A cross flow blower has a plate guide which extends along a spiral curve the distances from which to the periphery of the rotor increase gradually from the beginning of the spiral at the point of the smallest distance between the guide sheet and the periphery of the rotor up to a maximum, this distance to the periphery of the rotor corresponding at the beginning of the spiral approximately to 10 – 30 percent of the radius of the rotor, then increasing after a central angle of about 60° by a further 5 to 30 percent of the radius of the rotor, then again increasing after a central angle of about 30° by about 10 – 30 percent of the radius of the rotor, and increasing thereafter after a further central angle of about 30° by about 20 to 35 percent, whereafter it increases up to reaching the end of the spiral by about 20 to 50 percent of the radius of the rotor, the end of the spiral being reached after a central angle of about 140 to 190° as seen from the beginning or starting point of the guide sheet, the part of this guide plate extending beyond the said – of the spiral either in direction of the tangent to the end of the spiral or along a curve the point of inflection of which lies in the area of the end of the spiral, the distance between the point of the vortex forming tongue lying next to the periphery of the rotor and the periphery of the rotor corresponding to about 5 to 15 percent of the outer diameter of the rotor, and the central angle on the suction side between the beginning or starting point of the spiral and the point of the vortex forming tongue closest to the periphery of the rotor being between 130° – 180°.

The leg of the vortex forming tongue on the suction side has a finely porous wall permeable to air so that through it finely distributed and energy containing air arrives on the suction side of the blower which air comes from the pressure side of the blower through openings in the pressure side leg, which also consists of a finely porous wall permeable to air, thereby preventing the generation of a boundary layer within the incoming flow. Between the wall on the suction side and the wall on the pressure side there is arranged a filtering substance pervious for air and producing pressure losses.

12 Claims, 4 Drawing Figures
The invention refers to a cross flow blower and more particularly to a cross flow blower having a wedge-shaped vortex forming tongue to separate the incoming flow from the issuing flow and having, further, a guide plate to guide the flow, the distance from said guide plate to the periphery of the rotor increasing gradually from the inlet up to a spiral form, the said vortex forming tongue having the shape of a wedge-like body, the apex or tip of said tongue being directed towards the periphery of the rotor, the leg on the suction side and the leg on the pressure side of the said wedge-like body enclosing between them an angle of 10° to 60° and the leg on the suction side of the said body or tongue enclosing with the periphery of the rotor a gap narrowing towards the vortex and in direction opposite to the direction of the rotation.

SUMMARY OF THE INVENTION

It is the aim of the present invention to so improve a blower of the kind here in question that it presents optimum results as regards the pressure value, the efficiency and the noise.

A further aim of the invention is to provide a blower of the kind here in question in which departing from the idea that the transport and throughput of energy is proportional to the flow speed and to the variations of the component in the peripheral direction, the shape and the path of the high speed stream-lines are attended to with especially high carefulness and these high speed stream-lines participate as much as possible in the transport of energy.

For the above purpose with the cross flow blower according to the invention the guide sheet extends along a spiral curve the distances from which to the periphery of the rotor increase gradually from the center of the spiral at the point of the smallest distance between the guide sheet and the periphery of the rotor up to a maximum, this distance to the periphery of the rotor corresponding at the beginning of the spiral approximately to 10 – 30 percent of the radius of the rotor, then increasing after a central angle of about 60° by further 5 to 30 percent of the radius of the rotor, then again increasing after a central angle of about 30° by about 10 to 30 percent of the radius of the rotor, and increase thereafter after a further central angle of about 30° by about 20 to 35 percent, whereby it increases up to reaching the end of the spiral by about 20 to 50 percent of the radius of the rotor, the end of the spiral being reached after a central angle of about 140° to 190° as seen from the beginning or starting point of the guide plate the part of this guide plate extending after the said end of the spiral either in direction of the tangent to the end of the spiral or along a curve the point of inflection of which lies in the area of the end of the spiral, the distance between the point of the vortex forming tongue lying next to the periphery of the rotor and the periphery of the rotor corresponding to about 5 to 15 percent of the outer diameter of the rotor, the central angle on the suction side between the beginning or starting point of the spiral and the point of the vortex forming tongue closest to the periphery of the rotor being between 130° – 180°.

