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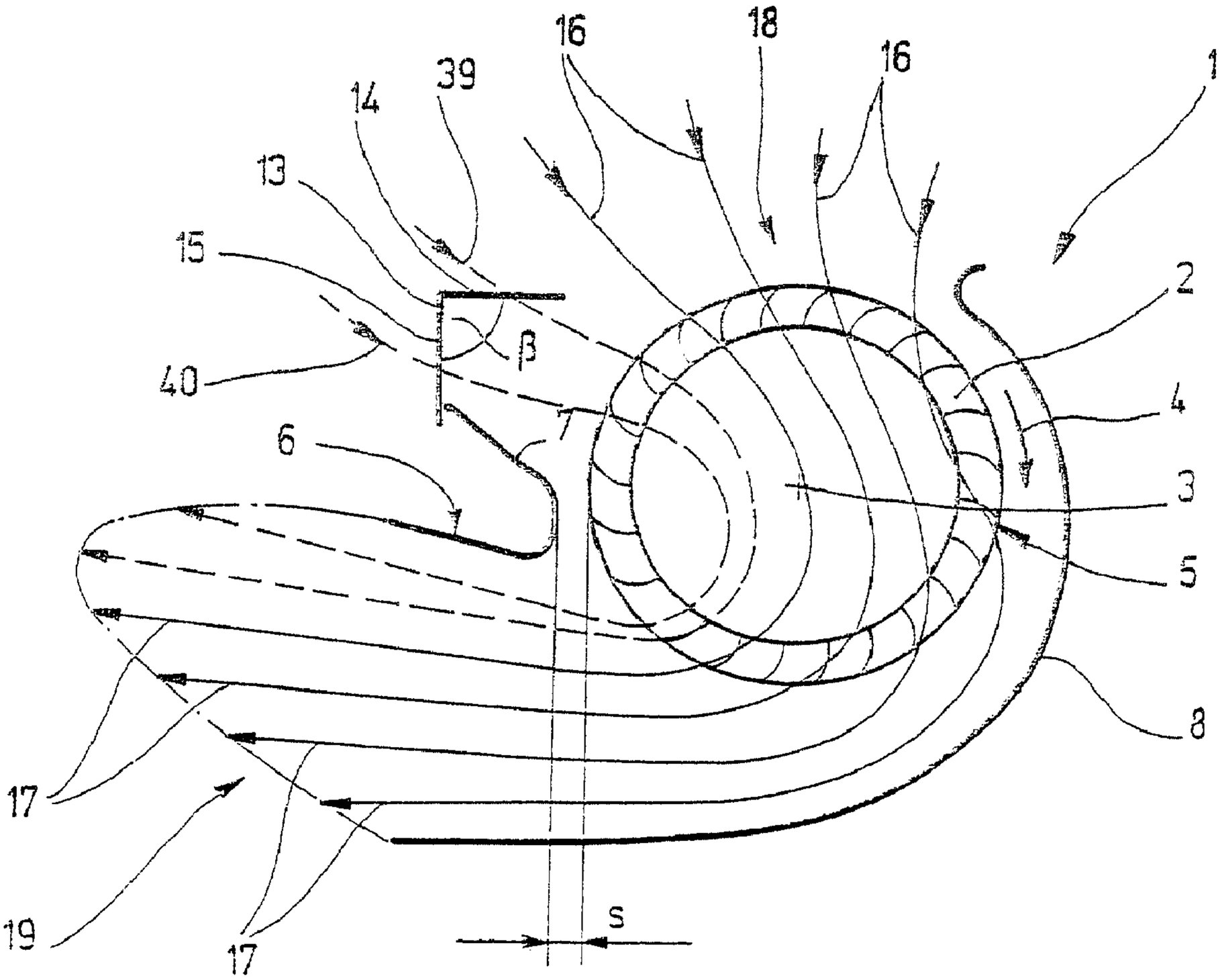
(54) Title: CROSS-FLOW FAN



(57) Abrégé/Abstract:
The invention relates to a cross-flow fan with at least one air inlet orifice, with an impeller and with at least one separating device between the suction side and the delivery side. The separating device cooperates with the impeller. The cross-flow fan is distinguished by an air guide device reducing the flow-around path of the separating device.

