



(51) International Patent Classification:

F16D 65/00 (2006.01) F16D 65/12 (2006.01)

(21) International Application Number:

PCT/US2020/040870

(22) International Filing Date:

06 July 2020 (06.07.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/872,560 10 July 2019 (10.07.2019) US

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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, IT, 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, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, 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: ROTOR ASSEMBLY WITH VENTING CONDUIT AND RELATED METHODS

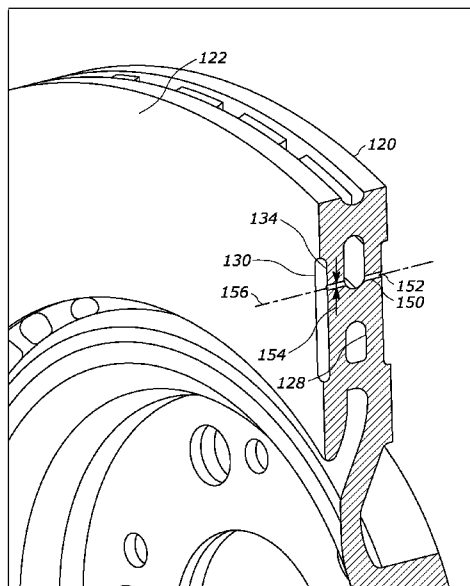


FIG. 2

(57) Abstract: A rotor assembly includes a rotor (120) having a friction surface (122) and at least one slot (130) within the friction surface, where the rotor has an inner venting area with at least one inner vent (128). The rotor has a conduit (150) connecting between the at least one slot (130) and the at least one inner vent (128).



Declarations under Rule 4.17:

- *as to the identity of the inventor (Rule 4.17(i))*
- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

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

ROTOR ASSEMBLY WITH VENTING CONDUIT AND RELATED METHODS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to US Provisional Application No. 62/872,560, filed July 10, 2019, wherein the contents of such application are incorporated herein by reference.

TECHNICAL FIELD

[0002] The disclosure herein relates to a braking rotor assembly with venting conduit and related methods.

TECHNICAL BACKGROUND

[0003] Conventional brake rotors generally include a pair of spaced-apart annular disks that present two opposed external frictional braking surfaces for engaging brake pads under a clamping operation of a brake caliper. Then the caliper clamps against the friction braking surfaces, friction and heat are created. The space between the disks typically includes a number of vanes with flow passages defined between each pair of adjacent vanes. Rotation of the rotor causes the vanes to increase air flow through the flow passages from the inner diameter to the outer diameter to assist with heat dissipation.

[0004] The external frictional braking surfaces may include slots therein, which are not connected with the space between the disks. The slots are used to direct

unwanted materials, such as water, away from the frictional braking surfaces.

However, when a caliper pad slides over the slot, the air is compressed into the slot and escapes with a clicking noise when the pad uncovers the slot.

[0005] What is needed is a better way to prevent the clicking noise associated with the slots while not compromising braking ability.

BRIEF SUMMARY

[0006] A rotor assembly includes a rotor having a friction surface and at least one slot within the friction surface, where the rotor has an inner venting area with at least one inner vent. The rotor has a conduit connecting between the at least one slot and the at least one inner vent.

[0007] In one or more embodiments, the conduit connects between each at least one slot and each at least one inner vent.

[0008] In one or more embodiments, the conduit is perpendicular relative to the friction surface.

[0009] In one or more embodiments, the conduit is a drilled hole.

[00010] In one or more embodiments, the drilled hole is disposed through a bottom of the at least one slot.

[00011] In one or more embodiments, the conduit has a width equal to or smaller than a slot width.

[00012] In one or more embodiments, the at least one inner vent is disposed concentrically within the rotor.

[00013] In one or more embodiments, the rotor includes two disks each having the friction surface and the rotor edge.

[00014] In one or more embodiments, the inner venting area is disposed between the two disks.

BRIEF DESCRIPTION OF THE DRAWINGS

[00015] FIG. 1 illustrates a rotor assembly, as constructed in accordance with one or more embodiments.

[00016] FIG. 2 illustrates rotor assembly, as constructed in accordance with one or more embodiments.

[00017] These and other embodiments, aspects, advantages, and features of the present invention will be set forth in part in the description which follows and will become apparent to those skilled in the art by reference to the following description of the invention and referenced drawings or by practice of the invention. The aspects, advantages, and features of the invention are realized and attained by means of the instrumentalities, procedures, and combinations particularly pointed out in the appended claims and their equivalents.