With the new blower, the shape of the guide sheet is optimally adapted to the distribution of the high speed streamlines. The wedge-like shape of the vortex forming tongue having the above mentioned angle between the leg on the suction side and the leg on the pressure side serves to separate or keep apart the incoming flow from the issuing flow as much as possible. In order to cause the peripheral component (Δcₚ in the equation cₚ) to have a considerable magnitude, there is imparted to the streamlines according to the invention a preliminary twist or turn as great as possible by making on the one hand the vortex forming tongue wedge-shaped with a predetermined angle between the leg on the suction side and the leg on the pressure side and associating on the other hand the leg on the suction side in a predetermined manner with the periphery of the rotor, i.e. the rotor blading. Selection according to the invention of the distance between the periphery of the rotor and the point of the vortex forming tongue next to the periphery of the rotor promotes the generation of a flow with optimal values, while the rounding of the wall portion between the two legs of the vortex forming tongue makes it possible to obtain an automatically developing flow which is able to adjust itself better in dependence on the throttling effect, for example, also because the adjustment of the stagnation point is more unfavorable with a sharply tapering vortex forming tongue.

It is especially advantageous to make the leg of the vortex forming tongue on the suction side with a finely porous or cascade-like shaped wall pervious or permeable for air so that through it finely distributed and energy containing air arrives on the suction side of the blower which air comes from the pressure side of the blower through openings in the pressure side leg, which leg may consist for example also of a finely porous wall pervious or permeable for air, thereby preventing the generation of a boundary layer within the incoming flow. Thereby, the arrangement can be such that between the wall on the suction side and the wall on the pressure side there may be arranged a filtering substance pervious for air and producing pressure losses, for example, foamed articial material, glasswool, rock wool filtering material impregnated with artificial resins etc.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects, features, and advantages of the present invention will become further apparent from the following detailed description thereof, whereby in the drawings several embodiments of the invention are shown.

FIG. 1 and FIG. 2 are two different embodiments of the object of the invention in diagrammatic representation.
FIG. 3 is a diagram showing the path of the flow within a flower according to the invention and
FIG. 4 is a further variation of the invention in schematic representation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiment of the invention shown in FIG. 1 has a rotor 1, a vortex forming tongue 2 and a guide wall 3 as its most important parts. The rotor 1 is constructed like a drum and carries on its periphery in a
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manner known per se equally spaced and uniformly distributed blades held with their axial ends between two end discs. The rotor rotates according to arrow 4 around the rotation axis 5. The vortex forming tongue 2 separates and keeps apart the incoming flow from the issuing flow and has a leg 6 on the suction side and a leg 7 on the pressure side. The guide wall deviates immediately after the inlet 8 from the rotor blading so that the distances between the guide wall and the rotor periphery increase gradually as the guide wall takes the form of a spiral.

In the embodiment according to FIGS. 1 and 2 the guide wall runs along a spiral curve the distances of which from the periphery of the rotor 1 increase gradually from the beginning 9 of the spiral, i.e. the point where the guide wall and the periphery of the rotor are closest to one another up to a maximum. At the beginning of the spiral the distance \( a_i \) between the guide wall and the periphery of the rotor corresponds approximately to 10 – 30 percent of the radius \( r \) of the rotor. After going through a central angle of about 60\(^\circ\), the distance \( a_i \) increases by about 5 – 30 percent of the radius \( r \). After another central angle of 30\(^\circ\), the distance \( a_i \) has increased again by about 10 – 30 percent of the radius \( r \). After covering a further central angle of 30\(^\circ\) the distance between guide wall and periphery of rotor increases up to a value \( a_i \) which is greater than \( a_i \) by about 20 – 35 percent of the radius of the rotor. Up to the end of the spiral which is reached after a central angle of about 140\(^\circ\) – 190\(^\circ\) from the beginning of the guide wall, the distance increases again up to a value \( a_i \) which is greater by about 20 – 50 percent of the radius of the rotor than the value \( a_i \). From this end of the spiral, the guide wall 3 deviates outwardly from the spiral, that is, it runs either in the direction of the tangent 10 to the end of the spiral (FIG. 1) or along a curve 11 (FIG. 2), the point of infection of which lies in the area of the end of the spiral. There results, therefore, a spiral form composed of circular arcs with different radii which are described with centers situated on a circular or elliptical curve which is described about the longitudinal middle axis of the rotor. In some embodiments of the invention the different radii associated to the different circular arcs increase gradually as seen from the beginning of the guide wall and then diminish gradually before the maximal distance between the periphery of the rotor and the guide wall has been reached. Finally, they diminish down to the value corresponding to that within the area of the beginning of the guide wall. In some embodiments of the blower according to the invention the curve is composed of circular arcs described with radii which are by about 40 – 100 percent greater than the radius of the associated rotor.

