A frame for the inlet of a fan having a fan wheel of either the axial flow or radial flow type, wherein the frame comprises an outer hollow cylindrical ring facing the inlet, an inner ring of smaller diameter facing the fan wheel and an abrupt transition between the rings provided by an annular flange. The ratio of the diameters of the inner and outer rings is within a critical range and is related to the length of the rings so that the air flow into the fan wheel generates a toroidal whirling and tumbling of the flow in the corner between the outer ring and the annular flange.
AIR INLET THROAT FOR FANS

The present invention relates to an air inlet throat for fans with a fan wheel for the transport of a gaseous medium, which comprises a frame surrounding the air inlet, said frame consisting of at least two rings of a certain width and of different diameters and arranged close to each other and having a decreasing cross section area for the gaseous medium in the flow direction of same.

The fan wheel of such an air inlet arrangement is commonly located in the ring having the smallest diameter and the ring with the greater diameter is located at the inlet passage for the gaseous medium and the rings are mutually joined in pairs by means of an annular ring thereby creating an abrupt diminishing cross section area for the flowing gaseous medium being transported by the fan wheel due to that the outer and inner diameters of said annular flange substantially correspond to the diameter of the great ring respectively of said small ring, said abrupt diminishing cross section area being arranged to create a toroid-like part of said gaseous medium rolling against said annular flange.

For such air inlets for fan wheels — where the air inlet is circular — there is in the prior art of manufacturing such devices with a continuously decreasing cross section flow area the demand that the inlet for the fan must be manufactured with double-bent surfaces. This has — from manufacturing view points — been a time wasting and — with respect to the tool costs — very expensive way of fabrication. Such conventional air inlets for fans necessitated often earlier to be manufactured by casting or by using some kind of plate possible to be deformed in plastic machining.

It is an object of the present invention to make the fan air inlet of at least two conventional separately manufactured rings of different sizes i.e. of a certain width and of different diameters the rings being arranged close to each other. The fan wheel is to be located in the ring having the smallest diameter size and furthermore the ring with the greater diameter is to be located at the inlet passage for the gaseous medium, the rings being mutually joined together in pairs by means of an annular flange. Due to this arrangement is created an abrupt diminishing cross section area for the flowing gaseous medium, the outer and the inner diameters respectively of this annular flange corresponding with the diameters of the greater respectively smaller ring, said abrupt decreasing cross section area being utilized to create a toroid-like part of said gaseous medium which will caused to whirl and tumble around against the said annular flange.

According to a preferred embodiment of the present invention object the dept (L) of the two rings calculated in the flow direction of the medium and the diameters $D_1$ (the smaller ring) and $D_2$ (the greater ring) respectively of which are so manufactured that:

$$(0.3D_2/D_1 - 0.3) < L/D_1 < (2.25D_2/D_1 - 2.45)$$

at the same time as

$$1.13 < D_2/D_1 < 1.3$$

When the fan consists of an axial fan the fan wheel may according to a suitable embodiment be arranged in the ring having the smallest diameter. When the fan consists of a radial fan the air inlet may according to another suitable embodiment be carried out with an axial slot (clearance) between the ring of the small diameter $D_1$ and the fan wheel or alternatively be so made that the ring of the small diameter $D_1$ projects somewhat into the wheel ring of the fan with a radial slot (clearance) between them.

The invention will now be described with reference to the accompanying drawings showing some exemplifying embodiments and wherein

FIG. 1 illustrates a perspective view of an air inlet at an axial flow fan

FIG. 2 shows a cross section of an air inlet and the used designations are defined

FIG. 3 shows an air inlet at radial flow fan with an axial slot (clearance) between the fan wheel and the air inlet

FIG. 4 shows an air inlet at a radial flow fan with a radial slot (clearance) between the fan wheel and the air inlet.

