A fuel pump is disclosed, especially a prefuel pump for feeding aircraft fuel to the high pressure pump, wherein the form-fit connection between the drive shaft (4) and the driven impeller (2) is produced by a regular, convex, triangular polygonal contour having rounded-off lateral faces and corner faces, the drive shaft and the impeller being provided with the polygonal contour. In this manner, the wear resulting from the poor lubricating power of the kerosene-based aircraft fuel can be reduced and the service life of the fuel pump can be increased.
FUEL PUMP FOR INTERNAL COMBUSTION ENGINES

TECHNICAL FIELD

[0001] The invention relates to a fuel pump, especially a prefeed pump for internal combustion engines comprising a gear pump with a pump impeller driven via a driveshaft, more preferably for diesel engines operated with aircraft fuel.

BACKGROUND

[0002] The fuel feed to the combustion chamber of aircraft engines operated in common-rail technology using aircraft fuel takes place from a tank via a prefeed pump and a high-pressure pump to a common distribution pipe (rail) connected to the individual cylinders, as is well known. Since a failure of a fuel pump invariably results in engine stoppage, an extremely high reliability is demanded particularly with aircraft engines. The reliability and the maximum operating duration of the fuel pumps are particularly limited in that they are lubricated with the delivered fuel and the bearings and sliding surfaces are under more or less load corresponding to the lubricating power of the fuel. The lifespan of the fuel pumps is thus decisively influenced by the lubricating properties of the respective fuel. Since the diesel engines employed in aircraft are operated with a kerosene-based aircraft fuel with significantly lower lubricating power compared with diesel fuel, the lifespan of the fuel pumps in this case is particularly low.

[0003] In the case of a prefeed pump designed as a gear pump the pump gear (drive gear) of said prefeed pump is connected to a drive shaft by way of a splined shaft toothing, whose outer toothing (outer profile) present on a shaft end form-fittingly engages in an internal toothing (inner profile) present on the drive gear of the prefeed pump. The prefeed pump designed in this manner only has a very short lifespan when used for a diesel engine operated with aircraft fuel since the driveshaft and the driven pump gear and consequently also the pump housing are subjected to high wear and the prefeed pump has to be replaced completely even after a short operating time.

[0004] DE 100 14 548 A1 describes a gear feed pump for diesel fuel with which the form-fit connection between the drive shaft and the one pump gear is established through a flattened circle geometry or via a profiling provided with recesses and protrusions.

SUMMARY OF THE INVENTION

[0005] The invention is therefore based on the object of designing the prefeed pump connected upstream of the high-pressure pump in such a manner that even when using fuel with reduced lubricating power a long lifespan is guaranteed.

[0006] According to the invention, this object is solved with a fuel pump or prefeed pump designed as gear pump, specifically a fuel pump, particularly a prefeed pump for internal combustion engines comprising a gear pump with a pump gear driven via a driveshaft, more preferably for diesel engines operated with aircraft fuel, characterized by a form-fit connection embodied as a regular convex polygon having lateral faces and corner regions curved to the outside between the driven pump gear and the driveshaft. Practical configurations of the invention are discussed below.

[0007] The essence of the invention in other words consists in that the form-fit connection between the driveshaft and the driven pump gear is established through a convex polygonal contour designed on the driveshaft and on the pump gear.

[0008] In a further embodiment of the invention the driveshaft comprises a coupling disc in the shape of a polygon shaped as triangle with lateral faces curved outwardly at a certain radius and corner regions rounded towards the outside, while in the driven pump gear a recess corresponding in shape and size to the coupling disc is formed, so that the coupling disc engages in the recess as an accurate fit.