The vortex forming tongue is constructed as a wedge-shaped body the leg 6 of which on the suction side encloses with the leg 7 on the pressure side an angle of about 10 – 60\(^\circ\), the tip or apex of the said tongue being directed towards the periphery of the rotor. Between the leg on the suction side and the periphery of the rotor there is provided a gap 13 which narrows towards the vortex forming tongue and against the direction of rotation according to arrow 4. The distance \( b \) between the point 14 of the vortex forming tongue nearest to the periphery of the rotor and the periphery of the rotor corresponds to approximately 5 – 15 percent of the outer diameter of the rotor. The tangent 15 to the periphery of the rotor on the point thereof nearest to the vortex forming tongue encloses with the leg 6 on the suction side an angle of about 15\(^\circ\) – 45\(^\circ\). The leg 6 on the suction side of the vortex forming tongue is connected with the leg 7 on the pressure side by a rounded surface which extends along an arc of circle described with a radius corresponding to 5 – 25 percent of the radius of the associated rotor. Thereby, the arrangement is such that the central angle on the suction side between the beginning 9 of the spiral and the point where the periphery of the rotor and the vortex forming tongue (point 18) are nearest to one another corresponds to approximately 130 – 180\(^\circ\).

The effective length of the leg 6 of the vortex forming tongue on the suction side corresponds thereby to at least 15 percent of the radius \( r \) of the associated rotor.

In the embodiment according to FIG. 2, the leg 7' of the vortex forming tongue 2' on the pressure side encloses with the guide sheet 3 an outlet channel 19 which narrows beginning with the area of the issuing flow leaving the blower and thereby accelerates the issuing flow. This narrowing portion of the outlet channel 19 has a length \( l \) which corresponds to approximately 0.75 – 1.25 of the radius \( r \) of the rotor, whereby the arrangement is such that the final speed of the flow issuing from the convergent portion of the outlet channel is greater than that of the flow entering it by about at least 20 percent. According to the invention the ratio between the smallest distance from the pressure side leg 7 or 7' of the vortex forming tongue 2 or 2' to the guide wall 3 within the outlet area and the radius "r" of the associated rotor 1 corresponds to approximately a value between 0.75:1 and 1.50:1 : : , whereas the greatest distance between the pressure side leg 7 or 7' of the vortex forming tongue 2 or 2' and the guide wall 3 within the outlet area on the one hand and the radius \( r \) of the associated rotor 1 on the other hand are in a ratio of between 2:1 and 1:1. Thereby, with some further embodiments of the invention at least the leg of the vortex forming tongue on the pressure side is designed as a curve with its concavity facing away from the inlet whereby it runs along a curve which is described with a radius which corresponds to two or three times the radius of the associated rotor.

It can be seen from FIG. 3 of the drawing that the rotor 1', the vortex forming tongue 2' and the guide wall 3' are associated or arranged with respect to one another according to the invention in such a manner that there results a speed distribution of the incoming flow 25 as shown in the drawings, whereby the high speed streamlines are situated in the area facing towards the vortex forming tongue, whereas with the outlet speed 26 there is obtained a speed distribution with which again the high speed streamlines are directed towards the vortex forming tongue. It can be seen that the construction of the guide wall and of the vortex forming tongue according to the invention promotes such a speed distribution of the flow in optimal manner. Within the rotor the flow is deflected as indicated by the streamline 27. There results thereby a flow which rotates around a vortex core 28, whereby this flow within the interior of the rotor has the
character of a potential vortex is symmetrical about a diameter indicated at 29 on the one end of which there is situated the vortex center 28. This flow is stabilized when in an unthrottled stage by the vortex forming tongue whereby the streamlines nearer to the vortex center have the greater flow speeds when the individual streamlines contain all about the same amount of energy.

