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(54) **IMPELLER FOR A FLUID PUMP**

(57) A monolithic impeller (10) for a fluid pump is described, the impeller (10) comprising a gear opening (12) defined by a cylindrical member (14) including an inner surface (16) being splined for receiving a gear shaft with said cylindrical member (14) defining an impeller axis, a plurality of blades (20) including an arcuate configuration extending outwardly relative to said impeller axis, each of said plurality of blades (20) including a proximal end (22) being disposed proximate said cylindrical member (14) and a distal end (24) disposed radially outwardly from said cylindrical member (14), a cover member (28) extending radially outwardly to said distal end (24) of said plurality of blades (20) and defining a fluid inlet (26) being concentric with said impeller axis, a hub member (44) spaced from said cover member (28) by said plurality of blades (20) and extending radially outwardly from said cylindrical member (14); and said proximal end (22) of said blades (20) extending radially inwardly of said fluid inlet (26) and said distal end (24) of said blades (20) terminating at a common concentric diameter as an outermost portion of said cover member (28) and said hub member (44).

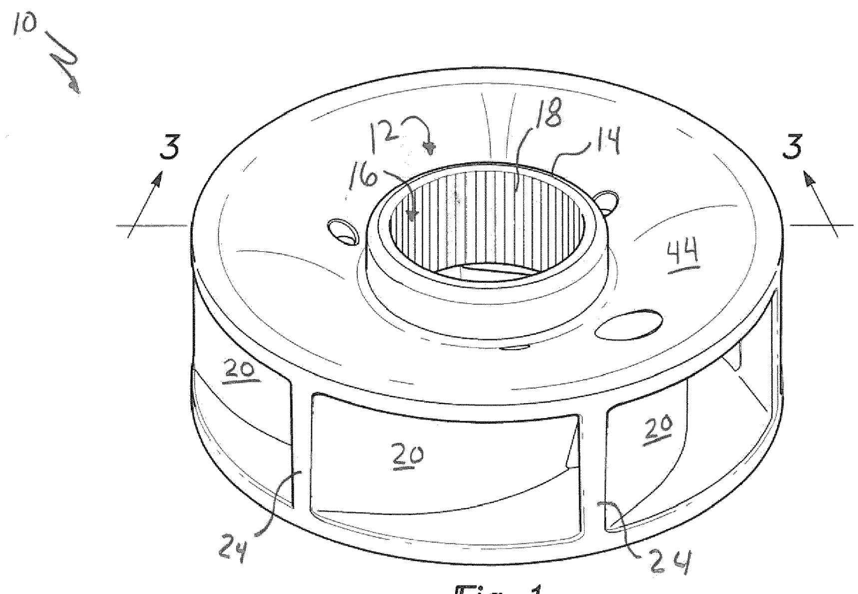

Fig-1

EP 3 324 052 A1

Description

TECHNICAL FIELD

[0001] The present invention relates generally toward an approved impeller for a fluid pump. More specifically, the present invention relates toward a monolithic impeller providing enhanced fluid dynamic.

BACKGROUND

[0002] Fluids have been used to cool, for example, internal combustion engines for many years. The heat generated by igniting fuel within a combustion chamber is necessarily, rapidly dissipated by fluid flowing through various components of the engine, including the engine block. Fluid pumped through the engine by way of a fluid pump is required to flow at a desirable rate and efficiency necessary to dissipate heat rapidly to maintain efficiency and prevent the engine from overheating. Therefore, a high efficiency pump is desirable.

[0003] Of primary importance to the efficiency of a pump, is efficiency of an impeller disposed within a pump chamber of the pump. As such, modern impellers used for circulating cooling fluid have become increasingly complex to meet performance objectives requiring two component manufacturing which is known to add costs, while reducing pump efficiency. Therefore, it would be desirable to provide an improved impeller of a fluid pump as manufactured at low cost, while providing enhanced efficiency over a known two component pump impeller.

