US 20140050565A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2014/0050565 A1**

(43) **Pub. Date: Feb. 20, 2014**

Schlosser et al.

(54) **HYDRODYNAMIC COMPONENT**

(75) Inventors: **Markus Schlosser**, Ellwangen (DE); **Thursten Luhrs**, Kirchberg (DE); **Achim Menne**, Crailsheim (DE); **Dieter Laukmann**, Crailsheim (DE); **Ravi Schade**, Satteldorf (DE); **Bruno Foehl**, Frankenhardt (DE); **Jürgen Kibler**, Aalen (DE); **Christian Ebert**, Neuler (DE)

(73) Assignee: **Voith Patent GmbH**, Heidenheim (DE)

(21) Appl. No.: **13/983,284**

(22) PCT Filed: **Jan. 25, 2012**

(86) PCT No.: **PCT/EP2012/000324**

§ 371 (c)(1), (2), (4) Date: **Nov. 6, 2013**

(30) **Foreign Application Priority Data**

Feb. 2, 2011 (DE) 10 2011 010 153.5

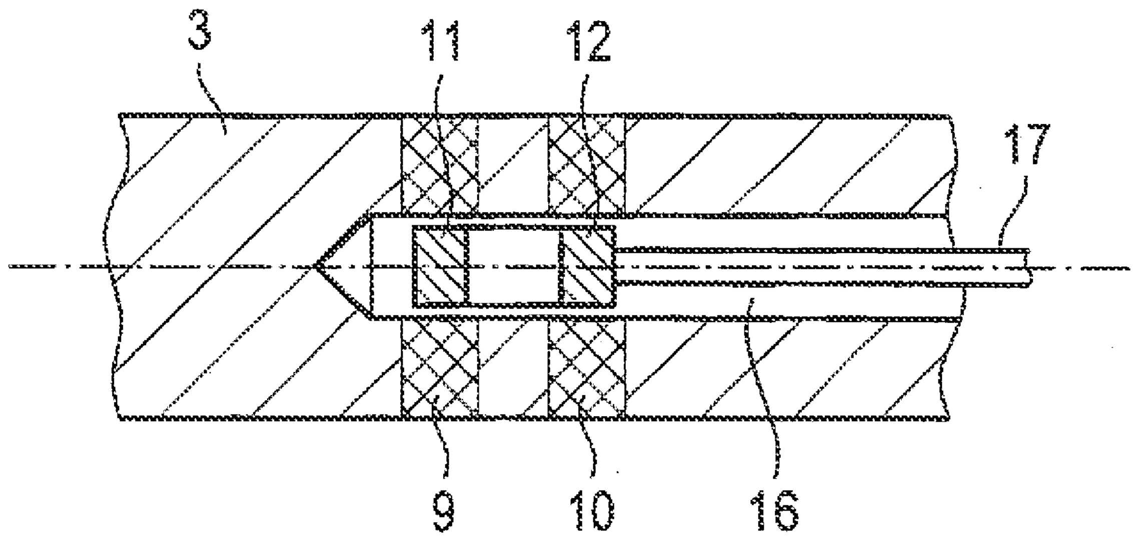
Publication Classification

(51) **Int. Cl.**
F01D 21/00 (2006.01)

(52) **U.S. Cl.**
CPC ***F01D 21/003*** (2013.01)
USPC **415/118**

(57) **ABSTRACT**

The invention relates to a hydrodynamic component comprising at least two elements which form a working chamber therebetween and which comprises a primary wheel and a secondary wheel. A working medium which can be introduced into the working chamber allows torque to be transmitted between said elements. At least one of the elements is arranged in a rotationally fixed manner on a shaft. The hydrodynamic component comprises a device for detecting a variable characterising at least directly the transmitted torque and/or the rotation of the shaft. According to the invention, the shaft is at least designed to have at least two sections which are at an axial distance from each other and which are made of a ferromagnetic material and is provided with a magnetic field which is rotationally stable with the respective section. Magnetic field sensors are arranged in areas corresponding to the at least two sections.



