Patent claims

Claims

1. A centrifugal pump for conveying a fluid with , comprising:

a housing (2), having an inlet (3)annular support surface, and an inlet and an outlet (4) for the fluid, with the annular support surface facing outwardly;

an impeller (5) arranged in the housing (2) for rotationand configured to rotate about an axial direction (A) in order to convey the fluid from the inlet (3) to the outlet (4), with ;

a shaft (6) extending in thean axial direction (A) for driving and configured to drive the impeller (5) and with ;

a stationary guide device (7) for guiding having an radial annular surface, and being configured to guide the fluid from the impeller (5) to the outlet (4), with, the stationary guide device (7) being connected to the housing (2), characterized in that , and the radial annular surface facing inwardly;

a resilient compensating element (10) is provideddisposed between the annular support surface of the housing (2) and the radial annular surface of the stationary guide device (7), which, the resilient compensating element (10) isbeing arranged around the shaft (6) and which canconfigured to hold the stationary guide device (7) in a centered position with respect to the impeller (5) upon a radial relative movement of the stationary guide device (7) relative to the housing (2).; and

2. A centrifugal pump according to claim 1, wherein the compensating element (10) is designed annularly.

3. A centrifugal pump according to anyone of the preceding claims, with the compensating element (10) comprising a first (101) and a second contact surface (102), wherein the first contact surface (101) abuts on the guide device (7) and the second contact surface (102) abuts on the housing (2) and wherein the first contact surface (101) and the second contact surface (102) are arranged offset to each other with respect to the axial direction (A).

4. A centrifugal pump according to anyone of the preceding claims, in which the compensating element (10) comprises a first transverse leg (103) for contacting the guide device (7) as well as a second transverse leg (104) for contacting the housing (2), wherein the first transverse leg (103) and

~~the second transverse leg (104) are connected to each other by a longitudinal leg extending in the axial direction (A).~~

~~5. A centrifugal pump according to anyone of the preceding claims with~~ a plurality of connecting elements ~~(9)~~ fixing the stationary guide ~~device (7)~~ to the housing ~~(2)~~ with respect to the axial direction ~~(A), wherein~~, each connecting element ~~(9) is designed in such a way, that it allows for a~~of the plurality of connecting elements configured to enable radial relative movement between the housing ~~(2)~~ and the stationary guide ~~device (7).~~

~~6. A centrifugal pump according to claim 5, with each connecting element (9) in each case~~, and comprising a sleeve ~~(92), which is~~ arranged in an axial bore ~~(13)~~ in the housing ~~(2)~~ or in the stationary guide ~~device (7) as well as~~and a fixing ~~means (91) for fixing the guide device (7), wherein the fixing means (91) extends~~ device extending through ~~the~~ a central longitudinal passage in the sleeve ~~(92)~~ and ~~wherein~~into an other of the housing or the stationary guide to fix the stationary guide, the central longitudinal passage disposed around an axis passing through a center of the sleeve ~~(92) has~~and the sleeve having an outer diameter ~~(D92),~~ which is smaller than ~~the~~an inner diameter ~~(D13)~~ of the axial bore ~~(13),~~, so that an annular gap ~~(14)~~ is formed between the sleeve ~~(92)~~ and ~~the~~a wall limiting the axial bore ~~(13).~~.

~~7. A centrifugal pump according to claim 6, with each sleeve (92) having a length (H) in the axial direction (A), which is larger than the length (L) of the axial bore (13), in which the sleeve (92) is arranged and wherein each sleeve (92) has a flange (93) at one of its axial ends, said flange having an outer diameter (D93), which is larger than the inner diameter (D92) of the respective axial bore (13), in which the sleeve (92) is arranged.~~

~~8. A centrifugal pump according to claim 7, wherein each sleeve (92) is designed in such a manner, that regarding the axial direction (A) an axial gap (15) is formed between the flange (93) and the housing (2) or the guide device (7), in which the respective axial bore (13) is provided, so that an abutting of the flange (93) on the housing (2) or on the guide device (7) is prevented.~~

~~9. A centrifugal pump according to anyone of the preceding claims~~2. The centrifugal pump according to claim 1, wherein the resilient compensating element is annular.

3. The centrifugal pump according to claim 1, wherein the resilient compensating element comprises a first contact surface and a second contact surface, the first

contact surface abutting the stationary guide and the second contact surface abutting the housing and the first contact surface and the second contact surface are arranged offset to each other with respect to the axial direction.

