

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property

Organization

International Bureau

(43) International Publication Date

02 January 2020 (02.01.2020)



(10) International Publication Number

WO 2020/005185 A2

(51) International Patent Classification:

F04D 1/00 (2006.01)

(21) International Application Number:

PCT/TR2019/050347

(22) International Filing Date:

20 May 2019 (20.05.2019)

(25) Filing Language:

Turkish

(26) Publication Language:

English

(30) Priority Data:

2018/07178

22 May 2018 (22.05.2018)

TR

(72) Inventor; and

(71) Applicant: KÜÇÜK, Osman [TR/TR]; İbni Sina Mah. Yıldırım Beyazıt Sk. No:20 Kaşkal, Derince/Kocaeli (TR).

(74) Agent: DESTEK PATENT, INC.; Lefkosa Cad. NM Ofis Park B Blok No:36/5, Beşevler, 16110 Bursa (TR).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: CENTRIFUGAL PUMP IMPELLER

(57) Abstract: The present disclosure relates to an impeller (10), wherein the impeller is manufactured in two parts by machining to increase efficiency of centrifugal pumps, minimize friction losses and facilitate periodic inspections against potential risks of failure, wear and corrosion. The key benefit of the impeller (10) is the precision of the surface quality and minimization of friction losses achieved through the machining method, which is more precise compared to casting processes. With more precise surface quality, friction losses of the impeller (10) are minimized. This ensures maximum efficiency output from the pump. Another key benefit of the impeller (10) is that the housing (20) and vanes (40) are separately produced and assembled by means of a connection element (50).



WO 2020/005185 A2

CENTRIFUGAL PUMP IMPELLER

Field of the Invention

The present disclosure relates to an impeller used in centrifugal pumps, which the impeller's assemble and maintainable is easy while reducing the manufacturing and repair costs at the same time.

The present disclosure particularly relates to an impeller, which the impeller is manufactured parts structured by machining to increase efficiency of centrifugal pumps, minimize friction losses and facilitate periodic inspections against potential risks of failure, wear and corrosion.

Prior Art

Pump is defined as a system that is used to move liquid from one place to another. Pump is a device that adds kinetic or potential energy to the fluid inside. Pumps are typically used for the purposes of moving or raising fluids and releasing gases. Liquid movement can be achieved by various means, including a reciprocating piston (piston pump), a fast rotating vaned impeller (centrifugal pump), a pressurized water injector (water-jet pumps, hydraulic pressure pumps) or a pressurized steam or air injector(injector).

Centrifugal pumps comprise a vaned impeller (wheel) inside a housing, and the entering fluid is directed to the center of the impeller. The liquid is rotated by the various curved vanes of the impeller which turns mechanical energy into hydraulic energy, resulting in pressure build-up. The liquid is driven towards the center of the impeller and rotates around the impeller through centrifugal forces. It is a structurally robust, simple and affordable and allows for direct connection to an asynchronous motor thanks to its high speed. Centrifugal pumps ensure a continuous flow of liquid, and the flow can be reduced without damaging the pump. The liquid enters between the vanes of the impeller due to the vacuum produced at the suction side of the impeller. While liquid passing through the vanes of the impeller, rotational movements of the impeller provides great tangential acceleration to the liquid. The liquid is driven between impeller

vanes and channels limited by the front and back profile of the impeller by centrifugal powers generated through rotational movement of the impeller towards the outlet. This movement ensures continuous flow of the liquid and suction at the suction side of the pump. The kinetic energy of the liquid which leaves the impeller vanes with great tangential speed turns into pressure energy at the spiral clearance between the fixed diffuser vanes. Unlike positive displacement pumps, centrifugal pumps do not contain a discharge valve. Maximum pressure is achieved through a certain rotational speed. Centrifugal pumps are suitable for use in all types of fluids and liquids.