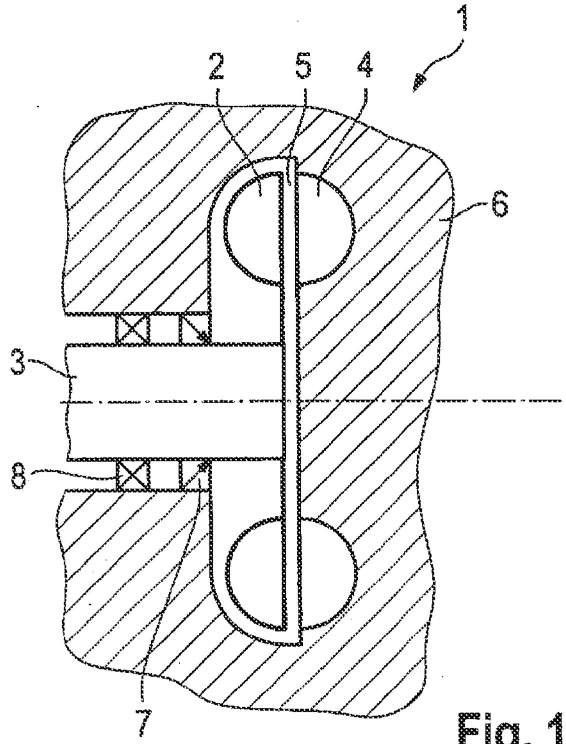


Fig. 1

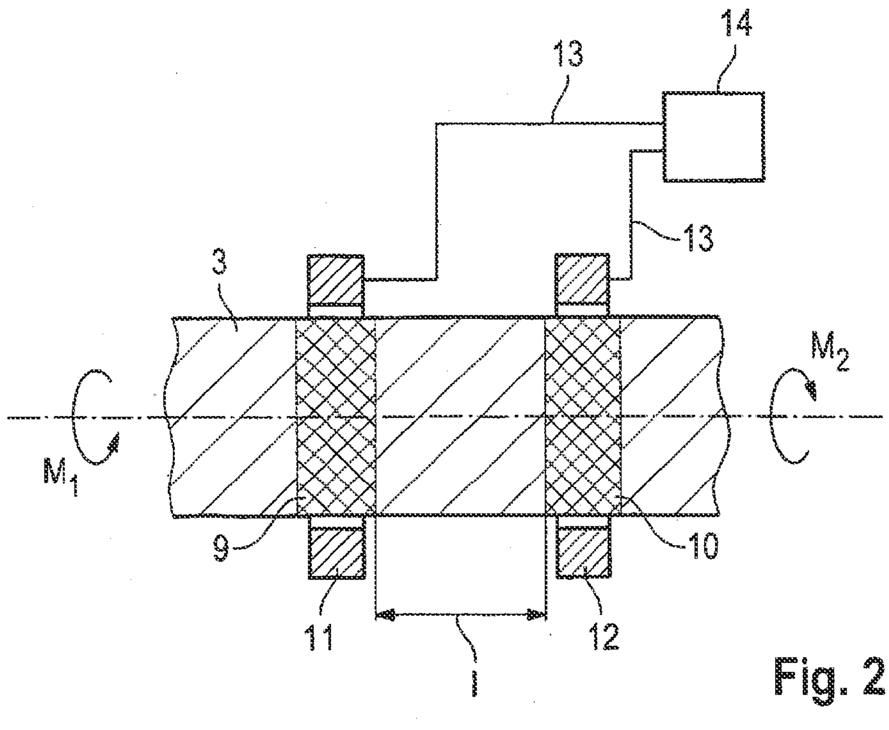


Fig. 2

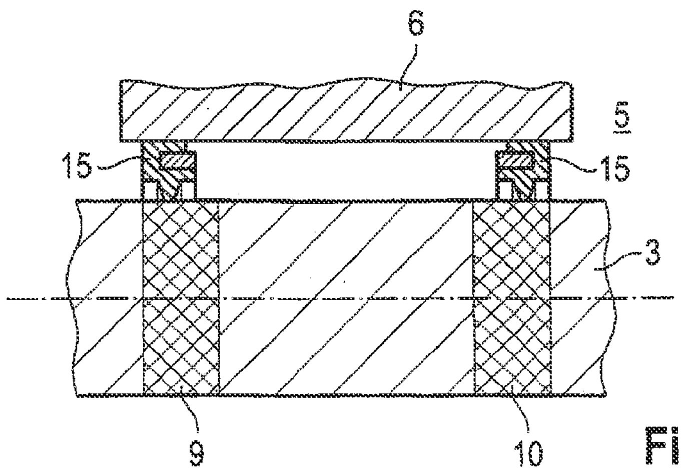


Fig. 3

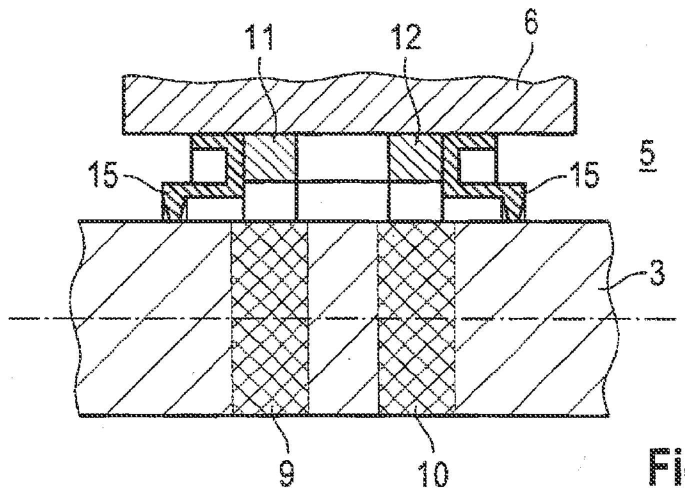


Fig. 4

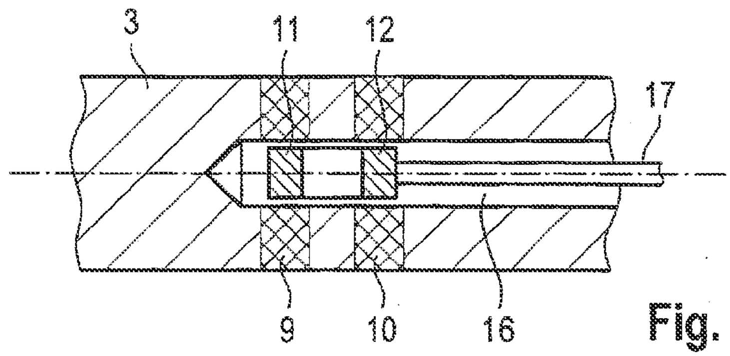


Fig. 5

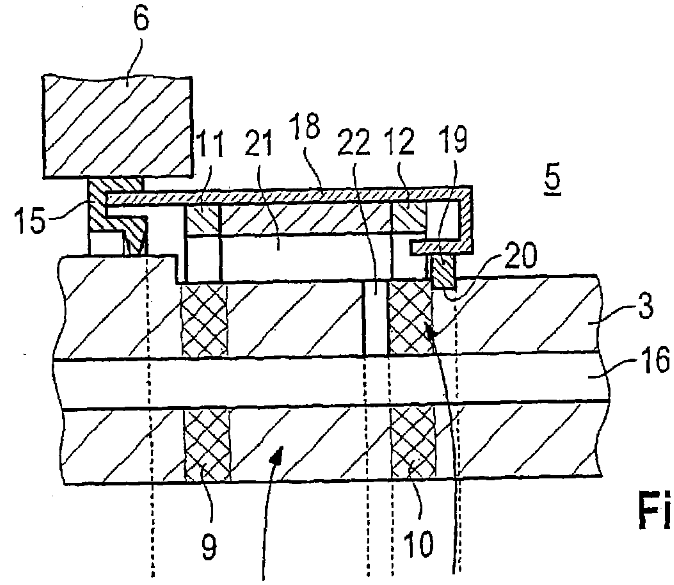


Fig. 6

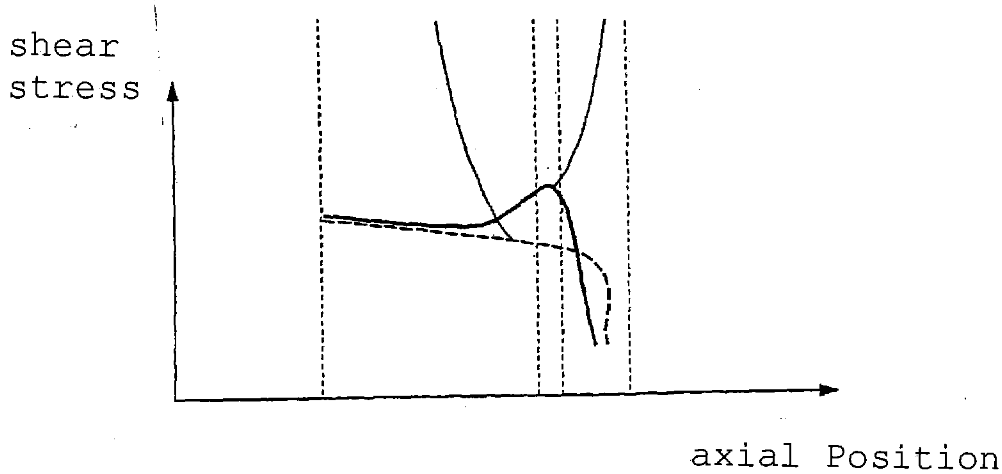


Fig. 7

HYDRODYNAMIC COMPONENT

BACKGROUND

[0001] 1. Technical Field

[0002] The invention relates to a hydrodynamic component having the features defined in detail in the preamble of claim **1**.

[0003] 2. Description of the Related Art

[0004] A generic hydrodynamic component is described in the German Patent Specification DE 10 2005 052 105 B4. This patent is concerned with a hydrodynamic system which is configured with a device for detecting a torque or a variable characterizing this torque. The structure is comparatively expensive since one of the two elements of the hydrodynamic system must be supported with respect to a positionally fixed element and the forces required for the support must be measured in the region of this support. A comparatively high constructive expenditure must be accepted for this and in particular a rotational movement of the supporting element must be possible, which for example in the case of a hydrodynamic retarder causes a correspondingly high expenditure. In addition, at least in certain operating situations the supporting element must be in a non-rotating state since the measurement is only possible here. In the case of a hydrodynamic converter or a hydrodynamic coupling, this is correspondingly expensive or in some cases not even possible.

