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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 March 2009 (12.03.2009)

PCT

(10) International Publication Number
WO 2009/032136 A1

(51) International Patent Classification:
B60T 1/06 (2006.01) *F16D 55/36* (2006.01)

(21) International Application Number:
PCT/US2008/010164

(22) International Filing Date: 27 August 2008 (27.08.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/935,808 31 August 2007 (31.08.2007) 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, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(54) Title: DRIVE ASSEMBLY HAVING GROWTH CAPACITY

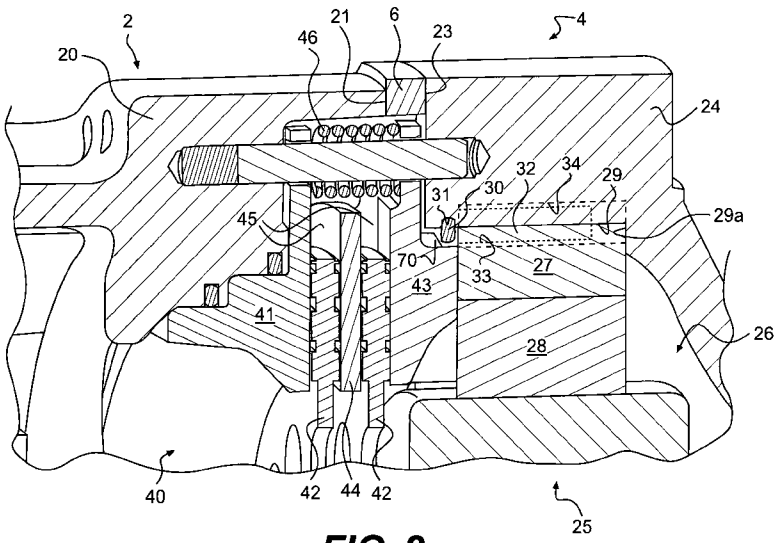


FIG. 2

(57) Abstract: A drive assembly (1) is disclosed. The drive assembly includes a central housing (20) including a length and two lateral ends, drive input, and output elements associated with the central housing, and a brake system (40) associated with the central housing. The drive assembly includes at least one leg housing (24) connected to one of the lateral ends of the central housing and configured to accommodate an output of the drive assembly. A housing spacer (5, 6) is situated between the central housing and the at least one leg housing and configured to extend the length of the central housing for accomodating at least one additional brake disc for increasing the brake capacity of the brake system.

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DRIVE ASSEMBLY HAVING GROWTH CAPACITY

Technical Field

The present disclosure is directed to a drive assembly and, more particularly, to a drive assembly having growth capacity.

Background

Machines, including on and off-highway haul and vocational trucks, wheel loaders, motor graders, and other types of heavy equipment are used for a variety of tasks. These machines generally include a drive assembly composed of a differential assembly and two final drive assemblies. The differential assembly includes a central housing enclosing a differential gear arrangement and an input shaft extending into the central housing to drivingly engage the differential gear arrangement. Each drive assembly includes a leg housing engaging the central housing, a planetary gear arrangement associated with the leg housing, including a sun gear, a planet carrier having at least one set of connected planet gears, and a ring gear, and an output shaft engaged with the differential gear arrangement and the ring gear. A brake system is associated with the central housing which includes a brake disk, an actuator, and a reaction plate. Pressurized fluid is directed to the actuator to engage the brake disk to the reaction plate, thereby slowing the rotation of the output shaft.

During the life of a machine, the machine tends to change in power output, weight, size, and other aspects. As machines change, brake capacities and their corresponding brake systems also change. It is known that brake systems can be altered by changing the diameter of the disks or brake

members, the number of coacting friction surfaces, and the brake application pressure.