Impellers and vanes used in the existing centrifugal pumps are manufactured in one piece design typically through the method of casting. Since no interventions can be performed at the interior part after the completion of the manufacturing process, impellers and vanes generally have rather low surface quality, which negatively affects the overall efficiency of the pump system. Moreover, since potential corrosion issues in the impeller cannot be detected through external visual inspection, the inspection stage also poses additional challenges. In order to eliminate this issue, a more expensive method, namely the non-destructive testing is employed. Nowadays, another issue in centrifugal pumps is that the whole system needs to be replaced instead of the related parts when failure, wear or breakdown is occurred as a result of the production of impellers and fins in one piece. For instance, in case of wear in impeller, the whole impeller section needs replacement. This is a major disadvantage in terms of increasing the cost and time of maintenance and repairs. Another disadvantage of existing applications is the demanding and difficult nature of the casting method employed to produce impellers and vanes.

Various studies have been carried out to eliminate the mentioned disadvantages and new centrifugal pumps have been manufactured as a result. One such study is the invention presented in Patent Application No. EP04736829.5, titled "Improved pump impeller". The invention relates to an impeller suitable for use in centrifugal pumps. The said impeller comprises opposed faces, an outer peripheral edge portion, a shroud which has a rotation axis, a plurality of pumping vanes on one of the faces of the shroud and extending away from the rotation axis, each pumping vane having an outer peripheral edge portion. Also, the impeller has a plurality of auxiliary vanes on the other faces of the shroud.

Each mentioned auxiliary vanes have an outer edge portion, wherein the dimension from the rotation axis to the outer peripheral edge portion is greater than the dimension from the rotation axis to the outer peripheral edge portion of the auxiliary vanes.

Another study is the utility model no. TR201011223, titled "High-Strength Thermoplastic Impeller for Centrifugal Pumps". The referred invention relates to a high-strength thermoplastic impeller comprising a square shaft end and a special vane structure for operation at the tip of the electric motor in the centrifugal pump.

Another such study is the invention presented in Patent Application No. EP05801669.2, titled "Vaned Impeller". This invention relates to an impeller used in pumps and more particularly, an impeller suitable for use in centrifugal or semi-axial pumps intended for pumping of fluids containing contaminants.

While the said studies and the resulting inventions offer an advantage in terms of efficiency, no similar advantage could be achieved in terms of maintenance - repair costs and duration as well as reduced manufacturing cost. Consequently, the need for a centrifugal pump which eliminates the existing disadvantages and the inadequacy of the proposed solutions entails a further development in the technical field.

Brief Description of the Invention

The present invention relates to an impeller suitable for use in centrifugal pumps, wherein the said impeller is easy to assemble and maintainable while reducing the manufacturing and repair costs to meet all abovementioned requirements, eliminate all disadvantages and bring additional benefits.

Based on the prior art, object of the invention is providing facility to assemble and manufacture since developed impeller is manufactured in two parts by means of machining.

The object of the invention is to maximize surface quality thereby producing by means of the machining method which is more precise than the casting method, minimize friction losses in the impeller with the improved accuracy of the surface quality, thus increasing efficiency.

Another object of the invention is to ensure precise processing of impeller vanes inside the centrifugal pump at optimum levels, and obtain nominal values for maximum

efficiency between impeller vane angles of 0-180° thanks to the two-part manufacturing design of the impeller.

Another object of the present invention to maximize the efficiency of the impeller at an angle range between 20 and 70 degree thanks to the two-part manufacturing design of the impeller.

Another object of the present invention is to increase the number of impeller vanes as well as reach maximum centrifugal force values thanks to maximum efficiency of the impeller at an angle range between 20 and 70 degree.

Another object of the present invention is to ensure continued use of the product by means of replacing only the damaged part in case of a potential failure, corrosion or wear in the impeller thanks to the two-part manufacturing design, thereby avoiding any unnecessary expenses and contributing to the national economy.

Another object of the present invention to ensure periodic inspections against potential risks of failure, wear and corrosion in the impeller and vanes are carried out in an easy and low-cost way within the shortest time thanks to the two-part manufacturing design of the impeller.

