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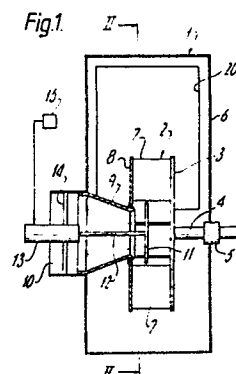
71 Applicant: KEITH BLACKMAN LIMITED  
Boughton Road  
Rugby Warwickshire, CV21 1BU(GB)

72 Inventor: Cory, William Thomas Worthington  
Millstead Daventry Road  
Kilsby Near Rugby, CV23 8XF(GB)

74 Representative: Kirby, Harold Victor Albert  
Central Patent Department The General Electric  
Company p.l.c. Hirst Research Centre East Lane  
Wembley Middlesex HA9 7PP(GB)

54 **Centrifugal fan with flow control.**

57 A centrifugal fan having the inner edges of the impeller blades (7) extending parallel to the impeller axis incorporates a circular damper plate (11) supported coaxially within the array of blades with its edge closely adjacent the inner edges of the blades, and movable in an axial direction so as to vary the useful width of the blades and thereby the flow rate. The damper plate, being separate from the impeller (2), may be supported in a non-rotatable manner and enables the fan to operate at an efficiency comparable with one having a radial vane damper, but is simpler mechanically as it requires only a single primary moving part.



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The invention relates to centrifugal fans of the kind in which the impeller comprises a back plate carrying an array of blades disposed around a peripheral region of the back plate with their inner 5 edges equally spaced from the axis of rotation to provide an inlet region, commonly known as the impeller eye, into which a gas, such as air, is drawn to replace that which is expelled outwards between the blades as the impeller rotates. In such fans the 10 impeller is normally housed within a casing in the form of a volute provided with an inlet opening which communicates with the eye of the impeller, and an outlet opening communicating with the space around the impeller through which the gas is discharged in 15 use of the fan.

The flowrate of a centrifugal fan can be varied by varying the speed of rotation of the impeller but this is not always desirable or practicable.

20 An alternative is to provide dampers, which may be positioned either on the inlet or outlet side of the fan, depending on the nature of the fan and the characteristics required, and although such dampers tend to lower the fan efficiency to some extent 25 depending on the form employed they have the advantage of simplicity and low initial cost compared with most methods used for varying the impeller speed.

One form of damper in common use consists of a plurality of parallel pivotable blades, usually 30 disposed across the fan outlet, and providing a greater or lesser resistance to the gas flow depending upon their angular setting.

Another form of damper makes use of radially extending pivotable vanes at the fan inlet. In use of 35 a centrifugal fan full pressure is developed by the fan only when gas enters the impeller eye axially and without swirl. The radial vane damper is arranged to develop

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a degree of pre-rotation of the gas in the direction of impeller rotation, and as a result the pressure developed by the fan is reduced, with a consequential reduction in flowrate and power absorption. Such  
5 damper permits the fan to operate at a greater efficiency than the parallel blade dampers referred to above, but the mechanism required to enable the blades to rotate in synchronism is considerably more complicated.

It is known that for a given blade arrangement  
10 and speed of impeller rotation the flowrate is a function of the blade width, and this is made use of in providing an alternative form of damper which has advantages over the forms of dampers above described, as will be apparent from the following description.

15 According to the invention a centrifugal fan of the kind referred to has the inner edges of impeller blades extending parallel to the impeller axis and incorporates a damper plate in the form of a circular disc supported coaxially within the array of blades,  
20 with its edge closely adjacent the inner edges of the blades, the disc being movable in an axial direction within the array of blades.

It has been found that such a damper effectively varies the useful width of the impeller blades, and  
25 enables the fan to operate at an efficiency which is comparable with one having a radial vane damper, but is considerably simpler mechanically, requiring only a single primary moving part, and moreover, is able to give stable control to almost zero flow, added resistance  
30 being virtually negligible.