In the embodiment shown in FIG. 4 of the drawings the leg 30a of the vortex core 30 on the suction side consists of a cascade-like or fine-pored wall pervious or permeable by air. The pressure side leg 30b of the vortex forming tongue may consist, for example, also of a fine-pored wall permeable by air. Thereby, a partial flow of finely divided and distributed energy containing air flows from the pressure side to the suction side of the blower. When entering into the suction side of the blower the generation of a boundary layer of the oncoming flow is prevented. Between the wall on the suction side and the wall on the pressure side there can be provided a resistance in the form of a filtering substance 31, for example, of glasswool or rock wool, of foamed artificial material, of filtering material impregnated with artificial resins etc. This filtering substance produces pressure losses and has also a sound silencing effect.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A cross flow blower having a bladed rotor and a wedge-shaped vortex forming tongue to separate the incoming flow from the issuing flow and having, further, a guide wall to guide the flow, the said guide wall deviating immediately after the inlet from the blading of the rotor whereby the distance from said guide wall to the periphery of the rotor increases gradually from the inlet up to a spiral form, the said vortex forming tongue having the shape of a wedge-like body the apex of which is directed towards the periphery of the rotor, the leg on the suction side and the leg on the pressure side of the said wedge-like body enclosing between them an angle of 10° to 60° and the leg on the suction side of the said tongue enclosing with the periphery of the rotor a gap narrowing towards the vortex and in a direction opposite to the direction of the rotation, wherein the said guide wall extends along a spiral curve the distances of which from the periphery of the rotor increase gradually from the beginning of the spiral at the point of the smallest distance between the guide wall and the periphery of the rotor up to a maximum, this distance to the periphery of the rotor corresponding at the beginning of the spiral approximately to 10 - 30 percent of the radius of the rotor, then increasing after a central angle of about 60° by a further 5 to 30 percent of the radius of the rotor, then again increasing after a central angle of about 30° by about 10 - 30 percent of the radius of the rotor, and increasing thereafter after a further central angle of about 50° by about 20 to 35 percent of the radius of the rotor, whereafter it increases up to reaching the end of the spiral by about 20 to 50 percent of the radius of the rotor, the end of the spiral being reached after a central angle of about 140° to 190° as seen from the beginning of the Guide wall the portion of the Guide wall extending beyond the said end of the spiral deviating outwardly therefrom, the distance between the point of the vortex forming tongue lying next to the periphery of the rotor and the periphery of the rotor corresponding to about 5 - 15 percent of the outer diameter of the rotor, the central angle on the suction side between the beginning of the spiral and the point of the vortex forming tongue closest to the periphery of the rotor being 130° - 180°.

2. The cross flow blower set forth in claim 1, wherein the tangent to the periphery of the rotor at the point thereof nearest to the vortex forming tongue encloses with the leg of the vortex forming tongue on the suction side thereof an angle of about 15° - 45°.

3. The class flow blower set forth in claim 2, wherein the suction side leg of the vortex forming tongue and the pressure side leg thereof are connected by a round surface running approximately along an arc of a circle with a radius with corresponds to 5 - 25 percent of the radius of the rotor.

4. The cross flow blower set forth in claim 1, wherein the effective length of the suction side leg of the vortex forming tongue corresponds to at least 15 percent of the radius of the rotor.

5. The cross flow blower set forth in claim 1, wherein the pressure side leg of the vortex forming tongue defines together with the guide wall an outlet channel which narrows beginning with the area of the flow leaving the rotor and thereby accelerates the flow leaving the blower.

6. The cross flow blower set forth in claim 5, wherein the narrowing portion of the outlet channel has a length corresponding to 0.75 - 1.25 of the radius of the rotor.

7. The cross flow blower set forth in claim 5, wherein the convergent portion of the outlet channel narrows in such a manner that the final speed of the flow leaving the said channel portion is greater than the initial speed entering it by at least about 20 percent.

8. The cross flow blower set forth in claim 1, wherein the ratio between the smallest distance from the pressure side leg of the vortex forming tongue to the guide wall in the outlet area on the one hand and the radius of the rotor on the other hand corresponds to a value between 0.75:1 and 1.50:1.

9. The cross flow blower set forth in claim 1, wherein the ratio between the greatest distance from the pressure side leg of the vortex forming tongue and the guide wall in the outer area on the one hand and the radius of the rotor on the other hand corresponds to a value of between 1:1 and 2:1.

10. The cross flow blower set forth in claim 1, wherein at least the pressure side leg of the vortex forming tongue is curved having its concavity directed away from the inlet and runs along an arc with a radius corresponding to two to three times the radius of the rotor.

11. The cross flow blower set forth in claim 1, wherein the suction side leg of the vortex forming tongue comprises a finely-pored wall pervious to air through which wall finely distributed and energy containing air passes to the suction side of the blower, the said air entering from the pressure side of the blower.
through openings in the pressure side legs, said airflow through the suction area preventing thereby the formation of a boundary layer by the oncoming flow.

12. The cross flow blower set forth in claim 11, wherein between the suction side wall and the pressure side wall of the vortex forming tongue there is provided a filtering substance, said filtering substance being pervious to air and producing pressure losses.

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