From the prior art, it is previously known to provide the inlet and/or outlet opening with a grating or “comb” in order to reduce this impact on the impeller blades. However, in the case of liquids containing suspended solids, in particular when the latter contain fibrous constituents, this results in the possibility of the contaminants getting caught on the grating bars, thereby reducing the delivery capacity of the pump. Furthermore, there are hygienic concerns in this case, when the contaminants are located in the pump housing for a relatively long time.

Furthermore, EP 2 646 691 B1 discloses an impeller pump in which the inlet or the outlet is configured in an elliptical manner. As a result, although the depth to which the impeller blades are pushed in can be reduced, on account of the elliptical shape of the inlet or outlet, only some of the impeller blades come into contact with the edge of the ellipse in each case, and so the impeller blades wear down to a greater extent there and thus unevenly, with the possible consequence of leaks.

Summary

Proceeding from the known prior art, it is an example of the present disclosure to design an impeller pump such that the abovementioned drawbacks of the prior art are resolved.

This example is achieved by an impeller pump according to independent Claim 1. Preferred examples are specified in the dependent claims, the figures and the description.

In one aspect, the present disclosure refers to an impeller pump comprising, a housing comprising, an inlet comprising an opening consisting of one inner inlet opening at which the inlet transitions into an interior of the housing, and an outlet comprising an opening consisting of one inner outlet opening at which the outlet transitions into the interior of the housing, and an impeller wheel disposed in the interior of the housing, rotatable about an axis of rotation, and comprising a plurality of elastic impeller blades, wherein a cross section of at least one of the inner inlet opening or of the inner outlet opening when viewed from the interior of the housing along an axis defined by the at least one of the inlet or the outlet is in a shape of a polygon comprising a plurality of straight line segments, a longitudinal extent that is oriented perpendicular to the axis of rotation, and a width of the cross section that is oriented parallel to the axis of rotation, wherein widths of the cross section vary along at least a part of the longitudinal extent.

Accordingly, an impeller pump having a housing, which has an inlet and an outlet, and having an impeller wheel, which is accommodated in the housing interior, with a plurality of elastic impeller blades is proposed. According to the disclosure, the cross section of the inlet and/or of the outlet on the side facing the housing interior is substantially in the shape of a polygon.

The inlet and the outlet have an inner inlet opening and an inner outlet opening, respectively, at which they transition in each case into the housing interior, in which the impeller wheel with the plurality of elastic impeller blades (made for example of rubber) is located.

The term “*cross section*” should be understood herein as meaning that in particular the inlet or the outlet is viewed from the interior of the housing along an axis defined by the inlet or outlet. This means for example that an inlet which is provided by a pipe having a circular cross section has a circular cross section even when the actual shape of the inlet opening in the housing is no longer circular when it is developed onto a plane of the pump housing.

Since the inlet and the outlet are openings, the polygon is usually a closed polygon.

Since the cross section of the inlet and/or of the outlet on the side facing the housing interior is substantially in the shape of a polygon, when an impeller blade moves over the inlet or outlet, even sweeping of the impeller blade over the edges of the inlet or the outlet can be achieved. In other words, the contact point between the impeller blade and the respective edge of the inlet or outlet is shifted substantially evenly, such that more even wearing down of the impeller blades occurs and thus a longer lifetime of the individual impeller blades and thus a longer service life of the impeller wheel is achieved.

The polygon can preferably have a number of from 3 to 17 corners.

The shape of the cross section of the inlet and of the outlet can be the same or different.

In a further preferred example, the polygon has a longitudinal extent and a transverse extent, wherein the ratio of the length of the transverse extent to the length of the longitudinal extent is less than or equal to 1:2, preferably about 1:3 or about 1:4. As a result, with the same inlet or outlet cross-sectional area, the width of the inlet or outlet opening is correspondingly smaller, and so it is also the case that only a correspondingly narrower section of the impeller blades does not come into contact with the housing wall during the movement over the inlet or outlet opening. As a result, the impact on the impeller blades by deformation decreases correspondingly, when the latter are moved over the inlet or outlet opening.