The structural properties, characteristics and all benefits of the invention will be more clearly understood by reading the detailed description of the invention in conjunction with the below drawings.

Brief Description of Drawings

The configuration and benefits of the present invention with additional components will be best understood if read in conjunction with the below drawings.

Figure 1 Is a schematic overall view of an impeller in accordance with the present invention.

Figure 2 Is a schematic overall view of vanes mounted to the housing.

Figure 3 Is a schematic overall view of the movement of the fluid inside the impeller.

Figure 4 Is a schematic overall back view of the housing.

Reference Numerals

- 10. Impeller
- 20. Housing
- 21. Suction side
- 5 22. Discharge side
- 30. Cover
- 40. Vane
- 50. Connection element

10 Detailed Description of the Invention

It should be understood that the detailed description of the impeller (10), which is manufactured in two parts by machining to increase efficiency of centrifugal pumps, minimize friction losses and facilitate periodic inspections against potential risks of failure, wear and corrosion, is intended for purposes of illustration only and is not intended to limit the scope of the disclosure.

The impeller (10) illustrated in Figure 1 is developed with the aim of improving the efficiency of centrifugal pumps and comprises vanes (40) on a housing (20), and a cover (30) mounted to the same housing (20). Mentioned cover (30) enables the liquid to be kept within an enclosed volume for generation of centrifugal force and also directs the fluid towards vanes (40). The housing (20) illustrated in Figure 2 is the portion where vanes (40) are connected and the fluid gains centrifugal force. Existing centrifugal pump vaned impellers are fixed on the housing in one piece. The key feature of mentioned impeller (10) is that the housing (20) and vanes (40) are separately produced and assembled by means of a connection element (50) to each other.

The fluid is transported by the centrifugal pump with a certain pressure and flow rate, and enters the impeller (10) through the suction side (21) at the center of the housing (20) and cover (30) as shown in Figure 3. Then, the fluid enters the vanes (40) between the housing (20) and the cover (30), and is dispersed towards the outlet of the housing (20), that is the discharge side (22). The fluid reaches high velocity during this dispersion, and exits the housing (20)-cover (30) assembly structure with great power. During the assembly of the housing (20) and the cover (30), a certain amount of tightening torque is applied through the connection element (50).

With the impeller (10) shown in Figure 4, pump impellers manufactured through conventional casting methods are now manufactured in two parts. Machining is the method employed during this production. This facilitates both production and assembly processes. The key benefit of the impeller (10) is the near-perfect surface quality achieved through the machining method, which is more precise compared to casting processes. With more precise surface quality, friction losses of the impeller (10) are minimized. This ensures maximum efficiency output from the pump.

Thanks to the two-part manufacturing design of the impeller (10), vanes (40) inside the centrifugal pump can be precisely processed at optimum levels, and nominal values can be obtained for maximum efficiency between impeller (10) vane (40) angles of 0-180°. Maximum efficiency can be achieved at a vane (40) angle between 20 and 70 degree. Vane (40) angles can be adjusted between the said values according to the demands of the end user and technical requirements. This makes it possible to increase the number of vanes (40) as well as reaching maximum values to centrifugal forces. Moreover, thanks to the two-part manufacturing design of the impeller (10), continued use of the product is ensured by means of replacing only the damaged part in case of a potential failure, corrosion or wear. This also makes it possible to avoid any unnecessary expenses and contribute to the national economy. The two-part manufacturing design also facilitates periodic inspections against potential failure, wear and corrosion risks in the impeller (10) and vanes (40).