SUMMARY

[0004] An impeller includes a gear opening defined by a cylindrical member. An inner surface of the gear opening is supplied for receiving a gear shaft. The cylindrical member defines an impeller axis. Each of a plurality of blades includes an arcuate configuration and extends radially outwardly relative to the impeller axis. Each of the plurality of blades include a proximal end disposed proximate the cylindrical member and a distal end disposed radially outwardly from the cylindrical member. A cover member extends radially outwardly to the distal end of the plurality of blades and defines a fluid inlet that is concentric with the impeller axis. A hub member is spaced from the cover member by the plurality of blades and extends radially outwardly from the cylindrical member. The proximal end of the blades extends radially inwardly of the fluid inlet and the distal end of the blades terminates at a common concentric diameter as the outermost portion of the cover member and the hub member. The impeller is formed as a monolithic construction not requiring assembly of any components requiring complex design to achieve desirable performance characteristics.

[0005] The unique architecture of the impeller of the present invention enhances efficiency of a pump into which the impeller is installed. In addition, the impeller of the present invention is constructed of a single component of unitary design reducing cost and ease of manufacture not previously attainable of high efficiency pump impellers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Other advantages of the present invention will be readily appreciated, as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Figure 1 shows a perspective view of the impeller of the present invention;
Figure 2 shows an alternate perspective view of the impeller of the present invention;
Figure 3 shows a side sectional view of the impeller of the present invention; and
Figure 4 shows a top view of the impeller.

DETAILED DESCRIPTION

[0007] An impeller for a fluid pump is generally shown at 10 of Figure 1. The impeller includes a gear opening 12 defined by a cylindrical member 14. The cylindrical member 14 includes an inner surface 16 having a plurality of splines 18 disposed in a parallel orientation to an impeller axis a (Figure 4) defined by the cylindrical member 14. The splines 18 are configured to receive a splined drive shaft (not shown) for providing rotary motion to the impeller in a known manner. A plurality of blades 20 each include an arcuate configuration extending radially outwardly relative to the impeller axis a. Each of the blades 20 include a proximal end 22 disposed proximate the cylindrical member 14 and a distal end 24 disposed radially outwardly from the cylindrical member 14.

[0008] As best represented in figure 2, a fluid inlet 26 is defined by a cover member 28. The fluid inlet 26 is concentric with the impeller axis a. The cover member 28 extends radially outwardly from the fluid inlet 26 to the distal end 24 of each of the impeller blades 20. In addition, the cover member 28 is substantially perpendicular to the impeller axis a. As used herein, substantially means nearly perpendicular.

[0009] The fluid inlet 26 is further defined by a flange 30 that is also coaxial with the impeller axis a and extends outwardly from the cover member 28 in an axial direction. The flange 30 includes a radially outward wall 32 defining a cylindrical surface. The flange 30 also includes a radially inward wall 34. The radially inward wall 34 defines a plurality of blade elements 36, each of which are complimentary to one of the plurality of blades 20. Each of the blade elements 36 defines a notch 38 in the radially inward wall 34. The proximal end 22 of each blade 20 is aligned with one of the notches 38 such that the proximal end 22 extends radially inwardly from the notch 38 beyond the flange 30. Therefore, a hypothetical ring defined by the plurality of distal ends 24 of the blades 20 is disposed radially inwardly of the flange 30, while, the distal end 24 of each blade 20 is spaced radially outwardly from the cylindrical member 14.

[0010] The proximal end 22 of each blade 20 includes an end portion 40 that is distinguishable from a body 42 of the blade 20. The end portion 40 of the proximal end 20 terminates at an angle that is offset from the impeller axis a. Therefore, it should be understood that the end portion 46 is disposed at an acute angle relative to the axis a. In addition, the end portion 40 is slightly offset radially outwardly from the body 42 of each blade 20. The unique interaction between the end portion 40, the proximal end 22 extending radially inwardly of the flange 30 and the notch 38 defined by each blade element 36 is believed to provide advantageous fluid dynamics resulting in an increased efficiency of the pump impeller 10.

[0011] Referring now to figure 3, a hub member 44 is spaced from the cover member 28 by the blade 20. The hub member 44 terminates proximate the impeller axis a at the cylindrical member 14 and extends radially outwardly to the distal end 24 of the blades 20. Therefore, the distal end of the blades 20, and the outermost portion of the cover member 28 and hub member 44 are disposed at a common concentric diameter from the impeller axis a. The outermost portion of the cover member 28 and the hub member 44 are substantially perpendicular to the impeller axis a. However, the hub member 44 presents a cross-sectional, arcuate or concave configuration progressing toward the cylindrical member 14 best seen in Figure 3. A lip 46 extends in an axial direction at the outermost portion of the hub member 44.