In FIG. 1 the air inlet for an axial flow fan according to the invention is mounted in an aperture of a wall 4. A fan motor 6 driving a fan wheel 7 is arranged in the aperture and the fan air inlet is formed by two concentrical rings 2,3, the ring 2 facing the air flow is carried out with a greater diameter than the other ring 3. The rings are mutually joined by means of an element 1 made as an annular ring the outer diameter of which is equal to the diameter of the greater ring 3. As has been shown by arrows the flow lines of the air flow converge outside the air inlet, while the flow lines at the fan wheel 7 pass to be substantially parallel, which has been marked with flow arrows 9. As has been marked with flow lines 8 there will occur at the outer, ring 2 having the greater diameter a ring-shaped tumbling (rotating) mass of air. This will contribute to and give as a result that the converging air current flowing against the fan wheel will be converted to an air flow directed parallel with the rotation shaft of the fan wheel 7, which flow will turn out to have equally distributed velocity vectors of mutually equal size.

In FIG. 3 and FIG. 4 the invention is exemplified by a radial flow fan with a fan casing 8 and the fan 7 is supported by a shaft 9, resting in bearings 10. The fan wheel 7 is in the embodiment shown in FIG. 3 located with an axial slot (clearance) between the ring 3 and said fan wheel 7, while in the embodiment shown in FIG. 4 the ring 3 projects somewhat in the wheel ring 13 of said fan wheel 7 with a radial slot between these parts.

Tests have evidenced that the invention give a surprisingly good result. An air flow into a duct with a sharp edge give a friction loss coefficient of the size of 1.0, whereas a duct plus a flange as air inlet means gave a friction loss coefficient of about 0.45 and lastly—a duct equipped with an air inlet means in accordance with the invention proved to give a friction loss coefficient of less than 0.1. This although the invention object is composed of a few elements cheap to manufacture and mount.

1. An air inlet throat for fans with a fan wheel for the transport of a gaseous medium, which comprises a frame surrounding the air inlet, said frame consisting of at least two hollow cylindrical rings of a certain width and of different diameters and arranged close to each other and having a decreasing cross section area for the gaseous medium in the flow direction of same, the fan wheel being located coaxial with and adjacent the ring
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having the smaller diameter, the ring of the greater diameter being located adjacent the inlet passage for the gaseous medium, the rings being mutually joined in pairs by means of an annular flange perpendicular to the axis of the rings, thereby creating an abrupt diminishing cross section area for the flowing medium owing to that the outer and inner diameters of said annular flange substantially correspond respectively to the diameters of the greater ring and of said smaller ring, said abrupt diminishing cross section area being arranged to create in the medium flowing into said inlet a toroid-like part of said gaseous medium whirling and tumbling around against said annular flange, the depth (L) of the two rings — measured in the flow direction of the gaseous medium — and the diameters D₁ (the smaller one) and D₂ the larger one) of said rings being such that:

\[(0.3D_2/D_1 - 0.3) < L/D_1 < (2.25D_2/D_1 - 2.45)\]

and the two rings having such sizes that

\[1.13 < D_2/D_1 < 1.3\]

2. An air inlet throat in accordance with claim 1 for an axial flow fan, wherein the fan wheel is located in the ring of the smaller diameter.

3. An air inlet throat in accordance with claim 1 for a radial flow fan, wherein the air inlet of the fan wheel is located adjacent said smaller ring with an axial clearance between the ring of the smaller diameter and the fan wheel inlet.

4. An air inlet throat in accordance with claim 1 for a radial flow fan, wherein the ring of the smaller diameter projects into the inlet of the fan wheel with a radial clearance between them.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,814,538 Dated June 4, 1974

Inventor(s) Lennart S. G. Sjoqvist

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading before [52] U.S. Cl., the following should be added:

[30] Foreign Application Priority Data
August 26, 1971 Sweden........10806/71

Signed and sealed this 17th day of September 1974.

(SEAL)
Attest:

McCoy M. Gibson Jr. C. Marshall Dann
Attesting Officer Commissioner of Patents