

### Fan Wheels

This invention relates to fan wheels and, in particular but not exclusively, to blower wheels driven by motors.

Blowers are extensively used both commercially and industrially to create a current of air. One type of conventional blower is shown in Figure 1. The conventional blower comprises a generally circular housing or enclosure 10 having an outlet channel 12. A generally central circular air intake opening 14 is provided in the upper surface of the enclosure 10. A fan wheel or blower wheel 16 is housed within the enclosure.

Referring now to Figure 2 of the drawings, which shows the blower wheel 16 of Figure 1 in more detail, the blower wheel 16 comprises a support plate 18 and a support ring 20 concentric therewith but spaced apart therefrom. The support ring 20 is provided with the curved profile shown in Figure 2B. A plurality of fan blades 22 are supported between the support ring 20 and the support plate 18. The support plate 18 is provided with an opening or socket 24 for receiving the rotor of a motor 26.

In use, the motor 26 causes the fan wheel 16 to rotate at a relatively high speed and air is drawn into the centre of the fan wheel via the opening 14 in the enclosure 10 and the central opening of the support ring 20. The centrifugal force generated by the rotation of the fan wheel forces the air from the centre of the fan wheel outward towards its periphery and out into the gap between the fan wheel and the enclosure. The fan blades are curved to minimise friction, and the direction of rotation of the fan wheel 16 is opposite to the direction of curvature of the fan blades 22, i.e. clockwise in the case of the wheel shown in Figure 1B. Thus, as the wheel rotates it produces a centrifugal force which forces air from the centre of the wheel out towards its periphery and into the gap between the wheel and the enclosure. The air is pushed around the outside of the fan

wheel 16 within the enclosure until it is expelled from the enclosure through the outlet channel 12.

Obviously, there are a wide range of applications in which fans and blowers may be required. Therefore, the levels of air flow or air volume required to be expelled from a fan or blower will also vary widely. Furthermore, it may be necessary to vary the level of air flow generated by any one fan or blower.

One way of achieving this would be to provide a variable speed motor to drive the fan wheel. It is well known that if the speed of rotation of the fan wheel is increased, then the static pressure generated by rotation of the wheel is increased, and the level of air flow generated is increased accordingly. Similarly, a reduction in speed of rotation will produce a corresponding reduction in the level of air flow generated.

However, there are a number of disadvantages associated with this solution. Firstly, variable speed motors are much more expensive than single speed motors. Thus, the use of a variable speed motor would substantially increase the overall cost of a fan or blower unit. Furthermore, variable speed motors still have a maximum speed threshold, beyond which the speed of rotation cannot be increased any further.

It is also well known that, if the speed of rotation is kept constant, then an increased diameter wheel will generate a higher air pressure and therefore an increased level of air flow. Similarly, a lower level of air flow can be achieved if a smaller diameter fan wheel is used. However, it is only practical to manufacture a finite number of different sized fan wheels. Therefore, it is often found that one commercially available fan wheel may be too powerful, whereas the next size down is too weak.

According to the present invention, there is provided an extension member for attachment to a blade of a fan of a blower of the type having a fan wheel supporting a plurality of peripheral fan blades, the outermost edges of which are substantially parallel with each other, said extension member comprising a rigid elongate strip, and

means for attaching said strip to a fan blade such that it extends beyond the outermost edge thereof.

The extension member of the present invention effectively enables the diameter of a commercially available fan wheel to be increased according to air flow requirements, without actually having to find or make a fan wheel of the required diameter. It can be used with AC or DC motor driven fans or blowers.

The extension member is preferably provided with a flange, by means of which the extension member is attached to a fan blade. The flange is preferably formed integrally with the rigid strip. The plane of the strip is preferably at an angle to a tangent at the tip of the fan blade, when in use. The flange is preferably curved so as to lie substantially flat against the surface of the fan blade, when in use. It has been found that the optimum angle between the strip and the fan blade is preferably in the range 20-30°, more preferably 25-29° most preferably around 27 degrees. Thus, in use, the flange is attached to the fan blade such that it lies substantially flat against the blade, and the strip extends beyond the edge of the fan blade at an angle thereto.

