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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 June 2017 (01.06.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/091171 Al

(51) International Patent Classification:
F16F 13/30 (2006.01)

(21) International Application Number:
PCT/TR20 16/000 167

(22) International Filing Date:
25 November 2016 (25.1 1.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2015/15094 27 November 2015 (27. 11.2015) TR

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(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, JP, KE, KG, 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).

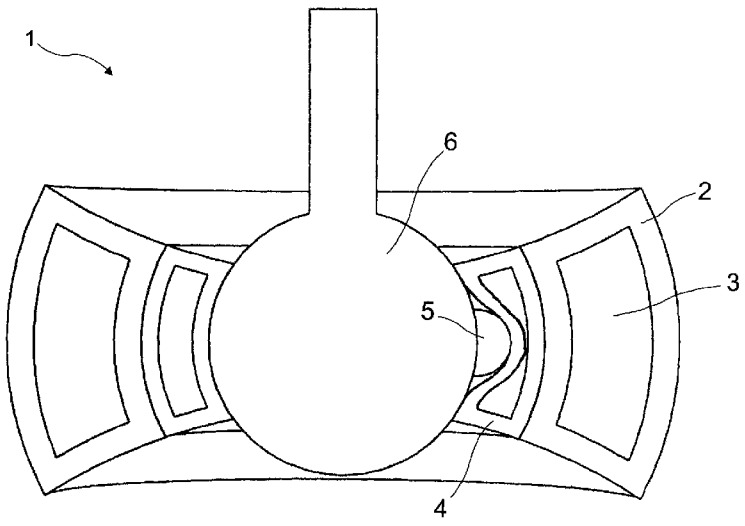
Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(54) Title: AN ADJUSTABLE DASHPOT

Figure 1



(57) Abstract: This invention is related to an adjustable dashpot (1) whose damping effect can be controlled, whose damping range does not change by means of its impermeability feature, which can be adapted to different joint geometries, comprising at least a control element (3) which can be mounted onto the body (2) and which can change the viscosity of the material whose viscosity can be changed depending on time, at least a housing (4) in which a material whose viscosity can be changed is housed, at least a pressure means (5) which applies a preferred amount of pressure onto the housing (4) and at least a rotating means (6) which can rotate around a central axis.

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DESCRIPTION

AN ADJUSTABLE DASHPOT

Technical Field

This invention is related to an adjustable dashpot whose damping effect can be controlled, whose damping range does not change by means of its impermeability feature and which can be adapted to different joint geometries.

Prior Art

Magneto-rheological materials, are smart materials whose rheological features change under magnetic field effects. These materials behave like liquids when a magnetic field is not present. They can change into viscoelastic solid form in the presence of an electromagnetic field. The rheological features of magneto-rheological materials can be precisely controlled by changing the applied electromagnetic field.

Magneto-rheological materials are used in several different fields. One of the fields in which said materials are frequently used is the field of motion damping and/or the field of braking. Presently magnetorheological material is injected into the device during application in these fields and a magnetic field is formed inside or outside the system and as a result the rheological features of the material is changed. By increasing the magnetic field, the viscosity of the magnetorheological material is increased and the movement of the system located therein is restricted. In the case that the magnetic field is sufficiently increased, the magnetorheological material is formed as a completely viscoelastic solid form and as a result the system located therein is completely immobilized. The magnetorheological material of the devices used in the known state of the art provide the lowest amount of resistance to motion when magnetic field effect is not present. Impermeability mean(s) need to be used

in order to prevent leakage in devices during motion. Impermeability means create undesired friction forces in a system. Moreover although an impermeability means is present in the device, after a while, leakage occurs and undesired or unexpected rheological features are formed under the same magnetic field effect depending on the leakage (loss) of magnetorheological material and in connection with this leakage, the information regarding the electromagnetic field in which the desired damping characteristic occur changes. In other words, in the case that there is a leakage, although the electromagnetic field strength applied to the system remains the same, the rheological properties of the magnetorheological material changes. This situation prevents the system from operating efficiently. Moreover unwanted effects can be experienced in the system or around it due to leakage, such as oily residues or contamination.