The term “*longitudinal extent*” should be understood herein as meaning the maximum length of the cross section and the orientation thereof. The term “*transverse extent*” describes a maximum width, oriented differently from the orientation of the longitudinal extent, of the cross section.

Preferably, the shape of the inlet or outlet is configured such that the longitudinal extent and the transverse extent are formed substantially perpendicularly to one another.

In order to achieve even wearing down of the impeller blades during the movement of the impeller blades over the inlet or outlet opening, and in order to achieve uniform flow conditions in the regions between the impeller blades and in the inlet and/or outlet, in a further preferred example, the polygon is configured in a symmetrical manner with respect to the longitudinal extent and/or is configured in a symmetrical manner with respect to the transverse extent.

In a further preferred example, the ratio of the length of the transverse extent of the polygon to the width of the impeller blades is less than 1:1, preferably less than or equal to 1:2, more preferably about 1:3 or about 1:4. In this way, it is possible to ensure that a sufficiently large part of the impeller blades is always in contact with the housing wall on sweeping over the inlet or outlet

opening. As a result, deformation of the impeller blade as a result of the passing into the inlet or outlet opening is limited. In addition, good sealing off between the housing wall and the little-deformed impeller blade is always ensured. The polygon is in this case preferable oriented such that the longitudinal extent extends in the direction of movement of the impeller blades.

In a particularly preferred example, the polygon has at least one rounded corner, wherein preferably all the corners of the polygon are rounded. This results in more uniform flow conditions during pump operation.

In a further example, the cross section of the inlet and/or of the outlet on the side facing away from the housing interior is substantially in the shape of a circle or the shape of a polygon, preferably of a rectangle, particularly preferably of a square. This makes it possible to attach the impeller pump described here to conventional pipelines or fit it into special arrangements.

Preferably, the area of the associated cross section on the side facing the housing interior and the area of the associated cross section on the side facing away from the housing interior differ substantially by less than 10%, and they are preferably substantially the same size. This allows a uniform inlet into the pump or outlet out of the pump, since the medium to be delivered cannot back up at a constriction, or turbulence cannot develop on account of a large increase in cross section.

Alternatively, the area of the associated cross section on the side facing the housing interior and the area of the associated cross section on the side facing away from the housing interior can differ, preferably by 15% - 75%, particularly preferably by 30% - 60% and very particularly preferably by about 50%. In this way, a cross section with a particularly small or short transverse extent can be employed, such that the impeller blades are correspondingly deformed and worn only a little.

The abovementioned example is also achieved by an impeller pump according to the additional examples. Preferred examples are specified in the dependent claims, the description and the figures.

In another aspect, the present disclosure refers to an impeller pump comprising, a housing comprising, an inlet comprising an opening consisting of one inner inlet opening at which the inlet transitions into an interior of the housing, and an outlet comprising an opening consisting of one inner outlet opening at which the outlet transitions into the interior of the housing, and an impeller wheel disposed in the interior of the housing, rotatable about an axis of rotation, and comprising a plurality of elastic impeller blades, wherein a cross section of at least one of the inner inlet opening or of the inner outlet opening on a side facing the interior of the housing has a longitudinal extent

and a transverse extent, a length of the longitudinal extent is greater than a length of the transverse extent, and the longitudinal extent of the cross section encloses an angle with the axis of rotation.

Accordingly, an impeller pump having a housing, which has an inlet and an outlet, and having an impeller wheel, which is accommodated in the housing interior and rotatable about an axis of rotation, with a plurality of elastic impeller blades is proposed. The cross section of the inlet and/or of the outlet on the side facing the housing interior has a longitudinal extent and a transverse extent, wherein the length of the longitudinal extent is greater than the length of the transverse extent. According to the disclosure, the longitudinal extent encloses an angle with the axis of rotation.

Since the longitudinal extent encloses an angle with the axis of rotation, more even wearing down of the individual impeller blades is achieved. The impeller blade does not, as in conventional impeller pumps, come into contact symmetrically with the edge of the inlet or outlet opening in each case at the same points of the impeller blades before and after sweeping over the middle of the inlet or outlet opening. Rather, the blade sweeps over the inlet or outlet opening in a substantially uniform progression from one side of the impeller blade to the other side of the impeller blade.