Obviously, the width of the strip, i.e. the amount by which the length of the fan blade is extended by an extension member according to the present invention, will depend on the amount by which the diameter of a particular fan wheel is to be extended. However, a useful range for some applications is 2 to 20mm. In particular extension members with strip widths from 4 to 7mm (e.g. around 5mm), from 8 to 12mm (e.g. around 10mm) or from 13 to 18mm (e.g. around 15mm) have been found to be useful for some applications, using a blower wheel having an initial diameter of 355mm. The length of the extension member is also dependent upon the blower wheel to which it is to be attached, in that the length of the extension member should be substantially equal to the length of the edge of the fan blade to which it is to be attached.

The extension member may be attached to the fan blade by a number of different means, for example, rivets, screws or clips.

The extension member of the present invention can be attached to each fan blade of any type of fan wheel or blower wheel, thereby providing convenient means of boosting the static pressure thereof, but it is particularly suitable for use with a 'backward curve fan' (i.e. the direction of curvature of the fan blades is opposite to the direction of rotation of the wheel, as shown in Figures 1 and 2) having a relatively small number of fan blades. The present invention also extends to a fan wheel having a plurality of fan blades, at least one of the fan blades having an extension member according to the present invention attached thereto. The invention also extends to a fan including such a fan wheel.

An embodiment of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1A is a front view of a conventional blower;

Figure 1B is a plan view of the blower of Figure 1A;

Figure 1C is a side view of the blower of Figure 1A;

Figure 2A is a plan view of a conventional blower wheel;

Figure 2B is a side view of the blower wheel of Figure 2A;

Figure 2C is a perspective view of the blower wheel of Figure 2A;

Figure 3A is a plan view of the blower wheel of Figure 2A, each of the fan blades being provided with an extension member according to an embodiment of the present invention;

Figure 3B is a side view of the blower wheel of Figure 3A; and

Figure 3C is a perspective view of the blower wheel of Figure 3A.

For components of the blower wheel which correspond to the blower wheel described with reference to Figure 2, the same reference numbers will be used in the following description.

Referring to Figure 3 of the drawings, each fan blade 22 of the blower wheel 16 described with reference to Figure 2 is provided with an extension member 28 according to an embodiment of the present invention. As shown in 'Detail B', each extension member 28 comprises an elongate strip 30 and a flange 32 formed integrally therewith at an angle thereto. With particular reference to Figure 3C, the length of the extension member 28 is substantially equal to the length of the edge of the fan blade 22 to which it is to be attached. The width of the strip 30, designated by 'L' in 'Detail B' is dependent upon the amount by which the static pressure of the blower is required to be boosted. However, for a blower wheel of diameter 355mm, extension members having a strip width  $L=5\text{mm}$ ,  $L=10\text{mm}$  and  $L=15\text{mm}$  have been found to be useful.

An extension member 28 is attached by means of its flange 32 to the edge of each fan blade 22, such that the flange 32 lies substantially flat against the fan blade, as shown in 'Detail B'. The strip 30 thus extends beyond the edge of the fan blade 22 at an angle to the plane thereof. The angle 34 between the strip 30 and the plane of the fan blade 22 can be any angle in the range 20 to 30 degrees. However, it has been found that an angle of around 27 degrees is preferable.

The extension member may be attached to the fan blade by any convenient means, for example, screws, rivets (as shown in 'Detail C1') or clips (as shown in 'Detail C2').

The extension members of the present invention have been found in tests to adequately boost the static pressure of a 355mm blower, and the results of tests using extension members having a 5mm strip, a 10mm strip and a 15mm strip are given in the Table 1. For comparison purposes, the results using a 355mm blower without the extension members are shown in the Table 2.