The United States patent document numbered US2004 107784 of the state of the art describes a system which can be controlled by using a magnetorheological fluid.

Objects of the Invention

The object of the invention is to form an adjustable dashpot with which impermeability is completely provided.

Another object of the invention is to provide an adjustable dashpot where the damping value can be controlled with precision and high repeatability.

Another object of the invention is to provide an adjustable dashpot where a smart material is contained inside a monolithic closed container made of elastic material.

Another object of the invention is to provide an adjustable dashpot which houses the smart material such that it does not contact any other mobile element directly.

Another object of the invention is to ensure that the smart material is carried with a peristaltic motion.

Detailed Description of the Invention

The dashpot provided in order to reach the objects of the invention has been shown in the attached figures, wherein the invention is intended to be applied to systems having different kinematics (linear, rotation etc.), elements and geometry in order to provide damping.

Fig. 1. Is the side section view of the dashpot.

Fig. 2. Is the perspective section view of the dashpot.

The parts in the figures are numbered individually and the references corresponding to the related part are listed below.

1. Adjustable dashpot
2. Body
3. Control element
4. Housing
5. Pressure means
6. Rotating element

The adjustable dashpot (1) whose damping effect can be controlled and whose damping range does not change by means of its impermeability feature and which can be adapted to different joint geometries. basically comprises;

- at least a body (2),
- at least a control element (3) which can be mounted onto the body (2) and which can change the viscosity of the material whose viscosity can be changed depending on time,

- at least a housing (4) in which a material whose viscosity can be changed is housed,
- at least a pressure means (5) which applies a preferred amount of pressure onto the housing (4)
- and at least a rotating element (6) which can rotate around a central axis.

According to an embodiment of the invention the adjustable dashpot (1) comprises a body (2) having radial geometry depending on the rotation movement of said dashpot. The control element (3) preferably has the ability to create an efficient level of magnetic field. By this means, if preferred, the control element (3), can create a magnetic field having the desired intensity. The magnetic field formation strength of the control element (3) can be precisely adjusted and therefore the magnetic field having the preferred strength can be formed by means of this control element (3). An insulating material can be placed if required, at the area where the control element (3) is in contact with the housing (4). This insulation material acts as an insulator in order to prevent unwanted effects, between the housing (4) and the control element (3). A housing (4) can be provided at the other surface of the insulation material which does not have a control element (3). The housing (4) has been produced from preferably an elastic material. Moreover, if preferred, the housing can be formed from any kind of material whose material features can be controlled and the housing is hollow. Preferably magnetorheological material is stored inside the housing (4). This material is not allowed to leak out of the housing. In order for the smart material inside the housing (4) to be able to flow, the channel inside the housing (4) has a closed off circulation structure. Preferably the housing (4) is monolithic and as it is a replaceable system component, it can be replaced if the technical effects are reduced depending on usage and the disadvantages of the adjustable dashpot (1) efficiency is minimized. The housing (4) can be elastically deformed from at least one section by means of the pressure element (5). As the housing (4) has an elastic structure, if any kind of force is applied onto the housing (4), the housing (4) is temporarily elastically deformed and when this force is no longer applied, the housing (4) take back its former shape. The force applied onto

the housing (4) is created by means of the pressure element (5). The pressure element (5) is preferably installed onto the rotating element (6). For different applications it may be preferred for the rotating element (6) to rotate around the centre and for the pressure element (5) to be fixed. An elastic deformation is formed on the surface of the housing (4) at the section that is in contact with the pressure element (5) and in the case that the pressure element (5) is in contact with another section of the housing (4) surface, the force on the initial deformed section is lifted, and elastic deformation is created at the other section of the housing which is now in contact with the pressure element (5). The pressure element (5) can be rotated at preferred angles, speed and axis (pitch, yaw, roll) depending on the motion of the rotating element (6). Not only a pressure element (5) which applies force from a single point can be used in said adjustable dashpot (1) but also a pressure element (5) or pressure elements (5) which can apply force from a plurality of points can be used. In the case that a plurality of pressure elements (5) is desired to be used, other geometries and/or coupling means can also be adapted to the adjustable dashpot (1).