[0012] It should be understood by those of ordinary skill in the art that the blade element 36 disposed in the radial inward wall 34 of the fluid inlet 26 not only enhance fluid dynamics improving the impeller efficiency, but that the blade element 36 also serve as a beneficial manufacturing feature. The blade element 36 also functions as a die relief enabling the impeller 10 to be of a unitary or monolithic design requiring no assembly. As such, a single die (not shown) is used to mold the impeller 10 without requiring assembly of various components as is known to prior art impellers of this complexity. As such, the blade element 36 provides a two-fold function further enhancing not only performance of the impeller 10 but also manufacturability. As such, impeller 10 is molded from a polymeric, or reinforced polymeric material of a single die cycle eliminating manual labor associated with assembling two piece impellers known of the prior art.

[0013] Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The foregoing invention has been described in accordance with the relevant legal standards; thus, the detailed description is merely exemplary other than limiting in nature. Variations and modifications to the disclosed embodiment has become apparent to those skilled in the art and do come within the scope of this invention. Accordingly, the scope of legal protection afforded this invention can only be determined by studying the following claims.

Claims

1. An impeller (10) for a fluid pump, comprising:

   a gear opening (12) defined by a cylindrical member (14) including an inner surface (16) being splined for receiving a gear shaft with said cylindrical member (14) defining an impeller axis;
   a plurality of blades (20) including an arcuate configuration extending outwardly relative to said impeller axis, each of said plurality of blades (20) including a proximal end (22) being disposed proximate said cylindrical member (14) and a distal end (24) disposed radially outwardly from said cylindrical member (14);
   a cover member (28) extending radially outwardly to said distal end (24) of said plurality of blades (20) and defining a fluid inlet (26) being concentric with said impeller axis;
   a hub member (44) spaced from said cover member (28) by said plurality of blades (20) and extending radially outwardly from said cylindrical member (14);
   and said proximal end (22) of said blades (20) extending radially inwardly of said fluid inlet (26) and said distal end (24) of said blades (20) terminating at a common concentric diameter as an outermost portion of said cover member (28) and said hub member (44) and said impeller (10) including a monolithic construction.

2. The impeller (10) set forth in claim 1, wherein said fluid inlet (26) is defined by a flange (30) being coaxial with said impeller axis and extending outwardly from said cover member (28).

3. The impeller (10) set forth in claim 2, wherein said flange (30) defines a radially outward wall (32) having a cylindrical surface and a radially inward wall (34) defining blade elements (36) being complimentary to each of said plurality of blades (20).

4. The impeller (10) set forth in claim 3, wherein each of blade elements (36) define a notch (38) in said radially inward wall (34).

5. The impeller (10) set forth in claim 4, wherein said proximal end (22) of each of said plurality of blades (20) extends radially inwardly of said fluid inlet (26) at said notch (38).

6. The impeller (10) set forth in claim 3, wherein each

of said plurality of blades (20) extends radially inwardly of said fluid inlet (26) proximate one of said blade elements (36).

7. The impeller (10) set forth in any of the preceding claims, wherein at least a portion of said cover member (28) and said hub member (44) extend radially outwardly at an angle being substantially perpendicular to said impeller axis.

8. The impeller (10) set forth in in any of the preceding claims, wherein said cover member (28) presents an arcuate cross-section relative to said fluid inlet (26) and said impeller axis.

9. The impeller (10) set forth in in any of the preceding claims, wherein said proximal end (22) of each of said plurality of blades (20) is disposed at an angle being offset from said impeller axis.

10. The impeller (10) set forth in in any of the preceding claims, wherein said distal end (24) of each of said plurality of blades (20) is parallel to said impeller axis.

11. The impeller (10) set forth in in any of the preceding claims, wherein said outermost portion of said hub member (44) defines a lip (46) extending in an axial direction.

12. The impeller (10) set forth in in any of the preceding claims, wherein said proximal end (22) of each of said plurality of blades (20) is spaced from said cylindrical member (14) defining said gear opening (12).