DETAILED DESCRIPTION

[00018] The following detailed description includes references to the accompanying drawings, which form a part of the detailed description. The drawings show, by way of illustration, specific embodiments in which the apparatus may be

practiced. These embodiments, which are also referred to herein as "examples" or "options," are described in enough detail to enable those skilled in the art to practice the present embodiments. The embodiments may be combined, other embodiments may be utilized, or structural or logical changes may be made without departing from the scope of the invention. The following detailed description is, therefore, not to be taken in a limiting sense and the scope of the invention is defined by the appended claims and their legal equivalents.

[00019] A rotor system 100 for a braking system includes a rotor 120 having a friction surface 122 and a circumferential rotor edge. The rotor further has at least one slot 130 within the friction surface 122, where the rotor 120 has an inner venting area 126 with at least one inner vent 128. The rotor 120 has a conduit 150 connecting between the at least one slot 130 and the at least one inner vent 128.

[00020] The rotor system 100 is shown in more detail in FIGs. 1 – 2. The rotor system 100 includes at least one disks 160, and in one or more embodiments includes two disks 160 disposed along a central axis with a central portion between the disks. The disks 160 each include a friction surface 122 such as an outer side planar friction surface. The friction surface 122 works in conjunction with calipers having brake pads. The calipers are used to clamp the brake pads against the friction surface to provide the braking to the vehicle. During the braking process, the friction causes heat that can be dissipated by a venting area, such as inner venting area 126 located, for example, between the outer side planar friction surfaces of the disks 160. The inner venting area includes at least one inner vent 128 disposed between the disks 160 in a central portion. In one or more embodiments, the at least one inner vent 128 extends along a circular path and is disposed concentrically within the rotor 120. For instance, the at least one inner vent 128 is concentric relative to an outer circumference of the

rotor 120. In one or more embodiments, a cross section of the at least one inner vent 128 has an oval shape. In one or more embodiments, there are two or more at least one inner vents 128 spaced concentrically from one another.

[00021] As shown in FIG. 1, the rotor system 100 includes at least one slot 130 disposed within the friction surface 122 of the disks 160. In one or more embodiments, the at least one slot 130 is disposed in each of the disks. In one or more embodiments, multiple slots 130 are disposed within the friction surface 122 of one of the disks. In one or more embodiments, multiple slots 130 are disposed within each of the disks 160. In a further embodiment, the multiple slots 130 on each of the disks 160 are aligned with each other. In yet another embodiment, each disk has the same number of slots 130, and the slots 130 of each of the disks are substantially aligned with each other where they have the same radial placement around the friction surface 122.

[00022] The at least one slot 130, in one or more embodiments, does not extend fully through the disk 160, and is partially recessed into the disk 160. The at least one slot 130 allows for materials to be directed away from the friction surface 122. Materials such as liquids can be directed away from the friction surface 122 allowing for the brake pads to more effectively contact the friction surface 122.

[00023] The rotor 120 further includes at least one conduit 150 that connects between the at least one slot 130 and the at least one inner vent 128. In one or more embodiments, the at least one slot 130 on each of the disks 160 are substantially aligned with one another around the friction surface 122, and the at least one conduit 150 extends from a slot 130 on a first disk to the at least one inner vent 128, and another at least one conduit 150 from the at least one inner vent 128 to the other disk, as shown in FIG. 2. The at least one conduit 150 allows for air or fluid within the slot 130 to be channeled to the at least one inner vent 128.

This allows for a clicking sound caused by trapped gases to be reduced or eliminated. In one or more embodiments, the at least one conduit 150 is perpendicular relative to the friction surface 122. In one or more embodiments, the conduit 150 is defined by a conduit width 154 that is equal to or smaller than a slot width 132. In one or more embodiments, the at least one conduit 150 is formed by drilling a hole through a bottom 134 of the at least one slot 130.

[00024] The above description is intended to be illustrative, and not restrictive. Many other embodiments will be apparent to those of skill in the art upon reading and understanding the above description. Embodiments discussed in different portions of the description or referred to in different drawings can be combined to form additional embodiments of the present application. The scope should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

CLAIMS

1. A rotor assembly comprising:
 - a rotor having a friction surface and a rotor edge;
 - the rotor having at least one slot within the friction surface;
 - the rotor having an inner venting area with at least one inner vent, the at least one inner vent concentric relative to the rotor edge; and
 - the rotor having a conduit connecting between the at least one slot and the at least one inner vent.
2. The rotor assembly as recited in claim 1, wherein the conduit connects between each at least one slot and each at least one inner vent.
3. The rotor assembly as recited in any one of claims 1 - 2, wherein the conduit has a conduit longitudinal axis that is perpendicular relative to the friction surface.
4. The rotor assembly as recited in any one of claims 1 - 3, wherein the conduit is a drilled hole.
5. The rotor assembly as recited in claim 4, wherein the drilled hole is disposed through a bottom of the at least one slot.