The dashpot (1) of the invention, basically comprises a rotating element (6), a plurality of pressure elements (5), a housing (4) containing smart material and a control element (3). These components can be designed and produced to have different kinematics and geometries. An embodiment of the invention can be illustrated as having a a pressure element (5) and a housing (4) containing smart material therein, and whose rheological features can be controlled by means of the control element (3). In order to increase the effects of the components, the number of parts may also be increased.

The operation of the adjustable dashpot (1) is as follows. The rotating element (6) that is connected to the pressure element (5) is driven, and the pressure element (5) moves at the desired direction and applies force onto the housing (4) and the material inside said housing by means of this drive. The pressure element (5) moves and deforms the housing (4) at the contact points. In the case that the motion is desired to be damped at a preferred rate, the control element (3) is activated and the

effect created ensures that the rheological features of the smart material contained inside the housing (4) is brought to a desired value. In such a case the resistance force applied to the pressure (5) element by the smart material inside the housing (4) is increased and this situtation causes said motion to occur at a slower speed. It is possible to completely prevent the rotating motion, depending on the magnetic field strength and the moment to be applied to the pressure element (5).

If necessary, other parts can be added to the adjustable dashpot (1) such as insulation components, a coupling element or a power transfer module.

CLAIMS

1. The adjustable dashpot (1) whose damping effect can be controlled and whose damping range does not change by means of its impermeability feature and which can be adapted to different joint geometries is characterized in that it basically comprises;
   - at least a control element (3) which can change the viscosity of the material whose viscosity can be changed depending on time,
   - at least a housing (4) in which a material whose viscosity can be changed is housed,
   - at least a pressure means (5) which applies a preferred amount of pressure onto the housing (4)
   - and at least a rotating means (6) which can rotate around a central axis.

2. Adjustable dashpot (1) according to claim 1, characterized by a body (2) having a radial geometry in connection with the rotation motion.

3. Adjustable dashpot (1) according to claim 1, characterized by a control element (3) which has the feature to be able to create a magnetic field at an efficient level, and which can create a magnetic field at the desired intensity if desired.

4. Adjustable dashpot (1) according to claim 1, characterized by a control element (3) whose magnetic field creation strength can be precisely adjusted and therefore which can create a magnetic field at the desired strengths.

5. Adjustable dashpot (1) according to claim 1, characterized by a control element (3) having an insulating material if required, at the area which contacts the housing (4).

6. Adjustable dashpot (1) according to claim 1, characterized by a housing (4) located at the other surface of the insulation material not having a control element (3).

7. Adjustable dashpot (1) according to claim 1, characterized by a hollow housing (4), produced from preferably an elastic material, or from a material whose features can be controlled if desired.

8. Adjustable dashpot (1) according to claim 1, characterized by a housing (4) containing magnetorheological material which completely prevents the leakage of said material.

9. Adjustable dashpot (1) according to claim 1, characterized by a housing (4) having a closed circulation channel therein in order to enable the flow of the smart material contained inside said housing.

10. Adjustable dashpot (1) according to claim 1, characterized by a housing (4) which is preferably monolithic, having a replaceable system component, which can be changed if the technical efficiency formed depending on usage is reduced.

11. Adjustable dashpot (1) according to claim 1, characterized by a housing (4) which can be deformed in at least one of its sections by means of a pressure means (5).

12. Adjustable dashpot (1) according to claim 1, characterized by a housing (4) which is deformable if force is applied thereon and which can take back its prior shape due to its elastic structure.

13. Adjustable dashpot (1) according to claim 1, characterized by pressure means (5) which is preferably mounted on the rotating element (6)and which forms a pressure on the housing (4).

14. Adjustable dashpot (1) according to claim 1, characterized by a pressure element (5) which can be rotated at preferred angles, speed and axis (pitch, yaw, roll) depending on the motion of the rotating element (6).

15. Adjustable dashpot (1) according to claim 1, characterized by a housing (4) whose rheological features can be controlled by means of the control element (3).