The axial movement of the damper plate, which is conveniently supported in a non-rotatable manner, may be achieved by means of a pneumatic, hydraulic or electrically operated actuator, which may be controlled  
35 automatically in response to a control signal derived

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in any suitable way, for example in dependence, either directly or indirectly, upon the fan output; however manual control means may alternatively or additionally be provided if required.

5           The fan impeller can be driven by an electric motor or by any other suitable drive means. A variable speed electric motor may be used in association with the movable damper plate to give an additional degree of control.

10           The invention is particularly applicable to blowing systems utilising relatively wide impellers of high specific speeds, a substantial range of control being possible. With the damper plate acting on width operation is unaffected by blade shape, and the impeller  
15 blades can therefore take any of the forms commonly employed in centrifugal fans; for example the blades may be backwardly inclined, backwardly or forwardly curved or of aerofoil section, provided their inner edges are parallel to the impeller axis as above des-  
20 cribed.

One centrifugal fan in accordance with the present invention will now be described by way of example with reference to Figures 1 and 2 of the accompanying schematic drawing, in which

25           Figure 1 represents in diagrammatic form an axial section through the fan, and Figure 2 represents a transverse section in the plane indicated by the line II-II of Figure 1.

The fan comprises, in the usual way, an outer  
30 casing 1 in the form of a volute having inlet and outlet openings 10, 20 and rotatably supporting within it an impeller 2, the impeller comprising a backplate 3 carried by a shaft 4 which extends through a bearing 5 mounted in the rear wall 6 of the casing for connection  
35 to a suitable drive member (not shown) such as an



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electric motor.

The backplate 3 supports an array of blades 7 disposed uniformly around the front face of the backplate, and having radially inner edges extending parallel to, and spaced equidistantly from, the impeller axis. An annular shroud 8 is attached to the front edges of the blades 7, its inner edge curving forwardly and surrounding the adjacent end of a stationary inlet venturi 9 which communicates with the inlet opening 10 in the front wall of the casing in known manner.

In accordance with the invention the fan incorporates a damper comprising a circular plate 11 supported coaxially within the array of impeller blades 7, and of a diameter such that its edge lies close to the inner edges of the blades with only a small clearance. The plate 11 is carried by an axially extending rod 12 which projects outwards through the inlet venturi 9, and is movable axially by means of an actuator 13 of any convenient kind, supported from the casing 1 by radially extending tie rods 14.

Movement of the actuating rod 12 alters the position of the damper plate 11 with respect to the impeller blades 7, and it has been found that this effectively controls the flowrate, by varying the useful width of the blades, without any substantial loss of fan efficiency, and with the minimum of moving parts. The flowrate can be varied from practically zero with the damper plate 11 in a withdrawn position closely adjacent the inlet venturi 9, to a maximum value when it lies close to the backplate 3.

The actuator 13 can be operated pneumatically, hydraulically or electrically or in any other convenient manner, either by manual or servo control as may be convenient, depending on the nature of the

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installation of which the fan forms part.

In one arrangement the fan may be associated with a temperature responsive sensor, as at 15 arranged to generate an output signal dependent upon 5 temperature and located in a position at which the temperature is responsive to changes in the output of the fan, the output signal controlling the actuator, and hence the position of the damper plate, in the sense which tends to maintain the temperature 10 substantially constant. In an alternative arrangement the temperature sensor may be replaced by another form of sensor responsive to a different condition, for example humidity, which is variable in response to changes in the fan output. Means may be provided for 15 adjusting the output signal, in order to vary the temperature or other condition obtainable by adjustment of the fan output.

Although the impeller blades 7 are shown as planar and backwardly inclined in Figure 2, it will 20 be understood that they can take any of the forms commonly employed in centrifugal fans of the kind with which the invention is concerned.