In other words, the contact point of the impeller blade shifts on moving past the inlet or outlet opening in the transverse direction to the direction of movement of the impeller blades. At the same time, the maximum width with which the individual impeller blades do not come into contact with the housing wall in each case is still relatively small on account of the greater longitudinal extent compared to the transverse extent, and so still only little deformation of the impeller blades and reduced passing of the impeller blade into the inlet or outlet opening occurs.

The term "*angle*" should be understood here as being the angle which forms when the cross section between the longitudinal extent – or possibly the elongation thereof – and the axis of rotation is seen in plan view. In other words, in order to determine the angle, the axis of rotation of the impeller wheel should be projected onto a plane defined by the cross section. The angle corresponds then to the angular dimension between the longitudinal extent and the projection of the axis of rotation.

The orientation of the longitudinal extent may be different for the inlet and the outlet, but may also have the same orientation.

Preferably, in this case, the angle is greater than 0° and less than 90°, preferably greater than or equal to 15° and less than or equal to 75°, particularly preferably greater than or equal to 30° and less than or equal to 60° and very particularly preferably about 5°, 10°, 15°, 20°, 25°, 30°, 35°, 40° or 45°.

In a further example, the cross section is substantially in the shape of an ellipse or polygon.

In order to further adapt the flow conditions during pumping, in a preferred example, the polygon has at least one rounded corner, wherein preferably all the corners are rounded. If the polygon is in the shape of an elongated rectangle, the radii of the roundings in this case correspond preferably to half the width of the rectangle, and therefore they are then selected such that an oblong hole is formed.

In a particularly advantageous preferred example, the ratio of the length of the transverse extent to the width of the impeller blades is less than 1:1, preferably less than or equal to 1:2, more preferably about 1:3 or about 1:4.

In order to keep the deformation of the impeller blades as the impeller blades move over the inlet or outlet opening low, the ratio of the length of the transverse extent to the length of the longitudinal extent is, according to a preferred example, less than or equal to 1:2, preferably less than or equal to 1:3 or about 1:4.

In a further preferred example, the ratio of the width of the impeller blades to a cross-sectional width parallel to the width of the impeller blades is greater than or equal to 3:2, preferably greater than or equal to 2:1. As a result, the deformation of the impeller blades on moving over the inlet or outlet opening can still be kept low.

In a further preferred example, the cross section of the inlet and/or of the outlet on the side facing away from the housing interior is substantially in the shape of a circle or the shape of a polygon, preferably of a rectangle, particularly preferably of a square, wherein preferably the area of the cross section on the side facing the housing interior and the area of the associated cross section on the side facing away from the housing interior differ substantially by less than 10%, and are preferably substantially the same size. Alternatively, the area of the associated cross section on the side facing the housing interior and the area of the associated cross section on the side facing away from the housing interior can differ, preferably by 15% - 75%, particularly preferably by 30% - 60% and very particularly preferably by about 50%. As a result, the abovementioned advantages are achieved.

In a further preferred example of the abovementioned impeller pumps, at least one edge of the inlet and/or of the outlet has a chamfer or is rounded at the transition to the housing interior, wherein preferably all the edges of the inlet and/or of the outlet have a chamfer or are rounded at the transition to the housing interior. As a result, the pressure which is applied to the impeller blade by the edge on account of the deformation and the pressure force of the impeller blade is reduced. This also results in smooth pressure-point progress on the impeller blade. It is also possible here for at least one edge to be rounded and for at least one other edge to have a chamfer.