SUMMARY

[0005] it is the object of the present invention to avoid these disadvantages and provide a hydrodynamic component in which a device for detecting a torque to be transmitted and/or the variable characterizing the rotational speed is simplified and is possible during operation with minimal constructive expenditure.

[0006] According to the invention this object is solved by the features in the characterizing part of patent claim **1**. The subclaims dependent on this give particularly preferred embodiments of the solution according to the invention.

[0007] The solution of the object mentioned initially consists in that the shaft is formed at least in at least two sections which are at an axial distance from each other and which are made of a ferromagnetic material and is provided with a magnetic field configured to be rotationally fixed with the respective section. Magnetic field sensors are then arranged in areas corresponding to the at least two sections, for example, on a housing surrounding the shaft. This structure allows a change in the magnetic fields in the respective sections to be detected by means of the physical effect of magnetostriction or the Joule effect having the most important component in the magnetostriction. In particular, a slight twist of the magnetic field in the first section in the direction of the shaft can be detected with respect to the magnetic field in the second section. From this twist of the magnetic fields in the sections, if the axial distance of the sections from one another is known and material properties and dimensions of the shaft are known, it is then possible to determine the torque in the region of the shaft. A torque will specifically twist the shaft. This torsion can then be detected by means of a change in the magnetic fields in the two sections in the angle with respect to one another and can be evaluated as the torque applied in the region of the shaft.

[0008] In addition, the measurement always allows the rotational speed of the shaft to be determined when the magnetic field disposed in a rotationally fixed manner to one of the sections has a constant inhomogeneity in the circumferential direction. Such an inhomogeneity can be achieved, for example, by a material variation, a mechanical variation of the material or a magnetic field coded accordingly in the circumferential direction, with which the shaft is provided. Alternatively to the torque, the rotational speed of the shaft can also be detected.

[0009] Ideally both the rotational speed and the torque in the shaft are detected with a correspondingly high measurement frequency so that the rotational speed and/or torque are available quasi-continuously. The measurement of the torque is in particular of interest here for a hydrodynamic retarder or a hydrodynamic coupling as a hydrodynamic component since the transmitted torque can be detected here by means of a suitable sensor system in one of the shafts. In principle, it is also feasible in a hydrodynamic converter where as a result of the supporting moment of the vanes between the primary wheel and the secondary wheel, either the torque both of the input shaft and of the output shaft must be detected or in addition to the torque in one of the shafts, the supporting moment of the vanes in order to determine the torque transmitted by the component.

[0010] The magnetic fields disposed in a rotationally fixed manner to the respective section of the shaft can in principle be constructed in any manner provided that they are configured to be rotationally fixed and constant at least during a certain time interval for the measurement. In particular, the magnetic fields or at least one of the magnetic fields according to a particularly favourable and advantageous embodiment of the hydrodynamic component according to the invention can be configured as a permanent magnetic field. As a result, the shaft can accordingly be magnetized once, for example, prior to assembly or the expenditure for the structures required to build up the magnetic field in the region of the shaft is eliminated. In the case of a corresponding magnetization of the shaft, for example, by means of a coded magnetic field and/or a magnetic field having at least two sub-regions which are magnetically different from one another in the circumferential direction, reference should be made for example to the international application WO 2005/064302 A2.

[0011] In a particularly favourable and advantageous embodiment of the hydrodynamic component according to the invention, it can be provided that the magnetic field sensors are configured to be contact-free with respect to the shaft. As a result, the measurement of the torque and/or the rotational speed can be made without friction losses.

[0012] According to a particularly favourable and advantageous embodiment of the hydrodynamic component according to the invention, it is further provided that the shaft is configured as a hollow shaft, wherein at least one of the magnetic field sensors is disposed in the interior of the hollow shaft. This structure of a hollow shaft with magnetic field sensors disposed fixedly inside the rotating hollow shaft is very space-saving since the sensors disposed inside the hollow shaft do not require any further installation space in the region of the housing surrounding the shaft.

[0013] In an additional or alternative configuration of the hydrodynamic component it can be provided that at least one of the magnetic field sensors is disposed in the region of a sealing element surrounding the shaft. Typically, in the case of a hydrodynamic component in the region of the shaft at least one sealing element is required in any case in order to seal with respect to the surroundings the working fluid located at high pressure in the working chamber between the elements, for example, the primary wheel and the secondary wheel during the transmission of torque. Such a sealing element surrounding the shaft is ideally suitable for integrating the magnetic field sensor, which for example can be a coil surrounding the shaft, in this sealing element and thus providing a hydrodynamic component having corresponding sensors according to the invention in a neutral manner in terms of installation space with suitable magnetizations of at least two axially spaced-apart sections of the shaft and arrangement of the magnetic field sensors in the region of the sealing element around the shaft.

[0014] In particular, at least one of the magnetic field sensors can be disposed in a shaft sealing ring surrounding the shaft. Such shaft sealing rings typically have a configuration in any case which allows sufficient space for the integration of a coil as a magnetic sensor. They are typically very readily accessible and connected to corresponding regions of the housing so that a lead can be guided from the region of the coil integrated in the shaft sealing ring, for example, to the outside of the housing to an electronic system or the like simply and without any problems.