Abstract

The invention relates to a cross-flow fan with at least one air inlet orifice, with an impeller and with at least one separating device between the suction side and the delivery side. The separating device cooperates with the impeller. The cross-flow fan is distinguished by an air guide device reducing the flow-around path of the separating device.

The invention relates to a cross-flow fan, with at least one air inlet orifice, an impeller, and at least one separating device between the suction side and the delivery side of the fan, the separating device cooperating with the impeller.

Cross-flow fans of the type mentioned in the introduction are known (DE 34 34 639 A1). They have in each case a vortex former as a separating device between the suction side and the delivery side, the separating device cooperating with the impeller. Between the outer surface of the impeller and the vortex former cooperating with the latter is formed a preferably very narrow gap, the size of which influences the aerodynamic properties of the cross-flow fan. One disadvantage is that cross-flow fans of this type give rise, while they are in operation, to what is known as rotational sound which contributes to forming an overall sound level felt to be disturbing when the cross-flow fan is in operation. The intensity of this rotational sound depends on the gap size between the outer surface of the impeller and the vortex former, on the operating rotational speed of the impeller and on the number of blades. Particularly cross-flow fans with a forwardly curved impeller have, to achieve a relatively high operating pressure, as narrow a gap as possible between the outer surface of the impeller and the vortex former, whilst at the same time having a large number of blades. Cross-flow fans designed in this way are characterized by a very high overall sound level while they are in operation.

US 3,415,443 also discloses a cross-flow fan, in which the separating device is followed by a circulation point for flow optimization and for increasing the fan efficiency.

The invention provides a cross-flow fan which, in comparison with known cross-flow fans, is distinguished by reduced rotational sound or overall sound level while in operation. The fan has at least one air inlet orifice and includes an impeller, at least one separating device between a suction side and a delivery side of the fan, said separating device as a vortex former cooperating with the impeller, and an air guide device arranged in the inlet side airflow. The air guide device is formed as a cover and arranged in a way that the separating device is covered from its end facing away from the impeller to at least its middle zone by said cover so that inflowing air coming from the inlet orifice does not flow along the separating device within the covered area, but is directed directly into the impeller.

As a result, the formation of rotational sound while the fan is in operation is reliably prevented or appreciably reduced, since the air stream coming from the air inlet orifice or a fraction of this does not flow against the separating device and is not diverted there so as to flow around the separating device, at the same time forming an air inlet surge, but, instead, by means of air guidance measures, acquires, even on its way from the air inlet orifice, a direction such that, as intended, it passes the separating device along a shorter flow-around path, in particular a rectilinear path. The air coming from the air inlet orifice is therefore supplied essentially to the impeller. The separating device is located, at least in the region of its end facing away from the impeller and at least of its middle zone, in the cover of the air guide device, so that a detour-free, short and therefore direct airflow path is formed. This leads to a considerable reduction in the rotational sound occurring during the operation of the fan and therefore of the overall noise level. At the same time, an air guide device of this type can be adapted specially to the respective fan geometry. It may, furthermore, be an integral structural part of the fan and/or be in operative contact as an external device with the fan.

Preferably, the air guide device is formed by a cover. An air guide device designed as a cover makes it possible in a relatively simple and reliable way to guide the air coming from the air inlet orifice essentially along a direct path in order to pass the separating device. Moreover, a cover can be adapted in a relatively simple way to the respective geometry of differently designed fans.

Advantageously, the cover covers the separating device on the air inlet side. The air coming from the air inlet orifice is thereby guided essentially directly into the impeller reliably and effectively and does not, as in the prior art, first impinge at least partially onto the side of the separating device, in order to flow from there to the free end of the separating device. The cover may at the same time have a streamlined profile. The result of this is that the reduction in the rotational sound is optimized.

According to a preferred embodiment, the cover is adjacent to the air inlet orifice. This ensures an optimized guidance of the airstream even at the inlet of the fan. It is possible, in this case, for the geometrical configuration of the air inlet orifice to be determined at least partially by the cover.