6. The rotor assembly as recited in any one of claims 1 - 5, wherein the conduit has a width equal to or smaller than a slot width.
7. The rotor assembly as recited in any one of claims 1 - 6, wherein the at least one inner vent is disposed concentrically within the rotor.
8. The rotor assembly as recited in any one of claims 1 - 7, wherein the rotor includes two disks each having the friction surface and the rotor edge.
9. The rotor assembly as recited in claim 8, wherein the inner venting area is disposed between the two disks.
10. The rotor as recited in any one of claims 1 - 9, wherein the friction surface is a side planar friction surface.
11. The rotor as recited in any one of claims 1 - 10, wherein the at least one inner vent includes two inner vents concentrically spaced from one another.
12. The rotor as recited in any one of claims 1 - 11, wherein the at least one inner vent has an oval shaped cross section.

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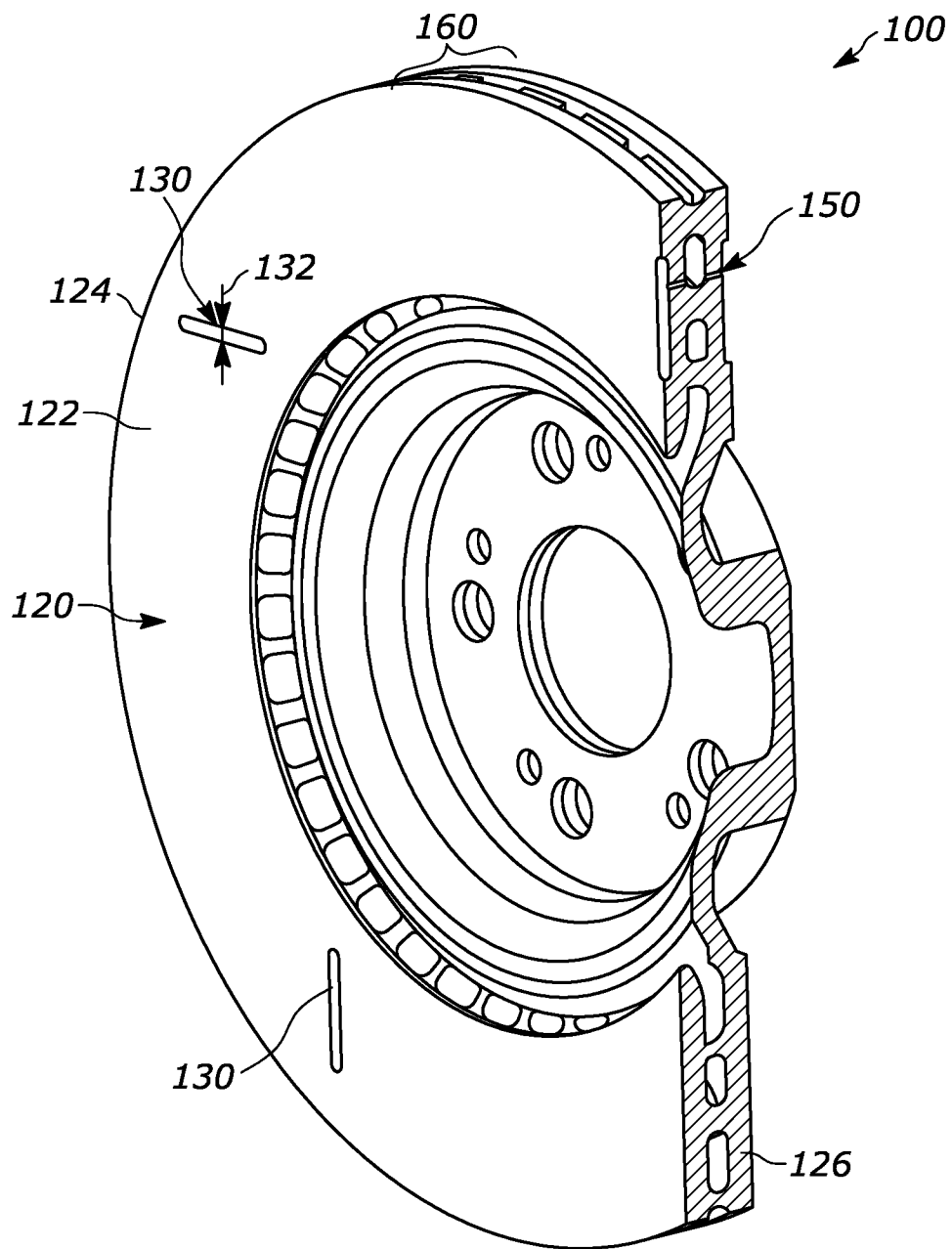