16. Adjustable dashpot (1) according to claim 1, characterized by a pressure element (5) which applies pressure onto the housing (4) and to the material inside the housing by moving at the desired direction following being driven by the rotating element (6) which is connected to the pressure element (5).

17. Adjustable dashpot (1) according to claim 1, characterized by a control element (3) which is used when the motion is desired to be damped at a preferred rate, and which ensures that the rheological features of the smart material contained inside the housing (4) is brought to a desired value by means of the effect created.

Figure 1

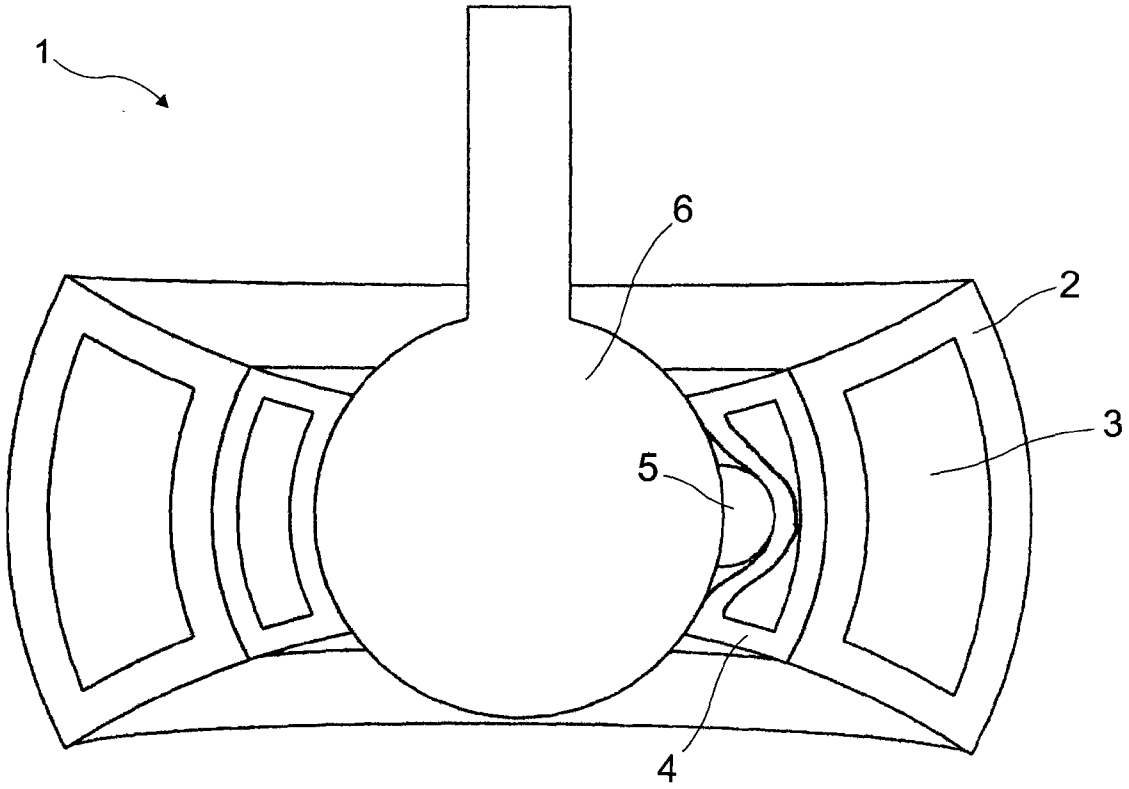
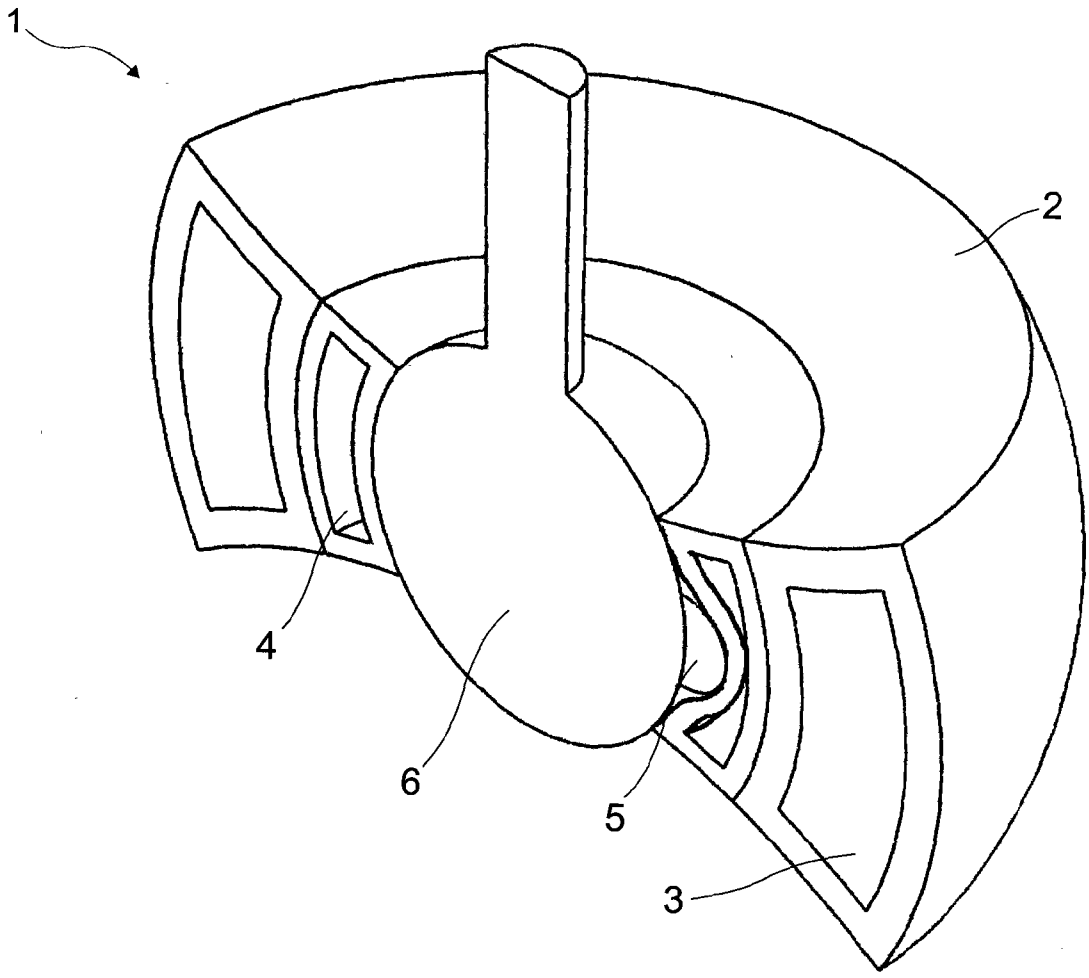