In a further example of the abovementioned impeller pumps, the transition of the inner wall of the housing from a region with a maximum diameter to a region with a reduced diameter coincides substantially with the transverse extent of the cross section of the inlet or outlet opening. In this case, this transition does not take place abruptly, but the distance of the housing inner wall from the axis of rotation of the impeller wheel decreases continuously from the maximum distance, at which

Claims

1. An impeller pump comprising:

a housing comprising:

an inlet comprising an opening consisting of one inner inlet opening at which the inlet transitions into an interior of the housing, and

an outlet comprising an opening consisting of one inner outlet opening at which the outlet transitions into the interior of the housing; and

an impeller wheel disposed in the interior of the housing, rotatable about an axis of rotation, and comprising a plurality of elastic impeller blades,

wherein a cross section of at least one of the inner inlet opening or of the inner outlet opening when viewed from the interior of the housing along an axis defined by the at least one of the inlet or the outlet is in a shape of a polygon comprising a plurality of straight line segments, a longitudinal extent that is oriented perpendicular to the axis of rotation, and a width of the cross section that is oriented parallel to the axis of rotation, wherein widths of the cross section vary along at least a part of the longitudinal extent.

2. The impeller pump of claim 1, wherein the polygon further comprises a transverse extent, and a ratio of a length of the transverse extent to a length of the longitudinal extent is less than or equal to 1:2.

3. The impeller pump of claim 2, wherein the ratio of the length of the transverse extent to the length of the longitudinal extent is 1:3 or 1:4.

4. The impeller pump of claim 2, wherein the polygon is symmetrical with respect to at least one of the longitudinal extent or the transverse extent.

5. The impeller pump of claim 2, wherein a ratio of the length of the transverse extent to a width of the impeller blades is less than 1:1.

6. The impeller pump of claim 5, wherein the ratio of the length of the transverse extent to the width of the impeller blades is 1:3 or 1:4.

7. The impeller pump of claim 1, wherein the polygon has at least one rounded corner.

8. The impeller pump of claim 1, wherein a cross section of at least one of the inner inlet opening or of the inner outlet opening on a side facing away from the interior of the housing is in a shape of a circle or the shape of a polygon.

9. The impeller pump of claim 8, wherein at least one of the cross section of the inner inlet opening or of the inner outlet opening on the side facing away from the interior of the housing is in a shape of a square.

10. An impeller pump comprising:

a housing comprising:

an inlet comprising an opening consisting of one inner inlet opening at which the inlet transitions into an interior of the housing, and

an outlet comprising an opening consisting of one inner outlet opening at which the outlet transitions into the interior of the housing; and

an impeller wheel disposed in the interior of the housing, rotatable about an axis of rotation, and comprising a plurality of elastic impeller blades,

wherein a cross section of at least one of the inner inlet opening or of the inner outlet opening on a side facing the interior of the housing has a longitudinal extent and a transverse extent, a length of the longitudinal extent is greater than a length of the transverse extent, and the longitudinal extent of the cross section encloses an angle with the axis of rotation.

11. The impeller pump of claim 10, wherein the angle is greater than 0° and less than 90°.

12. The impeller pump of claim 11, wherein the angle is greater than or equal to 30° and less than or equal to 60°.

13. The impeller pump of claim 10, wherein the cross section of at least one of the inner inlet opening or of the inner outlet opening is in a shape of an ellipse or a polygon.

14. The impeller pump of claim 13, wherein the polygon comprises at least one rounded corner.

15. The impeller pump of claim 10, wherein a ratio of the length of the transverse extent to a width of the impeller blades is less than 1:1.

16. The impeller pump of claim 15, wherein the ratio of the length of the transverse extent to the width of the impeller blades is less than or equal to 1:2.

17. The impeller pump of claim 10, wherein a ratio of a width of the impeller blades to a cross-sectional width of the cross section of at least one of the inner inlet opening or of the inner outlet opening parallel to the width of the impeller blades is greater than or equal to 3:2.

18. The impeller pump of claim 10, wherein a cross section of at least one of the inner inlet opening or of the inner outlet opening on a side facing away from the interior of the housing is in a shape of a circle or a shape of a polygon.

19. The impeller pump of claim 18, wherein the polygon comprises a rectangle.

20. The impeller pump of claim 10, wherein at least one edge of at least one of the inner inlet opening or of the inner outlet opening comprises a chamfer or is rounded at a transition to the interior of the housing.