FIG. 1

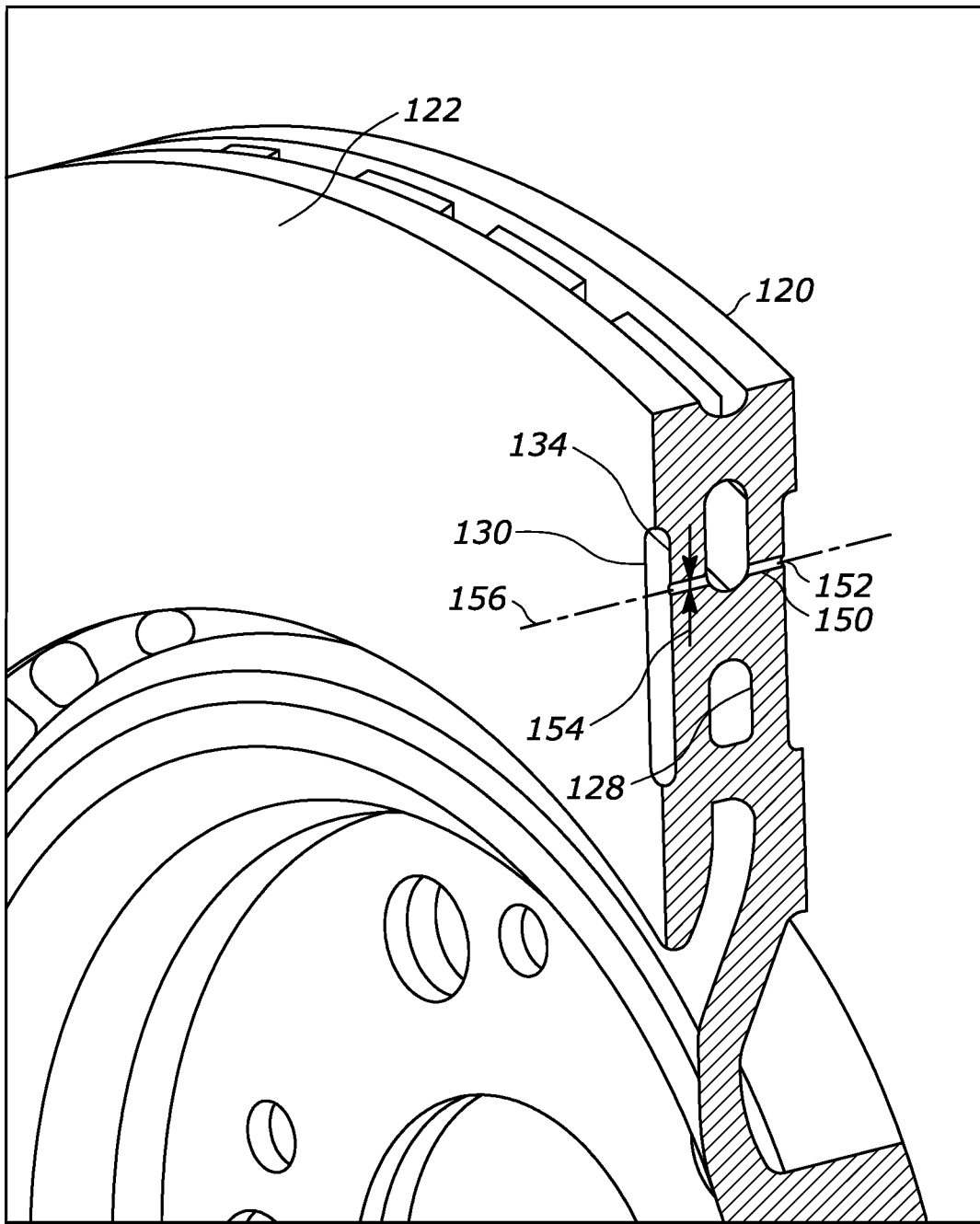


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2020/040870

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16D65/00 F16D65/12
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)
F16D

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	DE 10 2011 111837 B3 (AUDI AG [DE]) 6 December 2012 (2012-12-06) paragraph [0045] - paragraph [0047]; figures 1,3 -----	1-12
X	US 2014/014448 A1 (KAUTENBURGER MICHAEL [DE] ET AL) 16 January 2014 (2014-01-16) paragraph [0029] - paragraph [0037]; figures -----	1-12
X	US 2004/200678 A1 (LIN W) 14 October 2004 (2004-10-14) paragraph [0024] - paragraph [0027]; figures -----	1-12
X	DE 10 2016 218423 A1 (CONTINENTAL TEVES & CO OHG AG) 13 April 2017 (2017-04-13) paragraph [0031] - paragraph [0033]; figures 1,2 -----	1-12



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search

24 September 2020

Date of mailing of the international search report

08/10/2020

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2020/040870

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