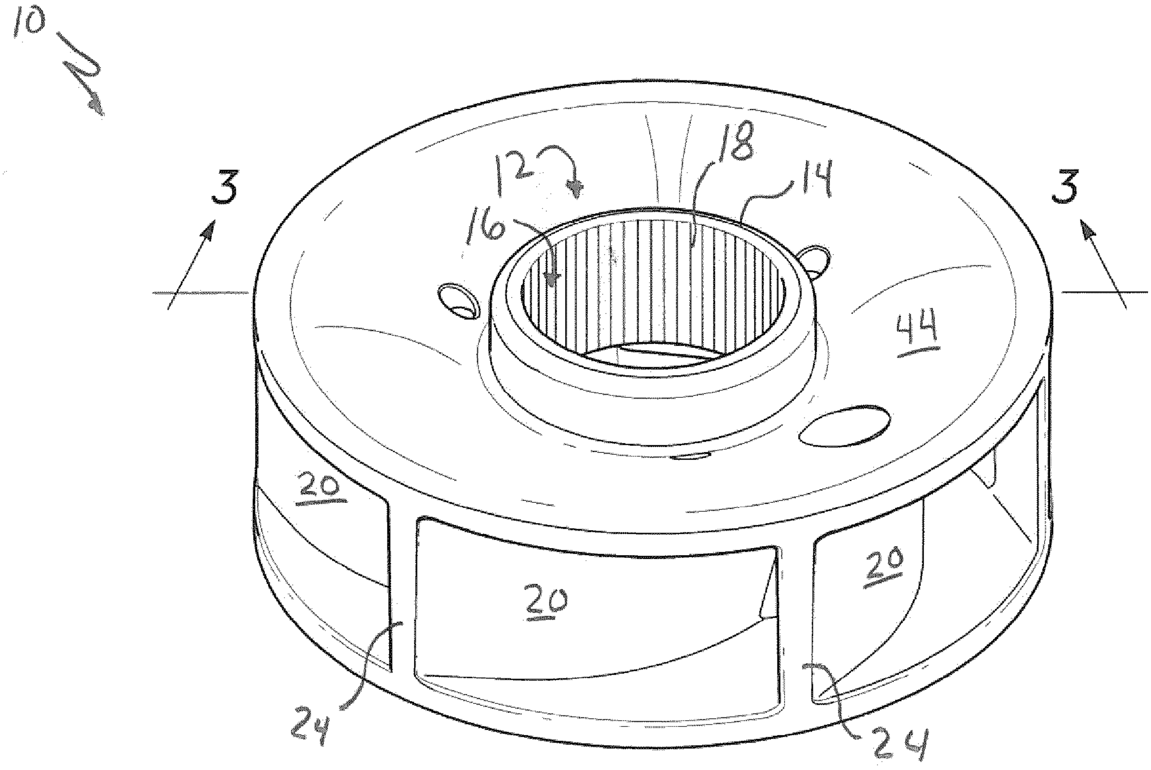
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Fig-1

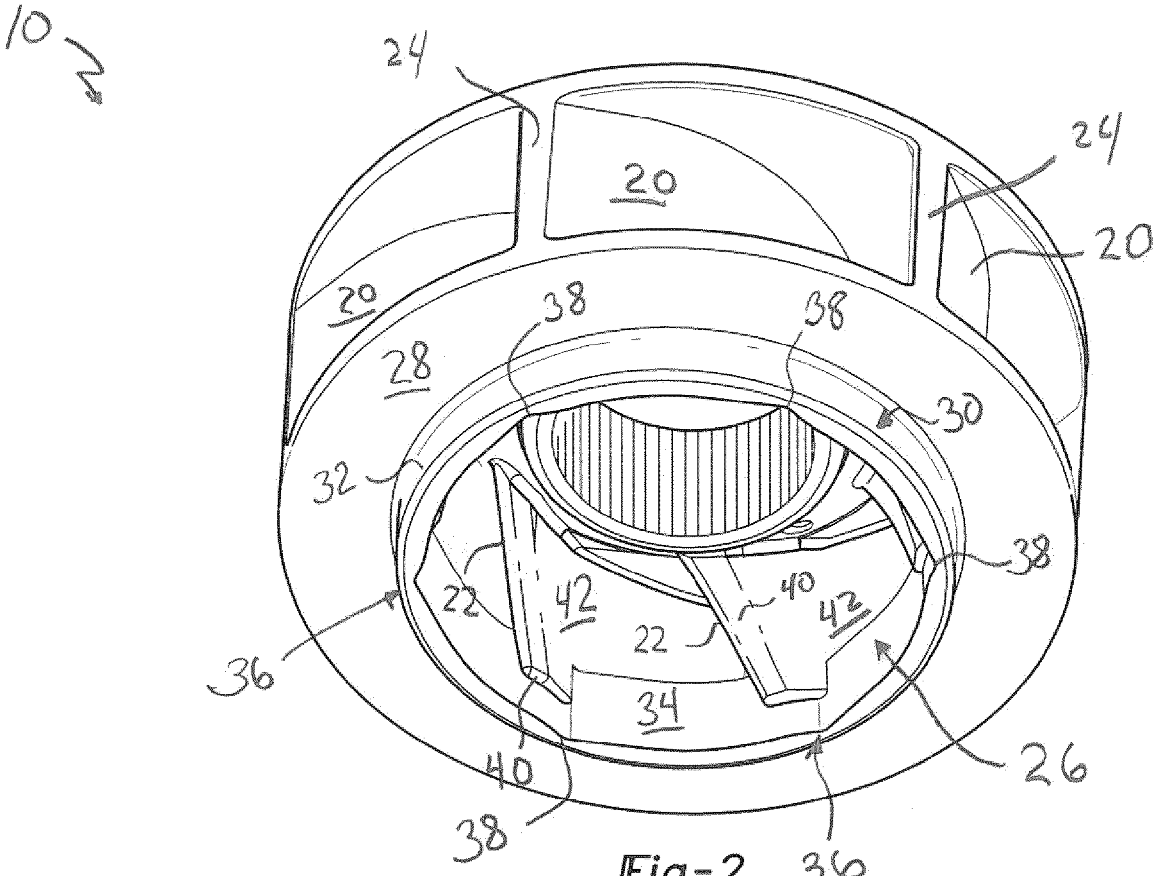
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Fig-2