[0009] Surprisingly it was discovered that the connection between driveshaft and pump gear established via two polygons form-fittingly engaging into each other guarantees a secure power transmission and results in a significant reduction of the wear on the form-fit connection point and thus the driveshaft, the pump gears and the pump housing and thus the lifespan of the fuel pump provided for delivering fuel with low lubricating power is increased and its especially for aviation indispensable reliability is improved. In a further configuration of the inventions the convexly curved polygonal contours form-fittingly engaging into each other can also be embodied as polygon, for example as tetragon.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] An exemplary embodiment of the invention is explained in more detail by means of the drawing. It shows:

[0011] FIG. 1 a perspective representation of a prefeed pump designed as gear pump in a disassembled state;

[0012] FIG. 2 a front view of the driveshaft designed with a coupling disc designed as polygon; and

[0013] FIG. 3 a front view of the drive gear of the prefeed pump with an inner profile designed as polygon.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The prefeed pump shown in a disassembled state in FIG. 1 is designed as gear pump and comprises a pump housing 1, in which a driven first pump gear 2 and a second pump gear 3 are mounted. In addition, a driven driveshaft 4 is mounted in the pump housing 1. A coupling disc 5 moulded onto the driveshaft 4 has the shape of a convex, regular, in this case, triangular polygon, i.e. of a triangle with three curved lateral faces of the same length and the same size internal angles. The coupling disc 5 engages in a recess 6 formed in the driven pump gear 2 whose contour shape as polygon corresponds to the contour of the coupling disc 5. Subject to the intermediate connection of a sealing ring 8 the pump housing 1 is closed-off through a housing cover 9 which is fastened by means of cheese-head screws.

[0015] The polygonal outer contour of the coupling disc 5 and the recess 6 provided in the driven pump gear 2 is shown in more detail in the FIGS. 2 and 3. The regular triangular polygon of the coupling disc 5 and of the recess 6 has a circumcircle with the diameter d1, and an incircle with the diameter d2. However, the polygon has no straight lateral edges (lateral faces) but is convexly shaped, i.e. with crowned lateral faces curved outwardly in the radius R1 and within the radius R2 rounded corner regions of the polygon of the coupling disc 5 and of the recess 6. The maximum width of the polygon of the recess 6 or of the coupling disc 5 is designated W in the drawing.

[0016] With the form-fit between the driveshaft 6 and the driven pump gear embodied as convex polygonal connection the wear of the first and also of the second pump gear as well as of the driveshaft and of the housing can be significantly
lowered and the lifespan of the prefeed pump designed as gear pump can be increased by up to three times even when using a fuel with low lubricating power.

[0017] The invention is not restricted to the exemplary embodiment described before. For example, the form-fit connection can also be formed through regular convex polygons with more than three corners such as a tetragon or pentagon and also be employed with other fuel pumps with rotating pump wheels.

LIST OF REFERENCE CHARACTERS

1. Pump housing
2. First, driven pump gear
3. Second pump gear
4. Driveshaft
5. Coupling disc, triangular convex polygon
6. Recess, triangular convex polygon
7. Cheese-head screws
8. Sealing ring
9. Housing cover
D<sub>p</sub> Circumcircle of polygon
D<sub>i</sub> Incircle of polygon
W Maximum width of the polygon
R<sub>y</sub> Radius of the lateral faces of the polygon
R<sub>x</sub> Radius of the corner faces of the polygon

1. A fuel prefeed pump for supplying fuel to a high pressure fuel pump for supplying diesel engines operated with aircraft fuel comprising a gear pump having a pump gear driven via a driveshaft, a form-fit connection between the driven pump gear (2) and the driveshaft (4) embodied as a regular convex polygon having lateral faces and corner regions curved to an outside thereof.

2. The fuel prefeed pump according to claim 1, characterized in that the form-fit polygon connection comprises a coupling disc (5) provided on the driveshaft (4) and a recess (6) moulded into the driven pump gear (2) having the corresponding polygonal contour.

3. The fuel prefeed pump according to claim 1, characterized in that the convex polygonal contour is triangular and in a radius R<sub>x</sub> has lateral faces curved to the outside and in a radius R<sub>y</sub> has corner regions curved to the outside.

4. The fuel prefeed pump according to claim 1, characterized in that the regular convex polygonal contour is a tetragon contour or a pentagon contour.

5. The fuel prefeed pump according to claim 2, characterized in that the convex polygonal contour is triangular and in a radius R<sub>x</sub> has lateral faces curved to the outside and in a radius R<sub>y</sub> has corner regions curved to the outside.

6. The fuel pump according to claim 2, characterized in that the regular convex polygonal contour is a tetragon contour or a pentagon contour.

* * * * *