Figure 2



INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2016/000167

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16F13/30
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16F G05G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2005 180613 A (POLYMATECH CO LTD) 7 July 2005 (2005-07-07)	1-15 , 17
A	abstract; figures 1, 2, 5-9 , 14	16
X	DE 10 2011 117749 Al (AUDI AG [DE]) 8 May 2013 (2013-05-08)	1-5 ,7-17
A	abstract; figure 2	6
X	EP 1 258 650 A2 (DELPHI TECH INC [US] ; GEN MOTORS CORP [US]) 20 November 2002 (2002-11-20)	1-5 , 7-15 , 17
A	abstract; figures 1, 3	6 , 16
A	US 2014/085765 Al (GUR0CAK HAKAN [US] ET AL) 27 March 2014 (2014-03-27) the whol e document	1-17

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
9 March 2017	17/03/2017

Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2016/000167

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	OKAN TOPCU ET AL: "A Novel Rotary Magneto-Rheol ogi cal Damper for Hapti c Interfaces", VOLUME 4B: DYNAMICS, VIBRATION , AND CONTROL, 13 November 2015 (2015-11-13) , XP055352960, DOI : 10. 1115/IMECE2015-50979 ISBN : 978-0-7918-5740-3 abstract; f i gure 5 -----	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/TR2016/000167

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