Advantageously, the cover extends over the entire length of the air inlet orifice, the entire length of the air inlet orifice corresponding to the length of the vortex former. A cover designed in this way thus makes it possible to guide the airstream through the air inlet orifice into the impeller uniformly along the longitudinal extent of the air inlet orifice.

According to two alternative embodiments, the cover may be designed as a planar covering element or as an angle element. In this case, in particular, the geometrical

configuration of the fan and the arrangement of the separating device in relation to the impeller must be taken into account. For example, the vortex former may extend with its rear end as far as a plane containing the air inlet orifice. In this exemplary embodiment, the vortex former is to be covered only in the air inlet direction, which may be carried out by means of a planar covering element (planar plate) as a cover.

According to a further alternative exemplary embodiment, the vortex former can also be arranged, in the air inlet direction, at a distance from the plane containing the air inlet orifice. In this case, the cover is preferably to be designed as an angle element (angle plate), since, on the one hand, the vortex former is to be covered sufficiently in the air inlet direction and, on the other hand, the lateral orifice present because of the distance between the air inlet orifice and the vortex former and extending in the air inlet direction is to be closed off at the edge. In this case, a cover designed as a plate can be adapted in a relatively simple way to the different geometries of various cross-flow fan versions, in order to obtain an optimized guidance of the airflow in the region of the air inlet orifice of the corresponding fan.

The separating device can be designed in the form of a vortex former. In this case, the air sucked in on the inlet side is led in the air inlet direction essentially along a direct path past the vortex former radially into the impeller by means of an air guide device (cover).

Advantageously, the covering depth of the cover is variably adjustable. By covering depth is meant that extent of the cover the variation of which influences the degree of covering with respect to the separating device and, where appropriate, also the size of the passage cross section of the inlet orifice through

which the air flows on the suction side in the direction of the impeller. This allows a flexible adjustment of the desired degree of covering of the separating device and therefore an optimized reduction in rotational sound.

According to one embodiment, the air guide device is formed in one piece with the housing of the fan. An air guide device formed in one piece with the fan housing can be implemented relatively simply in manufacturing terms.

Further advantageous refinements of the fan may be gathered from the description.

The invention is explained in more detail below in a plurality of exemplary embodiments with reference to an accompanying drawing, in which:

Figure 1 shows a diagrammatic cross-sectional illustration of a cross-flow fan with an air guide device according to the invention, according to a first exemplary embodiment; and

Figure 2 shows a diagrammatic cross-sectional illustration of a cross-flow fan with an air guide device according to the invention, according to a second exemplary embodiment.

Figures 1 and 2 show a cross-flow fan, designated in general by 1, which has an impeller 2, mounted rotatably about an axis of rotation 3 according to the arrow 4, with an outer surface 5. The cross-flow fan 1 is provided with a curved air guide plate 8 which extends from an air inlet orifice 18 of the cross-flow fan 1 as far as an air outlet orifice 19 of the cross-flow fan 1. The cross-flow fan 1 has a separating device in the form of a vortex former 6, this

separating device cooperating with the outer surface 5 of the impeller 2. The vortex former 6 is arranged in a position opposite the air guide plate 8 and is provided with a front region 7 which is located opposite the outer surface 5 of the impeller 2 so as to form as small a gap S as possible, which should preferably approach zero. The impeller 2 is connected to a drive, not illustrated, by means of which a rotation of the impeller 2 about the axis of rotation 3 can be generated in order to operate the cross-flow fan 1.

When the cross-flow fan 1 is in operation, by virtue of the rotation of the impeller 2 in the direction of rotation according to the arrow 4 air is sucked in (suction side) according to the arrows 16. The air passes through at least part of the cross section of the impeller 2 and is blown out (delivery side) according to the arrows 17 through the outlet orifice 19 which is delimited by the vortex former 6 and the air guide plate 8. Furthermore, the cross-flow fan 1 corresponding to Figures 1 and 2 is provided with an air guide device 13, by means of which the air coming from the air inlet orifice 18 is led essentially past the vortex former 6 which has the function of a separating device for separating the suction side from the delivery side. In Figure 1, the air guide device 13 is designed as a planar frontal covering element in the form of a cover plate 14, whereas, in Figure 2, the air guide device 13 is an angle element (angle plate) consisting of a frontal cover plate 14 and of a lateral cover plate 15 which are connected to one another to form an angle β of 90°.

