In addition, it is possible to place the blades (or their equivalent)

3

lent) in the flat face of the rotor and impeller intermediate the axis and the periphery.

In view of the foregoing, it will be seen that this invention is to be broadly construed and not to be limited except by the character of the claims appended hereto.

What is claimed is:

1. A pump comprising a casing having an inlet and an outlet, a compound electric motor having two sections placed in side-by-side relation and having shafts therein in axial alignment in the casing, the shafts of said motor sections being rotative in different directions, one of the shafts carrying a vaned rotor adjacent to the inlet, the second shaft carrying a vaned impeller adjacent to the outlet, and the vanes on the rotor are of a higher pitch than the the vanes on the impeller.

4

2. A pump as provided for in claim 1, wherein the rotor and impeller are each in the form of a cup-shaped element extending around the outside of the motor sections, the vanes for said rotor and impeller projecting from their outer faces.

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