[0015] In a further preferred embodiment of the hydrodynamic component according to the invention, it can also be provided that at least one of the magnetic field sensors is disposed between the shaft sealing rings surrounding the shaft. In this region between two shaft sealing rings of a multistage seal of the shaft or the working chamber surrounding the shaft, it is possible to dispose one or two magnetic field sensors between these shaft sealing rings. This has the advantage that abrasion from the working chamber will not enter into such a region to any extent and that contamination of the magnetic field sensors can thereby be largely avoided.

[0016] In a particularly favourable and advantageous embodiment of the hydrodynamic component according to the invention, it can be provided that a shaft seal comprises at least one shaft sealing ring and a piston ring connected via a support element to the shaft sealing ring. In this structure at least one of the magnetic field sensors can be disposed on the support element. This structure with a piston ring placed between working chamber and first sealing chamber allows a reduction of the pressure in the first sealing chamber compared with the pressure in the working chamber to, for example, about 20% of the pressure in the working chamber. In this case, the piston ring is frequently connected to a shaft sealing ring via a support element which ensures the sealing of the first sealing chamber with respect to the surroundings or optionally also with respect to a further second seating chamber. Such a support, possibly lengthened in the axial direction, is ideally suitable for carrying the magnetic field sensor since this is typically formed from a sheet metal sleeve which appropriately surrounds the shaft. With sufficient axial length of this support element it is also very readily possible to place the magnetic field sensors corresponding to the two axially spaced-apart sections of the shaft, both at a certain axial distance from one another on the support element in order to thus ensure simply and efficiently a possibility for integration of the sensors.

[0017] In an advantageous further development of the invention it can be provided that in the region of one of the sections, the shaft is configured at one or more locations distributed around the circumference of the shaft such that A mechanical loading of the shaft causes a stress gradient. The Joule effect in this case results in a variation of the magnetic field accompanying the position of this location. If one or more locations distributed over the circumference are provided in the region of one of the sections which cause such a variation in the magnetic field, this then results in the possibility of measuring the rotational speed without the magnetic fields needing to be provided specially for a rotational speed measurement, since a characteristic variation of the magnetic field caused by the location with the stress gradient is detected once or several times per revolution depending on the number of locations. A rotational speed signal can be derived very simply from this.

[0018] In a very advantageous further development of this idea, it can be provided that the locations are configured as stress-relief or runoff holes for a lubricant from a region between two seating elements of the shaft. Such stress-relief holes can be provided, for example, in the region between two shaft seals or in the region between a piston ring and a shaft sealing ring, i.e. in a sealing region adjacent to the working chamber in order to remove lubricant accordingly at lower pressure, for example, through a central hole running inside the shaft. These stress-relief holes cause a stress gradient so that without additional expenditure on production technology and with the particular side effect of having already integrated one or more stress relief holes, a rotational speed measurement can be achieved simply and efficiently by means of the inhomogeneous magnetic field over the circumference which rotates with the shaft in the respective section.

[0019] The configuration of the hydrodynamic component according to the invention can be a converter or a hydrodynamic coupling. In particular, the component can also be a hydrodynamic retarder. This retarder can be constructed correspondingly simply since in contrast to structures in the prior art, the stator can be configured to be integrated directly in the housing since the torque can be detected in the region of the shaft and no rotational movement of the stator around its axis is required for this. In addition, due to the simple and compact integration of the sensors, for example, in the shaft sealing rings or in the region of the sealing elements, a sensor system can be integrated with minimal expenditure and minimal installation space into the corresponding retarder which can be implemented very simply, efficiently and in a space-saving manner, it allows both the torque and the rotational speed to be measured and therefore everything for controlling the retarder or for controlling a braking system comprising the retarder as one of the possibilities for braking.

[0020] The sensors constructed according to the principle of magnetostriction can be used under numerous conditions since the magnetic field sensors are correspondingly simple and can be configured to be very resistant to temperature, environmental influences and the like. For example, they can be used in the region of the lubricating oil or working medium and can in particular be operated securely and reliably at correspondingly high ambient temperatures.

[0021] Further advantageous embodiments of the hydrodynamic component according to the invention are obtained from the remaining subclaims and will become clear by reference to the exemplary embodiments which are explained in detail hereinafter by reference to the figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] In the figures:

[0023] FIG. **1** shows a schematic diagram of a hydrodynamic retarder;

[0024] FIG. **2** shows a structure for measuring the torque and/or the rotational speed on the shaft of the retarder according to FIG. **1**;

[0025] FIG. **3** shows a first possible embodiment for the arrangement of the magnetic field sensors;

[0026] FIG. **4** shows a second possible embodiment for the arrangement of the magnetic field sensors;

[0027] FIG. **5** shows a third possible embodiment for the arrangement of the magnetic field sensors;

[0028] FIG. **6** shows a fourth possible embodiment for the arrangement of the magnetic field sensors; and

[0029] FIG. **7** shows a diagram of the shear stress profile in the shaft according to FIG. **6**.