In the two embodiments according to Figure 1 and Figure 2, the air guide device 13 provided for covering the vortex former 6 extends over the entire length (perpendicularly to the drawing plane) of the air inlet orifice 18, that is to say parallel to the axis of rotation 3. The frontal cover plate 14 thus serves for

covering the vortex former 6 on the air inlet side, the air inlet orifice 18 being delimited, parallel to the axis of rotation 3, in the longitudinal direction of the cross-flow fan 1 by the frontal cover plate 14, on the one hand, and by the air guide plate 8 on the other hand. The frontal cover plate 14 is contiguous to and flush with the rear region of the vortex former 6 and extends in the direction of the air inlet orifice 18, with an increasing distance from the front region 7 of the vortex former 6 being formed.

In Figure 2, the air guide device 13 is arranged and is offset with respect to the vortex former 6, so that the air inlet orifice 18 is defined by boundary points located essentially in one plane (horizontal in the drawing). Since the vortex former 6 according to Figure 2 is also arranged with its rear region at a distance from the frontal cover plate 14, the air guide device 13 is additionally provided with a lateral cover plate 15. The lateral cover plate 15 prevents the situation where air may pass through the interspace between the vortex former 6 and the frontal cover plate 14 to the impeller 2 and is thus detrimental to an effective covering of the vortex former 6.

Figure 2 illustrates, furthermore, an imaginary frontal and lateral airflow path 39, 40, illustrated in each case as a broken arrow line, which would occur in the cross-flow fan 1 if there were no air guide device 13 (according to Figure 2) provided. The sharply curved, virtually S-shaped profile of the airflow path 39 or 40 is particularly disadvantageous in terms of the formation of rotational sound and therefore in terms of the overall noise level during the operation of the cross-flow fan 1 because of the relatively sharp - and mutually opposed - deflections of the air (reversal of direction of flow) directly upstream of the vortex former 6 and in the impeller 2. By contrast, the cover of the vortex former 6 serves for reducing a rotational

sound which is established during the operation of the cross-flow fan 1 and which constitutes noise pollution felt to be disturbing. Thus, by means of a reduction in the rotational sound, the overall noise level which is established during the operation of the cross-flow fan 1 can be lowered effectively. By means of the vortex former 6, therefore, a separation of the suction side and of the delivery side of the cross-flow fan 1 takes place, whilst the air guide device 13 ensures a favourable flow of air into the cross-flow fan 1.

The air guide device 13 may also be used advantageously in cross-flow fans of a different configuration. For example, the cross-flow fan can have a curved air guide plate extending along part of the outer surface of the impeller.

By means of the air guide device 13, it is advantageously possible to achieve a reduction in the rotational sound with no or virtually no losses of the operating volume flow and of the operating pressure of the air occurring in the fan. There is, advantageously, an optimization of the inflow contour or of the inflow profile of the air sucked into the fan, since the air guide device 13 ensures a reduction in the flow-around path of the separating device 6. The air guide device 13 designed as a cover thus makes it possible to have an optimized flow of the air around the vortex former 6.

According to an embodiment which is not illustrated, the frontal cover plate 14 and/or the lateral cover plate 15 can be movable in terms of its respective covering position, so that an optimization of the degree of covering can be achieved in a relatively simple and flexible way.

Claims

1. A cross-flow fan with at least one air inlet orifice, said fan including:

an impeller,

at least one separating device between a suction side and a delivery side of the fan, said separating device as a vortex former cooperating with the impeller, and

an air guide device arranged in the inlet side airflow,

wherein the air guide device is formed as a cover and arranged in a way that the separating device is covered from its end facing away from the impeller to at least its middle zone by said cover so that inflowing air coming from the inlet orifice does not flow along the separating device within the covered area, but is directed directly into the impeller.

2. A cross-flow fan according to claim 1 wherein the cover covers said at least one separating device on the suction side.

3. A cross-flow fan according to claim 1 or claim 2 wherein said cover is adjacent to the at least one air inlet orifice.