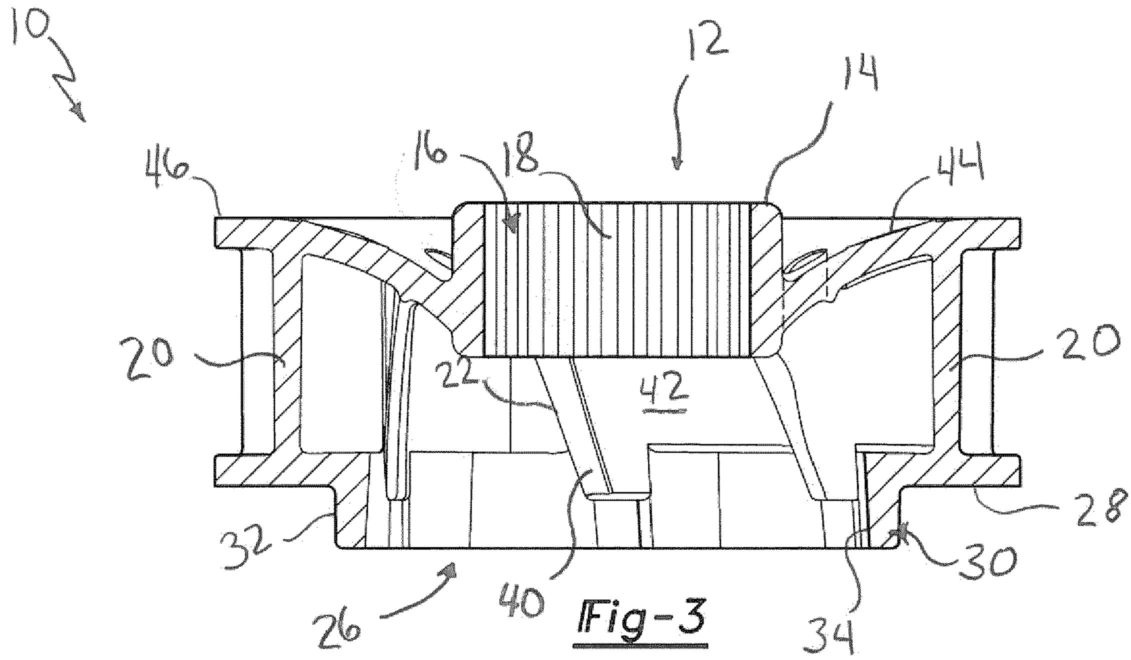
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Fig-3