DETAILED DESCRIPTION

[0030] in the diagram in FIG. **1**, a very simply constructed hydrodynamic component **1** in the form of a retarder **1** can be identified in a schematic diagram. The hydrodynamic retarder **1** consists of a primary wheel **2** which is configured to be rotationally movable and which is disposed in a rotationally fixed manner on a shaft **3**. The primary wheel of the hydrodynamic retarder **1** is also designated as rotor. The rotor **2** now has at its outer end a bladed region which together with a corresponding bladed region in a secondary wheel **4** forms a toroidal working chamber designated by **5**. In the structure of the retarder the secondary wheel **4** is typically fixed and in the very simple exemplary embodiment shown here is designed to be integrated in a housing **6**. The secondary wheel **4** is also designated as stator **4**. The working chamber **5** of the retarder **1** is filled with a working medium, for example, the cooling water of a cooling circuit in the case of a water retarder or an oil as working medium whenever wear-free braking is to be achieved with the retarder **1**. The working chamber **5** is sealed with respect to the surroundings by means of sealing elements **7** indicated schematically here, the shaft **3** is suitably mounted by means of indicated bearings **8**, for example, roller bearings.

[0031] The retarder **1** can, for example, be disposed in a commercial vehicle, a rail vehicle or the like. The rotor **2** moves the working medium located in the working chamber **5** with its bladed region and thereby attempts to transmit a corresponding torque to the stator **4**. Since the stator **4** for its part is configured to be non-rotationally movable, a corresponding torque is formed. The accumulated work is converted into heat in the working medium. If the working medium is the cooling medium in the cooling circuit of a vehicle fitted with a retarder **1**, the heat is removed directly via the cooling medium, if an oil is used as working medium for the retarder **1**, this is cooled by means of a heat exchanger from a cooling medium in a circuit of the vehicle.

[0032] Such a retarder **1** frequently forms a part of a braking system and is combined with further brakes. These can, for example, be an engine brake, a friction brake, and possibly a generator for recuperative braking. In order to distribute the braking power ideally to the individual brakes, it is important that the torque applied, by the individual brakes is known. For this purpose the torque, for the exemplary embodiment shown here in the region of the retarder **1**, should be measured accordingly. For this purpose, the retarder **1** indicated schematically in FIG. **1** should have a device for detecting the transmitted torque which is shown schematically in the diagram in FIG. **1**. This device substantially consists of two sections **9**, **10** of the shaft **3**, which have been provided with a permanent magnetic field. For this purpose at least the two sections **9**, **10**, but in particular the entire shaft **3** can be made of a ferromagnetic material. As shown in the prior art mentioned in the description, the sections **9**, **10** can be provided with a permanent magnetic field which remains permanently in the region of the shaft **3** or in the region of the sections **9**, **10** and thus only needs to be generated once before mounting the shaft **3** in the retarder **1**. The magnetic field located in the two sections **9**, **10** is in this case configured in a rotationally fixed manner to the respective section **9**, **10** of the shaft **3**.

[0033] If as indicated in the diagram in FIG. **2**, a loading of the shaft **3** by means of a torque M_1 comes about, a corresponding counter-torque is formed due to the rotationally fixed rotor **2** connected to the shaft and the principle of action of the retarder **1** described above, which is designated in the diagram of FIG. **2** by M_2. As a result of the torque and the counter-torque a (slight) torsion of the shaft **3** occurs. The torque in the region of the shaft **3** can thus be determined from the axial distance **1** of the two sections **9**, **10**, the material properties and the geometry of the shaft **3** in this region and an angle of twist of the first section **9** with respect to the second section **10**. The shaft **3** itself in this case forms the primary sensor. Magnetic field sensors **11**, **12** are disposed as secondary sensors in a non-manner around the sections **9**, **10** of the shaft **3**. These are implemented in the form of coils which surround the shaft **3**. They are connected via corresponding line elements **13** to evaluation electronics **14**, which for example can be disposed outside the housing **6** of the retarder **1**. The magnetic field located in the region of the sections **9**, **10** can be detected by means of the magnetic field sensors **11**, **12**. if an angular deviation occurs between the two sections **9**, **10**, the magnetic fields imprinted in a rotationally fixed manner with the shaft in the sections **9**, **10** are twisted at an angle to one another. This angle of twist can be detected by the magnetic field sensors **11**, **12** and the torque can be determined with the geometric properties and the material property of the structure.