| BLOWER 355B                  |      |      |      |      |
|------------------------------|------|------|------|------|
| L = 5 (mm)                   |      |      |      |      |
| Power Supply (Hz)            | 38   | 40   | 45   | 50   |
| Rotative Velocity (rpm)      | 1140 | 1200 | 1350 | 1500 |
| Total Static Pressure (mmAq) | 18.5 | 18.6 | 21.5 | 23.1 |
| L = 10 (mm)                  |      |      |      |      |
| Power Supply (Hz)            | 38   | 40   | 45   | 50   |
| Rotative Velocity (rpm)      | 1140 | 1200 | 1350 | 1500 |
| Total Static Pressure (mmAq) | 18.7 | 18.8 | 21.7 | 23.9 |
| L = 15 (mm)                  |      |      |      |      |
| Power Supply (Hz)            | 38   | 40   | 45   | 50   |
| Rotative Velocity (rpm)      | 1140 | 1200 | 1350 | 1500 |
| Total Static Pressure (mmAq) | 18.9 | 19.2 | 22.3 | 25.3 |

Table 1

| BLOWER 355A                  |      |      |      |      |
|------------------------------|------|------|------|------|
| Power Supply (Hz)            | 38   | 40   | 45   | 50   |
| Rotative Velocity (rpm)      | 1140 | 1200 | 1350 | 1500 |
| Total Static Pressure (mmAq) | 17.4 | 17.6 | 19.8 | 22.8 |

Table 2

It can be seen that, for example, with a 50 Hz power supply and the speed of rotation of the blower wheel at 1500 rpm, the total static pressure generated by a 355mm blower (alone) is 22.8 mmAq. If each fan blade of the 355mm blower is provided with an extension member having a strip of width 5mm, the static pressure generated is increased to 23.1 mmAq. If extension members having a strip width of 10mm are used, this figure is further increased to 23.9 mmAq. In the case of extension members with a 15mm strip width, this is yet further increased to 25.3 mmAq. Thus, the static pressure

generated by any particular blower can be significantly increased, simply by using extension members according to the present invention.

The present invention has been described above purely by way of example, and modifications can be made within the spirit of the invention. The invention also consists in any individual features described or implicit herein or shown or implicit in the drawings or any combination of such features or any generalisation of any such features or combination.

**CLAIMS:**

1. An extension member for attachment to a blade of a fan of a blower of the type having a fan wheel supporting a plurality of peripheral fan blades, the outermost edges of which are substantially parallel with each other, said extension member comprising a rigid elongate strip, and means for attaching said strip to a fan blade such that it extends beyond the outermost edge thereof.
2. An extension member according to claim 1, wherein the means for attaching the strip to a fan blade comprises a flange which is attached to or formed integrally with an elongate edge of the strip.
3. An extension member according to claim 1 or claim 2 wherein the plane of said strip is at an angle to a tangent at the tip of the fan blade, when in use.
4. An extension member according to any preceding claim, wherein said flange is curved so as to lie substantially flat against the surface of the fan blade, when in use.
5. An extension member according to claim 4, wherein the angle between the strip and the tangent at the tip of the fan blade is in the range 20 to 30 degrees.
6. An extension member according to claim 5, wherein the angle between the flange and the strip is 25 to 29 degrees, most preferably around 27 degrees.
7. An extension member according to any preceding claim, wherein the width of the strip is in the range from 2 to 20 mm.
8. An extension member according to claim 7, wherein the width of the strip is from 4 to 7mm or from 8 to 12mm or from 13 to 18mm most preferably around 5mm or around 10mm or around 15mm.



9. An extension member according to any preceding claim, wherein the means for attaching the strip to a fan blade comprises a screw or a rivet or a clip.
10. An extension member substantially as herein described with reference to Figure 3 of the drawings.
11. A fan wheel having a plurality of fan blades, at least one of said fan blades being provided with an extension member according to any one of the preceding claims.
12. A fan wheel according to claim 11, wherein each of said fan blades is provided with an extension member according to any one claims 1 to 10.
13. A fan wheel according to claim 11 or claim 12, wherein the length of the or each extension member is substantially equal to the length of the fan blade to which it is attached.
14. A fan wheel substantially as herein described with reference to Figure 3 of the drawings.
15. A fan comprising a fan wheel according to any one of claims 11 to 13 housed within an enclosure.
16. A fan substantially as herein described with reference to Figure 3 of the drawings.