4. The centrifugal pump according to claim 1, wherein the resilient compensating element comprises a first transverse leg configured to contact the stationary guide and a second transverse leg configured to contact the housing, the first transverse leg and the second transverse leg connected to each other by a longitudinal leg extending in the axial direction.

5. The centrifugal pump according to claim 1, wherein the impeller ~~(5) and /~~ or the stationary guide ~~device (7)~~ is made of a different material than the housing ~~(2).~~.

~~10. A~~6. The centrifugal pump according to ~~anyone of the preceding claims, with~~claim 1, further comprising a drive unit ~~(8) for driving~~ configured to drive the impeller ~~(5), which~~, the drive unit ~~(8) is~~being connected to the shaft ~~(6), wherein the drive unit (8) is~~, and arranged in the housing.

7. The centrifugal pump according to claim 1, wherein the housing ~~(2).~~
is

~~11. A centrifugal pump according to anyone of the preceding claims, wherein the housing (2) is designed as~~ a pressure housing~~, preferably for~~.

8. The centrifugal pump according to claim 7, wherein the pressure housing is configured to operate at an operating pressure of at least 200 bar.

~~12. A~~
9. The centrifugal pump according to ~~anyone of~~claim 1, wherein the ~~preceding claims, which~~ pump is designed for a fluid having a temperature of more than 400° C.

~~13. A~~10. The centrifugal pump according to ~~anyone of the preceding claims, wherein~~claim 1, further comprising a drive unit ~~(8) is provided, which is~~ arranged below the impeller ~~(5)~~ with respect to ~~the~~a vertical direction.

11.

~~14. A~~The centrifugal pump according to ~~anyone of the preceding claims~~claim 1, wherein the impeller ~~(5)~~ is ~~designed as~~ a radial impeller ~~(5).~~.

12.

~~15. A~~The centrifugal pump according to ~~anyone of~~claim 1, wherein the ~~preceding claims, designed as~~pump is a boiler circulation pump or as an ebullating pump ~~for the circulation of~~ configured to circulate a process fluid.

13. The centrifugal pump according to claim 1, wherein each sleeve has a length in the axial direction which is larger than a length of the axial bore in which the sleeve is arranged, and each sleeve has a flange at one axial end thereof, the flange having an outer diameter which is larger than the inner diameter of the axial bore in which the sleeve is arranged.

14. The centrifugal pump according to claim 13, wherein each sleeve is configured and arranged such that in the axial direction an axial gap is formed between the flange and the housing or the stationary guide in which the axial bore is provided, so as to prevent abutting of the flange with the housing or the stationary guide.

15. A centrifugal pump for conveying a fluid, comprising:

a housing having an annular support surface, and an inlet and an outlet for the fluid, the annular support surface facing outwardly;

an impeller arranged in the housing and configured to rotate about an axial direction to convey the fluid from the inlet to the outlet;

a shaft extending in an axial direction and configured to drive the impeller; a stationary guide having an radial annular surface, and being configured to guide the fluid from the impeller to the outlet, the stationary guide being connected to the housing, and the radial annular surface facing inwardly; and

a resilient compensating element disposed between the annular support surface of the housing and the radial annular surface of the stationary guide, the annular support surface of the housing disposed radially inside of the radial annular surface of the stationary guide, the annular support surface of the housing facing in a

direction away from the shaft and the radial annular surface of the guide facing in a direction of the shaft, and the resilient compensating element being arranged around the shaft and configured to hold the stationary guide in a centered position with respect to the impeller upon radial relative movement of the stationary guide relative to the housing.

16. The centrifugal pump according to claim 15, further comprising a plurality of connecting elements fixing the stationary guide to the housing with respect to the axial direction, each connecting element configured to enable radial relative movement between the housing and the stationary guide.

17. The centrifugal pump according to claim 16, wherein each connecting element comprises a sleeve arranged in an axial bore in the housing or in the stationary guide, and a fixing device configured to fix the stationary guide, the fixing device extending through the sleeve.

18. The centrifugal pump according to claim 17, wherein each sleeve has a length in the axial direction which is larger than a length of the axial bore in which the sleeve is arranged, and each sleeve has a flange at one axial end thereof, the flange having an outer diameter which is larger than the inner diameter of the axial bore in which the sleeve is arranged.

19. The centrifugal pump according to claim 18, wherein each sleeve is configured and arranged such that in the axial direction an axial gap is formed between the flange and the housing or the stationary guide in which the axial bore is provided, so as to prevent abutting of the flange with the housing or the stationary guide.