[0034] The device for detecting the torque in this case uses the principle of magnetostriction or the Joule effect. The magnetic field sensors **11**, **12** in the form of coils surround the shaft **3** in a non-contact manner so that as a result, additional friction expenditure or the like is formed. In addition, they are comparatively small and very robust so that they can also be inserted in lubricating oil at high temperatures and in the working medium of the retarder **1**. Since the shaft itself or the magnetized sections **9**, **10** of the shaft **3** serve as primary sensor, the structure is extraordinarily compact since only the magnetic field sensors **11**, **12** require an additional installation space. In order to now be able to arrange these in a comparatively space-saving manner in the retarder **1**, it can in particular be provided to dispose these in the region of the sealing elements **7** or integrate them in said elements.

[0035] The diagram in FIG. **3** shows a corresponding section with the shaft **3** and the housing **6** of the retarder **1**. Two shaft sealing rings **15** are disposed around the shaft **3** but merely shown above the shaft **3**, which sealing rings seal with respect to one another the region of the surroundings located to the left of the section shown with the working chamber **5** located to the right of the section shown. The shaft sealing rings **15** are designed in a manner known per se. In addition, they have the two magnetic field sensors **11**, **12** in the form of coils. A very compact structure is obtained by integrating the magnetic field sensors **11**, **12** into the shaft sealing rings **15**. Since the shaft sealing rings **15** are present in any case, these must only be minimally adapted in their design and thus can easily be retrofitted in existing constructions since the overall structure can be formed from shaft sealing ring **15** and integrated magnetic field sensors **11**, **12** such that this corresponds to a conventional shaft sealing ring **15** in external dimensions. Since the primary sensor in the region of the shaft **3** is merely imprinted by magnetizing, in practice no additional expenditure is incurred with regard to the installation space.

[0036] A similar diagram can be seen in FIG. **4**. In the exemplary embodiment shown here the two magnetic field sensors **11**, **12** are integrated between two shaft sealing rings **15** in the space located between the shaft sealing rings **15**. The space provided in any case in conventional designs can in particular be used for integration of the magnetic field sensors **11**, **12** since comparatively controlled and uniform conditions prevail here and since moderate pressures and comparatively little abrasion from the region of the working chamber **5** are present here. The magnetic field sensors can thus operate over a long period of time under very constant conditions so that the reliability of the structure can be increased. This also applies to the structure shown in FIG. **3**.

[0037] The diagram in FIG. **5** shows an alternative embodiment. The shaft **3** is here designed as a hollow shaft which has a through hole or blind hole **16**. Since the magnetization of the sections **9**, **10** acts not only towards the outside but also into the interior of the hollow shaft, it is possible to arrange the magnetic field sensors **11**, **12** not only around the shaft **3** but also in the interior of the shaft **3**. These are connected in a positionally fixed manner to a non-rotating part, for example, the housing **6** via a corresponding support **17**. They can then measure similarly to the exemplary embodiments described above. As a result of their integration in the shaft, they are securely and reliably protected from events arising from the outer region of the shaft. The line elements **13** can be simply guided towards the outside via the support **17**.

[0038] The diagram in FIG. **6** shows a further embodiment of the structure shown similarly to that in FIGS. **3** and **4**. Only a shaft sealing ring **15** is shown in this structure. This is connected via a support element **18** to a piston ring **19** and supports this. The support element **18** can surround the shaft **3** as an annular sheet metal element The piston ring **19** cooperates with a corresponding groove **20** in the shaft **3** and seals the working chamber **5** with respect to the first sealing region **1** located between the sealing ring **19** and the shaft sealing ring **15**. In the region of the working chamber, typically pressures of the order of magnitude of, for example, 10 bar can be present. Typically a pressure of the order of magnitude of 1.5 to 2.5 bar can be established in the first sealing region **21** between the piston ring **19** and the shaft sealing ring **15**. The support element **18** is also known and usual in conventional structures. It has a comparatively small axial length. In the exemplary embodiment shown in FIG. **6** this axial length of the support element **18** was correspondingly enlarged in order to thus enlarge the first sealing region **21** and provide space for the magnetic field sensors **11**, **12** which are connected to the support element **18**. A structural integration of the magnetic field sensors **11**, **12** can thus be achieved in which merely a minimal adaptation of the structure is required. In order to be able to achieve a good sealing of the retarder **1** with respect to the surroundings, in addition a further shaft sealing ring **15** can optionally be present in order to thus form a second sealing chamber on the side of the shaft sealing ring **15** shown here facing away from the first Sealing chamber **21**. In addition, the first sealing chamber **21** is connected via a stress-relief hole **22** to a hole **16** in the region of the shaft **13** designed as a hollow shaft. Oil can flow out from the second sealing chamber via this stress-relief hole **22** and thus decisively improve the sealing of the retarder **1**.

[0039] In addition to the torque which is measured by means of the magnetic field sensors **11**, **12** and the magnetized sections **9**, **10** of the shaft **3**, with the device for detecting the torque it is also possible to detect the rotational speed of the shaft **3** additionally or alternatively to the torque. In this case, for example, the magnetic field can be configured so that this has magnetically differently acting subregions around the circumference of the shaft **3** so that a corresponding region can be detected by means of the magnetic field sensors **11**, **12** and can be assigned to a revolution of the shaft.

