SIDE CHANNEL PUMP FOR CONVEYING FUEL IN A MOTOR VEHICLE

ABSTRACT

A side channel pump for conveying fuel having a flow divider disposed in an impeller. The flow divider divides blade chambers of the impeller into individual partial chambers. Flow dividers are also disposed in housing parts opposing the impeller having partial ring-shaped channels radially encompassing each other. The flow dividers in the impeller and in the housing parts are at a distance from each other in order to allow cross flow between the conveyance chambers formed by the partial chambers and the partial ring-shaped channels. The side channel pump thereby has a high efficiency and particularly low radial dimensions.
SIDE CHANNEL PUMP FOR CONVEYING FUEL IN A MOTOR VEHICLE

PRIORITY CLAIM

This is a U.S. national stage of application No. PCT/EP2008/059171, filed on 14 Jul. 2008, which claims priority to the German Application No.: 10 2007 038 144.3, filed: 13 Aug. 2007; the content of both incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a side channel pump for conveying fuel in a motor vehicle, with an impeller arranged rotatably between two casing parts, an inlet arranged in one of the casing parts and an outlet arranged in the other casing part, two conveying chambers concentrically surrounding one another and led from the inlet to the outlet, the conveying chambers having rings of guide blades arranged in the two end faces of an impeller, which delimit blade chambers, and part-annular channels arranged in the casing parts.

2. Prior Art

A side channel pump is known from DE 103 27 573 A1. In this side channel pump, the impeller has two rings of guide blades which delimit blade chambers. The blade chambers of the radially inner ring are separated from the radially outer blade chambers by an intermediate ring. The intermediate ring is led as far as the casing parts and forms a gap seal between the conveying chambers concentrically surrounding one another. Moreover, the rings have, in each case, a different number of guide blades. It is therefore necessary to seal off the conveying chambers to prevent the circulation flow generated in one conveying chamber from flowing over to the other conveying chamber and generating turbulence there at a guide blade. The two conveying chambers concentrically surrounding one another are connected in parallel and make it possible to generate an especially high volume flow.

SUMMARY OF THE INVENTION

A disadvantage of the known side channel pump, however, is that it has very large dimensions. Furthermore, as a result of contamination or wear, a higher pressure may arise in one conveying chamber than in the other conveying chamber which leads to a low efficiency of the side channel pump.

According to an embodiment of the invention, a side channel pump of the type initially mentioned has especially high efficiency and, in the radial direction, especially small dimensions.

According to one embodiment of the invention, the impeller and the casing parts are spaced apart from one another between the conveying chambers concentrically surrounding one another.

As a result of this configuration, a separation of the conveying chambers concentrically surrounding one another is avoided. Spacing the impeller apart from the casing parts makes it possible for the conveyed fuel to flow from the conveying chamber having the higher pressure into the conveying chamber having the lower pressure. The pressure equalization brought about thereby leads to an especially high efficiency of the side channel pump according to one embodiment of the invention. A reduction in the efficiency due to wear or contamination of the conveying chambers is kept particularly low by virtue of the invention. Furthermore, by virtue of the invention, a leaktight partition between the conveying chambers is avoided, and therefore the conveying chambers can be arranged especially near to one another. This leads to a particularly compact set-up of the side channel pump according to the invention and to especially small radial dimensions.

A contribution to a further increase in the efficiency of the side channel pump according to the invention is made when a flow divider subdivides the blade chambers in each case into two subchambers arranged radially next to one another. The flow divider makes it possible to route the flows into the individual conveying chambers. Moreover, as a result of the configuration, the radially inner and the radially outer conveying chamber have the same number of guide blades which are also arranged in alignment with one another.

Turbulences when the conveyed fuel overflows is thereby kept especially low.

According to another embodiment of the invention, the overflow of the conveyed fuel has especially low turbulence when the subchambers arranged radially next to one another are connected to one another on end faces of the impeller.

According to an embodiment of the invention, the structural layout for connecting the subchambers is kept especially low when the flow divider is spaced apart from the end faces of the impeller.

A contribution to a further increase in the efficiency of the side channel pump according to another embodiment of the invention is made when the part-annular channels have further flow dividers standing opposite the flow divider in the impeller, and when the further flow dividers are spaced apart from that side of the casing parts which stands opposite the impeller.

Assembly of the side channel pump according to one embodiment of the invention is especially simple when the flow dividers are manufactured in one piece with the impeller or with the casing parts.

BRIEF DESCRIPTION OF DRAWINGS

The invention permits numerous embodiments. To make its basic principle even clearer, one of these is illustrated in the drawing and is described below. In the drawings:

FIG. 1 is a part section through a fuel pump with a pump stage according to one embodiment of the invention designed as a side channel pump;

FIG. 2 is an enlarged portion of the side channel pump from FIG. 1 with two conveying chambers concentrically surrounding one another; and

FIG. 3 is an enlarged portion of the side channel pump in a sectional view along the line III-III from FIG. 2.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fuel pump with a side channel pump 2 driven by an electric motor 1. The side channel pump 2 has an impeller 4 arranged fixedly in terms of rotation on a shaft 3 of the electric motor 1. The impeller 4 is arranged between two casing parts 5, 6 that are held spaced apart from one another by a spacer ring 7. A jacket 8 of the fuel pump prestresses the casing parts 5, 6 against the spacer ring 7. The side channel pump 2 has a radially inner conveying chamber 9 and a radially outer conveying chamber 10. The conveying chambers 9, 10 have in each case rings, standing opposite one another, of guide blades 13, 14 which delimit subchambers 11, 12, and part-annular channels 15, 16 arranged in the casing parts 5, 6. The part-annular channels 15, 16 extend from an inlet 17 arranged in the casing parts 5 to an outlet 18 arranged in the other casing part 6. Subchambers 11, 12, stand opposite one another. The conveying chambers 9, 10 are connected to one another within the impeller 4.
During a rotation of the impeller 4, fuel is drawn in through the inlet 17 and distributed to the two conveying chambers 9, 10. The fuel in this case flows axially through the impeller 4 and is conveyed to the outlet 18. The fuel subsequently passes through the electric motor 1 to a connection piece 19 of the fuel pump. A forward-flow line, not illustrated, can be connected to the connection piece 19.