4. A cross-flow fan according to any one of claims 1 to 3, wherein said cover extends over the entire length of the at least one air inlet orifice.

5. A cross-flow fan according to any one of claims 1 to 4, wherein said cover is a planar covering element.

6. A cross-flow fan according to any one of claims 1 to 4, wherein said cover is an angle element.

7. A cross-flow fan according to any one of claims 1 to 6, wherein said cover has a covering depth which is variably adjustable.

8. A cross-flow fan according to any one of claims 1 to 7, wherein said air guide device is formed in one piece with a housing of the cross-flow fan.

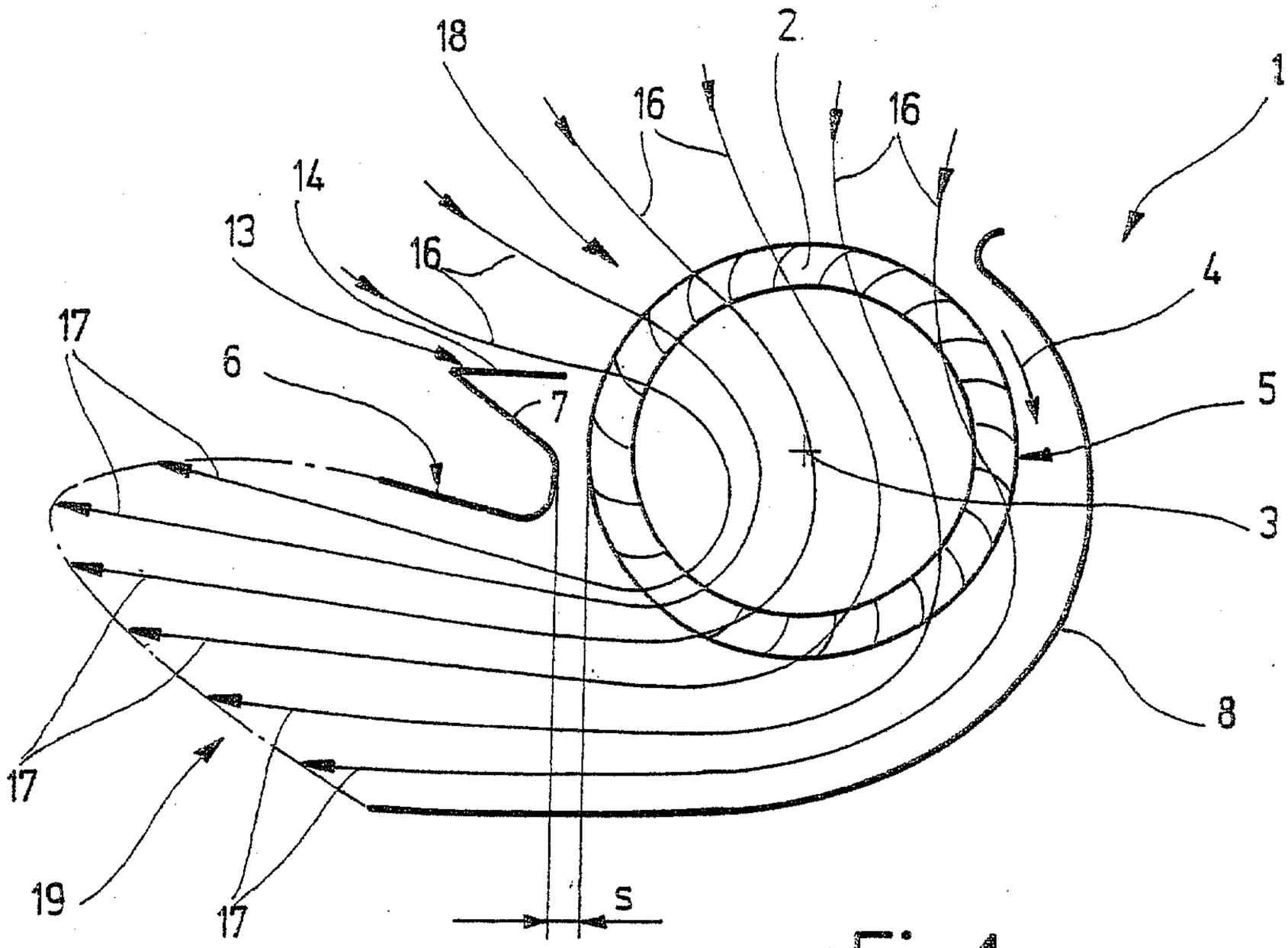

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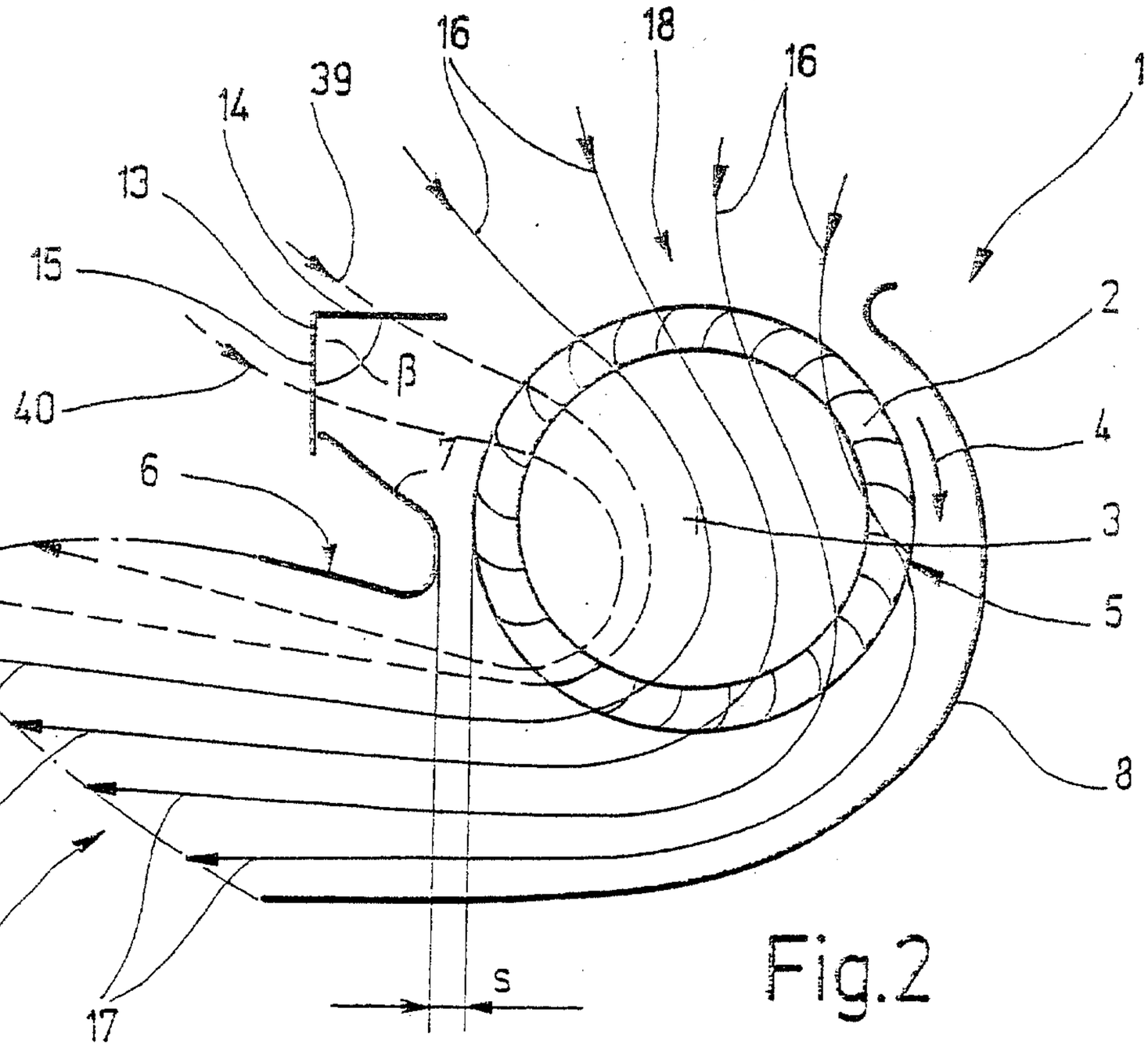
Fig.1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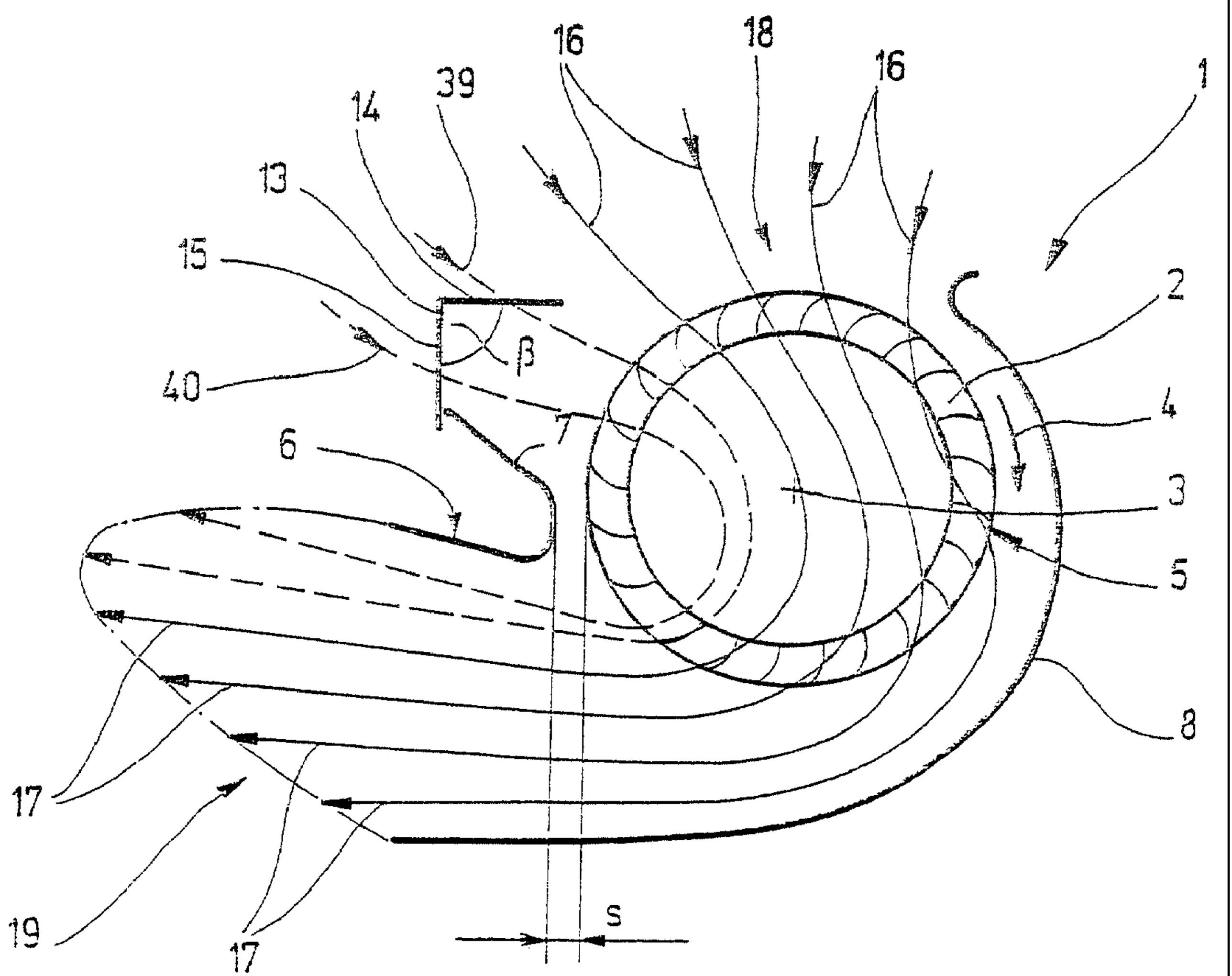
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