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CLAIMS

1. A centrifugal fan of the kind referred to having the inner edges of the impeller blades extending parallel to the impeller axis, in which there is incorporated a damper plate in the form of a circular disc supported coaxially within the array of blades, with its edge closely adjacent the inner edges of the blades, the disc being movable in an axial direction within the array of blades.
2. A centrifugal fan according to Claim 1 in which the damper plate is supported in a non-rotatable manner.
3. A centrifugal fan according to Claim 1 or 2, incorporating, for producing the axial movement of the damper plate, an actuator which is controllable automatically in response to a control signal.
4. A centrifugal fan according to Claim 3 including a sensor arranged to generate a signal which is dependent upon a condition variable in response to changes in the output of the fan, and means for applying said signal as a control signal for controlling the actuator, and hence the position of the damper plate, in a manner which tends to maintain said condition substantially constant.
5. A centrifugal fan according to Claim 4 wherein the sensor is responsive to temperature changes.
6. A centrifugal fan according to Claim 2, 3, 4 or 5 wherein the actuator is operable electrically.
7. A centrifugal fan according to Claim 2, 3, 4 or 5 wherein the actuator is operable pneumatically or hydraulically.
8. A centrifugal fan according to Claim 2 wherein the actuator is controllable in response to a manually produced control signal.
9. A centrifugal fan according to any preceding Claim wherein the impeller is driven by a variable

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speed electric motor.

10. A centrifugal fan of the kind referred to constructed and adapted to operate substantially as shown in and as hereinbefore described with reference 5 to the accompanying drawing.



Fig.1.

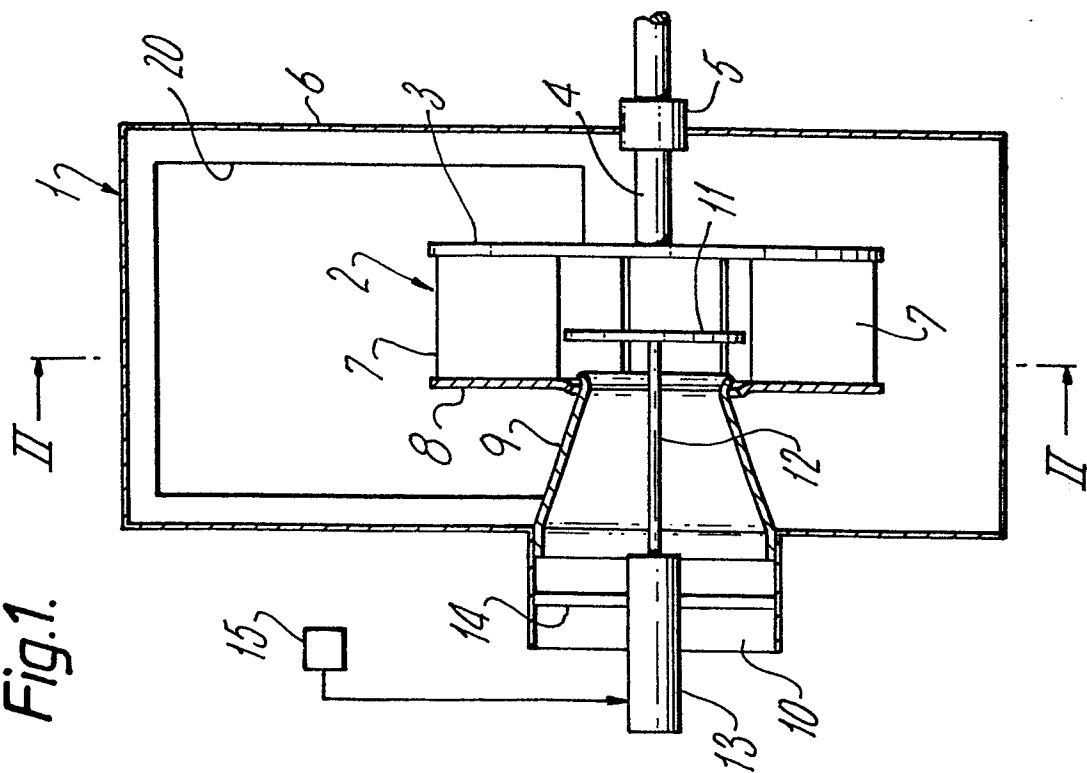


Fig.2.