[0040] In particular however, such an inhomogeneity of the magnetic field around the circumference of the shaft **3** is also obtained when a corresponding location is disposed in the region of the shaft **3** which ensures a stress gradient in the stress produced in the stress produced under the mechanical loading of the shaft. Such a location can, for example, be a groove, step or the like running in the axial direction. In particular the stress-relief hole **22** or a plurality of stress-relief holes **22** disposed over the circumference of the shaft **3** can be used accordingly. The diagram in FIG. **7** shows the shear stress in the region of the shaft **3** over the axial extension thereof. The dashed line shows the shear stress in the regions in which no stress-relief hole **22** is provided. The continuous line shows the shear stress in the region in which the stress-relief hole **22** is disposed. This strongly deviating shear stress ensures a variation in the magnetic field of the associated section according to the joule effect, in this case the associated second section **10**, so that a corresponding variation of the magnetic field occurs in this section at the locations of the circumference on which the stress-relief hole **22** is disposed. If then, for example a stress-relief hole **22** is disposed around the circumference, the corresponding perturbation in the shear stress and therefore in the magnetic field will always be detected when this location is at a certain position. This event can therefore be detected once per revolution of the shaft, with the result that a simpler and more efficient speed sensor is formed, which accordingly utilizes the circumstances present in any case, in this case the stress-relief hole **22** of the sealing system in order to be able to detect the rotational speed of the shaft **3** along with the torque simply, efficiently and reliably without additional expenditure on production or assembly.

1-18. (canceled)

19. A hydrodynamic component

comprising at least two elements which form a working chamber therebetween, which comprises a primary wheel and a secondary wheel, and which via a working medium which can be introduced into the working chamber transmit a torque between said elements,

at least one of the elements is arranged in a rotationally fixed manner on a shaft,

comprising a device for detecting a variable characterizing at least indirectly the transmitted torque and/or the rotational speed of the shaft,

characterized in that

the shaft at least consists of at least two sections which are at an axial distance from each other and which are made of a ferromagnetic material and are provided with a magnetic field configured to be rotationally fixed with the respective section and that magnetic field sensors are arranged in areas corresponding to the at least two sections.

20. The hydrodynamic component according to claim **1**, characterized in that at least one of the sections is provided with a permanent magnetic field.

21. The hydrodynamic component according to claim **1**, characterized in that the magnetic field of at least one section is configured as a coded magnetic field.

22. The hydrodynamic component according to claim **1**, characterized in that the magnetic field of at least one section has at least two sub-regions which are magnetically different from one another in the circumferential direction.

23. The hydrodynamic component according to claim **1**, characterized in that the magnetic field sensors are configured to be contact-free with respect to the shaft.

24. The hydrodynamic component according to claim **1**, characterized in that the magnetic field sensors are configured in the form of coils.

25. The hydrodynamic component according to claim **1**, characterized in that the magnetic field sensors surround the shaft.

26. The hydrodynamic component according to claim **1**, characterized in that the shaft is configured as a hollow shaft, wherein at least one of the magnetic field sensors is disposed in the interior of the hollow shaft.

27. The hydrodynamic component according to claim **1**, characterized in that at least one of the magnetic field sensors is disposed in the region of a sealing element surrounding the shaft.

28. The hydrodynamic component according to claim **1**, characterized in that at least one of the magnetic field sensors is disposed in a shaft sealing ring surrounding the shaft.

29. The hydrodynamic component according to claim **1**, characterized in that at least one of the magnetic field sensors is disposed between the shaft sealing rings surrounding the shaft.

30. The hydrodynamic component according to claim **1**, characterized in that at least one of the magnetic field sensors is disposed in the region of a holder for a sealing element.

31. The hydrodynamic component according to claim **1**, characterized in that a shaft, seal comprises at least one shaft sealing ring and a piston ring connected via a support element to the shaft sealing ring, wherein at least one of the magnetic field sensors is disposed on the support element.

32. The hydrodynamic component according to claim **1**, characterized in that in one of the sections the shaft is configured at one or more locations distributed around the circumference of the shaft such that a mechanical loading of the shaft causes a stress gradient.

33. The hydrodynamic component according to claim **14**, characterized in that the locations comprise stress-relief holes for a lubricant from a region between two sealing elements.

34. The hydrodynamic component according to claim **14**, characterized in that the locations comprises an edge or groove running axially to the shaft.

35. The hydrodynamic component according to claim **1**, characterized by its configuration as a hydrodynamic coupling or as a hydrodynamic retarder.

36. The hydrodynamic component according to claim **1**, characterized by its configuration as a hydrodynamic converter.

37. The hydrodynamic component according to claim **2**, characterized in that the magnetic field of at least one section is configured as a coded magnetic field.

38. The hydrodynamic component according to claim **2**, characterized in that the magnetic field of at least one section has at least two sub-regions which are magnetically different from one another in the circumferential direction.

* * * * *