FIG. 2 is a greatly enlarged partial view of a radial outer region of the side channel pump 2 from FIG. 1 at the outlet 18. It can be seen that the connection of subchambers 11, 12 standing opposite one another is made as a result of their overlapping. Furthermore, the conveying chambers 9, 10 are connected to one another at the parting plane between the impeller 4 and casing parts 5, 6. Flow dividers 20, 21 are arranged in the impeller 4 and in the part-annular chambers 15, 16 and route the flow of conveyed fuel in the respective conveying chamber 9, 10. However, since the flow dividers 20, 21 are spaced apart from the parting plane between the impeller 4 and casing parts 5, 6, a flow from a first one of the conveying chambers 9, 10 over to a second of the conveying chambers 9, 10 is possible. Furthermore, the conveying chambers 9, 10 are arranged especially near to one another, so that the side channel pump 2 has especially small radial dimensions.

FIG. 3 is an enlarged radially outer partial region of the impeller 4 in a sectional view through the side channel pump 2 from FIG. 2 along the line III-III. It can be seen here that the two conveying chambers 9, 10 have the same number of subchambers 11, 12. The flow divider 20, arranged in the impeller consequently subdivides the blade chamber 22 formed by the guide blades 13, 14 into the individual subchambers 11, 12 of the conveying chambers 9, 10, radially surrounding one another. This ensures that fuel flowing from one conveying chamber 9, 10 over into the other conveying chamber 10, 9 is supplied in an intended position upstream of the respective guide blade 13, 14.

Thus, while there have shown and described and pointed out fundamental novel features of the invention as applied to a preferred embodiment thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit of the invention. For example, it is expressly intended that all combinations of those elements and/or method steps which perform substantially the same function in substantially the same way to achieve the same results are within the scope of the invention. Moreover, it should be recognized that structures and/or elements and/or method steps shown and/or described in connection with any disclosed form or embodiment of the invention may be incorporated in any other disclosed or described or suggested form or embodiment as a general matter of design choice. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

7. A side channel pump for conveying fuel in a motor vehicle comprising:
   a first and a second casing part;
   an impeller having a plurality of blades rotatably arranged between the first and the second casing parts, the impeller having respective end faces that face the first and the second casing parts;
   an inlet arranged in one of the first and the second casing parts;
   an outlet arranged in the other of the first and the second casing parts;
   two conveying chambers having concentrically arranged rings from the inlet to the outlet comprising:
   partially annular channels arranged in the first and the second casing parts corresponding to the two conveying chambers at the respective end faces of the impeller;
   and
   a plurality of blade chambers arranged in the end faces of the impeller and delimited by the plural guide blades, wherein the impeller and the casing parts are spaced apart from one another in an area between the concentrically arranged rings of the two conveying chambers.

8. The side channel pump as claimed in claim 7, further comprising a plurality of flow dividers configured to subdivide each of the plural blade chambers into two respective subchambers arranged radially next to one another.

9. The side channel pump as claimed in claim 8, wherein the two respective subchambers arranged radially next to one another are coupled to one another on the end faces of the impeller.

10. The side channel pump as claimed in claim 8, wherein the plural flow dividers are spaced apart from the respective end faces of the impeller.

11. The side channel pump as claimed in claim 8, wherein the two conveying chambers further comprise respective casing flow dividers in the first and the second casing parts arranged between the two conveying chambers opposite the plural flow dividers in the impeller, the casing flow dividers arranged spaced apart from a side of the first and the second casing parts facing the impeller.

12. The side channel pump as claimed in claim 8, wherein the plural flow dividers are manufactured in one piece with the impeller.

13. The side channel pump as claimed in claim 8, wherein the two respective subchambers arranged radially next to one another are coupled to one another on the end faces of the impeller.

14. The side channel pump as claimed in claim 8, wherein the plural flow dividers are spaced apart from the respective end faces of the impeller.

15. The side channel pump as claimed in claim 10, wherein the two conveying chambers further comprise respective casing flow dividers arranged therebetween, the casing flow dividers arranged spaced apart from a side of the first and the second casing parts facing the impeller.

16. The side channel pump as claimed in claim 14, wherein the two conveying chambers further comprise respective casing flow dividers arranged therebetween, the casing flow dividers arranged spaced apart from a side of the first and the second casing parts.

17. The side channel pump as claimed in claim 15, wherein the casing flow dividers are manufactured in one piece with the first and the second casing parts.

18. The side channel pump as claimed in claim 16, wherein the casing flow dividers are manufactured in one piece with the first and the second casing parts.

19. The side channel pump as claimed in claim 11, wherein the plural flow dividers are spaced apart from the respective end faces of the impeller.

20. The side channel pump as claimed in claim 19, wherein the casing flow dividers are manufactured in one piece with the first and the second casing parts.

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