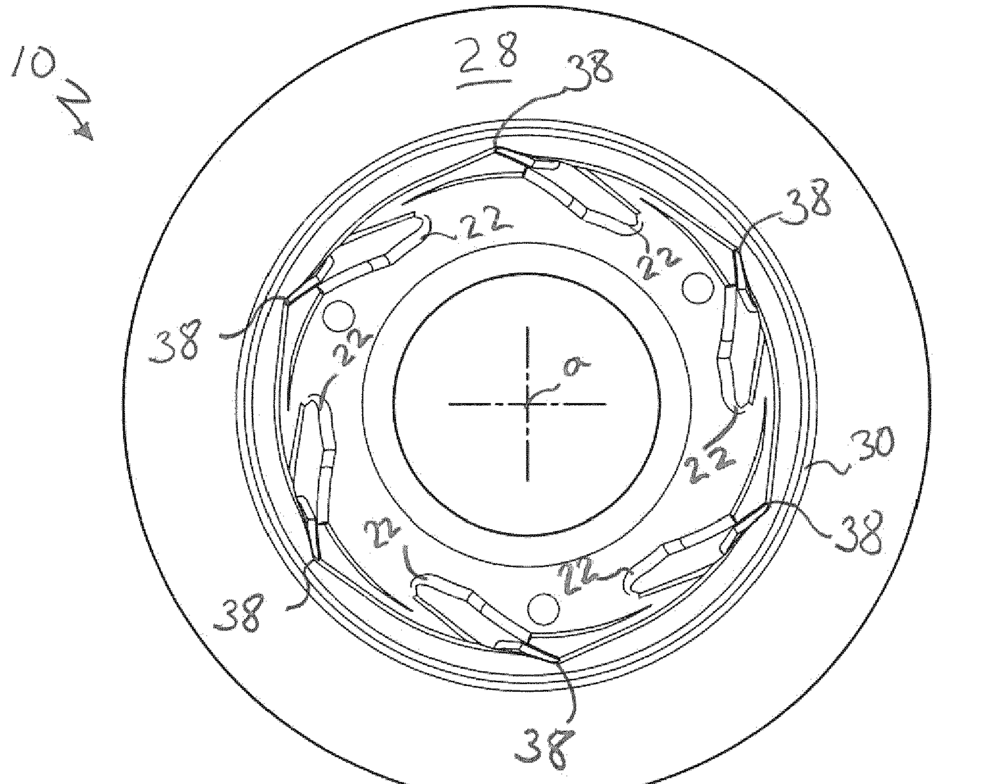
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Fig-4

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 9566

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2008/141381 A1 (WEIR MINERALS AUSTRALIA LTD [AU]; BURGESS KEVIN EDWARD [AU]; CANTRILL) 27 November 2008 (2008-11-27) * page 13, line 26 - line 31 * * page 14, line 1 - line 7 * * figures 9-14 * -----	1-4,6-12	INV. F04D29/22
A	US 6 398 494 B1 (CLEMENTS MARTIN A [US]) 4 June 2002 (2002-06-04) * column 2, line 43 - line 67 * * column 3, line 1 - line 13 * * figures 1-3 * -----	1-3,6-12	
A	US 2015/292516 A1 (REE SIGURD [NO]) 15 October 2015 (2015-10-15) * paragraph [0048] - paragraph [0051] * * figures 3a, 3b * -----	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

F04D
F01P

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	17 May 2017	Lovergine, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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17-05-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008141381 A1	27-11-2008	AU 2008253598 A1	27-11-2008
		BR PI0810324 A2	14-10-2014
		CA 2685313 A1	21-11-2008
		CA 2856861 A1	21-11-2008
		CA 2934308 A1	21-11-2008
		CL 2008001474 A1	28-11-2008
		CN 101779044 A	14-07-2010
		CN 102678618 A	19-09-2012
		CN 104061184 A	24-09-2014
		CN 105782110 A	20-07-2016
		CN 105864054 A	17-08-2016
		EA 200971075 A1	30-06-2010
		EP 2153071 A1	17-02-2010
		PE 01312009 A1	11-03-2009
		US 2010135765 A1	03-06-2010
		US 2014112755 A1	24-04-2014
		WO 2008141381 A1	27-11-2008
US 6398494 B1	04-06-2002	NONE	
US 2015292516 A1	15-10-2015	EP 2917586 A1	16-09-2015
		NO 334954 B1	04-08-2014
		US 2015292516 A1	15-10-2015
		WO 2014073976 A1	15-05-2014

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