CLAIMS

1. An impeller (10) which increases the efficiency of centrifugal pumps, minimizes friction losses and facilitates periodic inspections against potential risks of failure, wear and corrosion, **characterized by comprising;** vanes (40) separately manufactured, then assembled to each other and a housing (20) which the fluid gains centrifugal force.
2. The impeller (10) according to Claim 1, **characterized by comprising;** a connection element (50) for assembly housing (20) and vanes (40) to each other after separately manufactured by a certain amount of tightening torque.
3. The impeller (10) according to Claim 1, **characterized by comprising;** a cover (30) which enables the liquid to be kept within an enclosed volume for generation of centrifugal force and directs the fluid towards vanes (40).
4. The impeller (10) according to Claim 1, **characterized by comprising;** a suction side (21) at the center of the housing (20) and cover (30), which the fluid transported by the centrifugal pump with a certain pressure and flow rate enters the impeller (10).
5. The impeller (10) according to Claim 1, **characterized by comprising;** a discharge side (22) at the outlet of the housing (20), which the fluid enters the vanes (40) between the housing (20) and the cover (30) and gets dispersed by centrifugal force.
6. The impeller (10) according to Claim 1, **characterized in that;** the housing (20) and vanes (40) are manufactured as two separate parts by machining method.

1/2

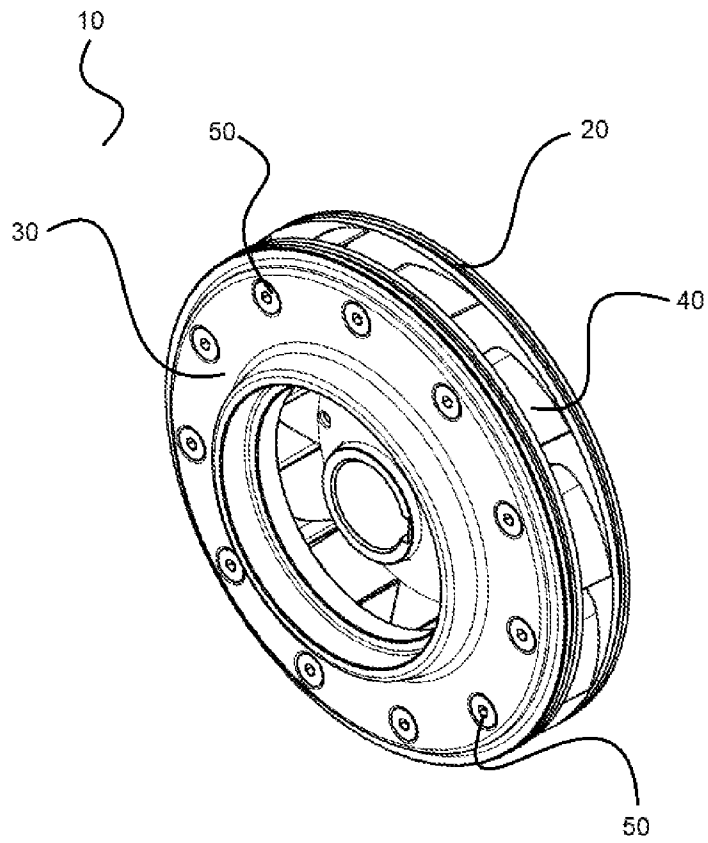


Figure-1

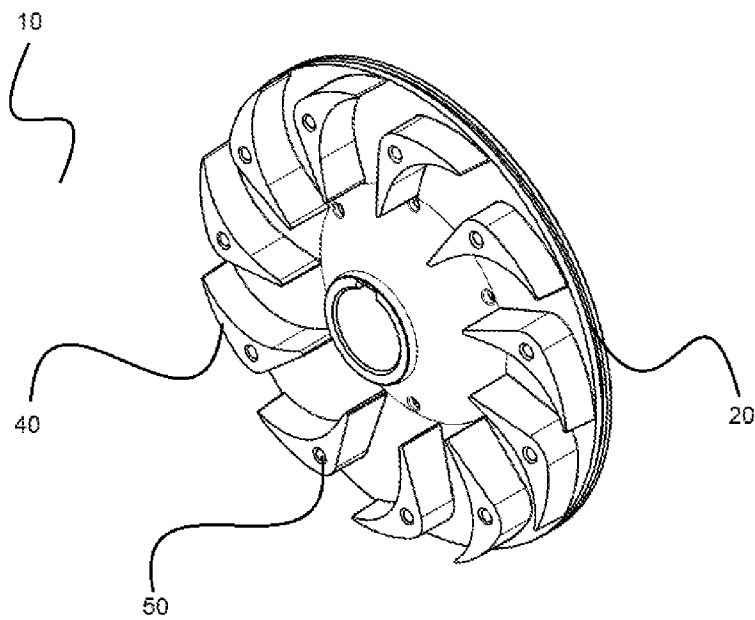


Figure-2

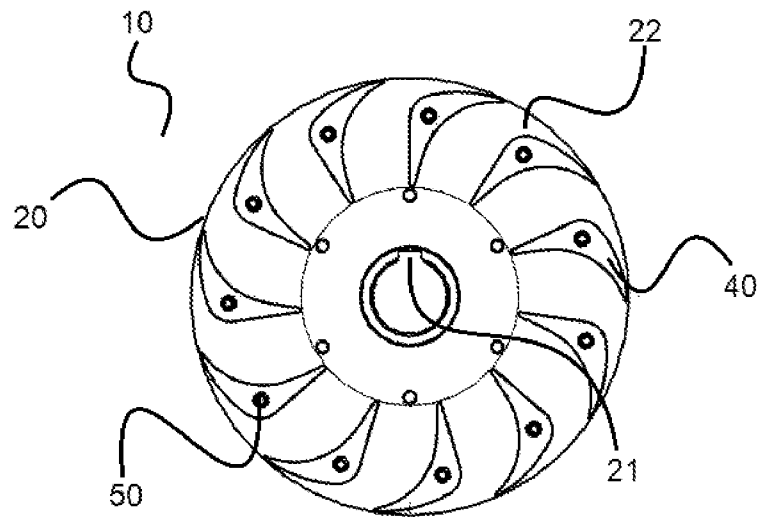


Figure-3

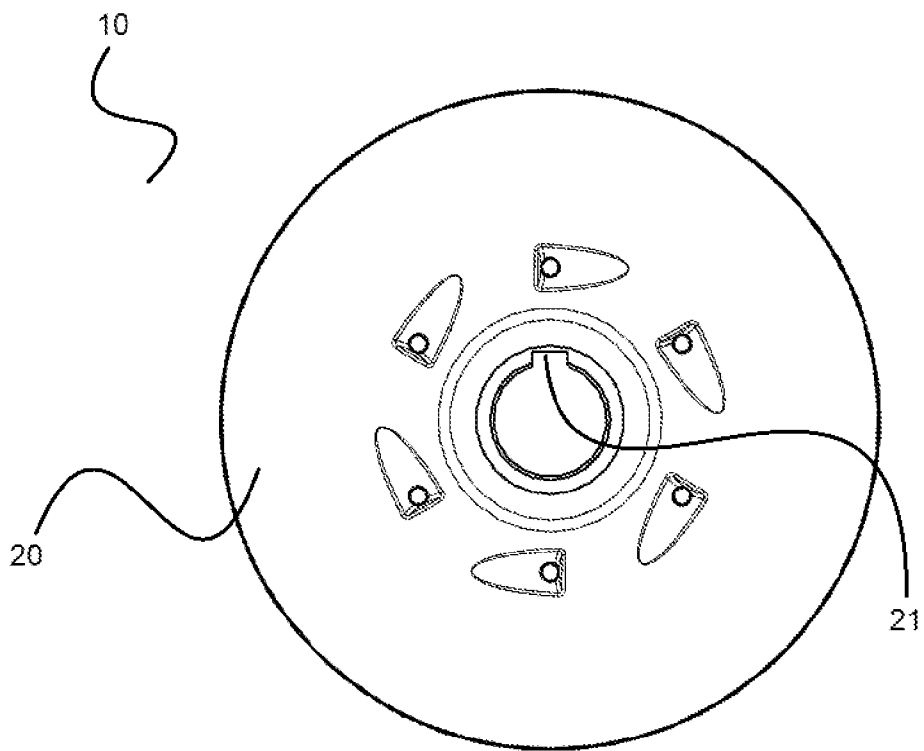


Figure-4