One such example is described in U.S. Patent Application No. 4,207,968 (the '968 patent) issued to Chamberlain on 17 June 1980. The '968 patent describes a brake system of a drive assembly comprised of multiple disks to be incorporated in vehicles of substantial size and weight. The disk diameter and pressure application are limited, and the number of coacting frictional surfaces is increased. For each brake, there are two equal sets of disk packs positioned in a back to back arrangement with a common brake component actuator disposed centrally between them. Pressurized oil extends multiple pistons from opposed sides of the common actuator in equal sets, with each set adapted to operate one of the back to back disk packs. This is done as identical pressure plates transmit the piston force to the disk packs. When hydraulic pressure is removed from the pistons, a compression spring and pin retract the pressure plates and deactivate braking.

Although the brake system and drive assembly in the '968 patent may be adequate for some situations, they may have limitations. For example, the brake system and drive assembly are for vehicles of substantial size and weight and cannot be used for different sized machines without significant component redesign or changes. Also, the system is limited as to the size of the brake disks that may be employed. For example, any increase in disk diameter is very limited.

The drive assembly of the present disclosure solves one or more of the problems set forth above.

Summary of the Invention

One aspect of the present disclosure is directed to a drive assembly. The drive assembly may include a central housing having a length and two lateral ends, drive input and output elements associated with the central housing, and a brake system associated with the central housing. The drive

assembly may also include at least one leg housing connected to one of the lateral ends of the central housing and configured to accommodate an output of the drive assembly. A housing spacer may be situated between the central housing and the at least one leg housing and configured to extend the length of the central housing.

Another aspect of the present disclosure is directed to a method of increasing the versatility of a drive assembly, the drive assembly including a central housing, at least one leg housing connected to the central housing, and a brake system associated with the central housing and including at least one brake disk. The method may include increasing the brake capacity of the brake system by assembling the brake system with at least one additional brake disk. The method may also include increasing a length dimension of the central housing to accommodate the at least one additional brake disk by assembling a housing spacer between the central housing and the at least one leg housing.

Brief Description of the Drawings

Fig. 1 is a pictorial illustration of an exemplary disclosed drive assembly;

Fig. 2 is an enlarged cross-sectional illustration of an exemplary brake system of the drive assembly of Fig. 1; and

Fig. 3 is an enlarged pictorial illustration of an exemplary disclosed mounting pad of the drive assembly of Fig. 1.

Detailed Description

Fig 1. illustrates an exemplary disclosed drive assembly 1. Drive assembly 1 may be associated with a mobile machine (not shown) so as to propel the machine. As such, drive assembly 1 may include a differential assembly 2 and first and second final drive assemblies 3, 4. Attached between final drive assembly 3, 4 and differential assembly 2 are first and second housing spacers 5, 6, which may be annular members. Housing spacers 5, 6 may extend (i.e.,

lengthen) the length dimension of a central housing of differential assembly 2. Two mounting pads, such as a first mounting pad 7 and a second mounting pad 8, may connect a machine frame (not shown) to drive assembly 1. Two output members, such as a first output shaft 9 and a second output shaft 10, may drivingly connect final drive assemblies 3,4 to associated traction devices (not shown) located on opposing sides of the machine. In one embodiment, the traction devices may embody wheels. Final drive assemblies 3, 4 may be drivingly coupled to differential assembly 2 such that a rotation of a driveshaft 11 results in a corresponding rotation of output shafts 9, 10 and associated traction devices.

As illustrated in Fig 2, differential assembly 2 may include a central housing 20, which may be a generally cylindrical housing having an axial, length direction substantially aligned with the output shafts. At a lateral end of central housing 20, an end face 21 may be located to connect central housing 20 to one side of housing spacer 6. An end face 23 of a leg housing 24 of final drive assembly 4 may connect to the opposite side of housing spacer 6. Without the presence of housing spacer 6, end face 21 of central housing 20 may connect directly to end face 23 of leg housing 24. However, when housing spacer 6 is present, the length dimension of central housing 20 may be extended. The degree of extent may vary, depending on the thickness of housing spacer 6 employed in a given machine.

Leg housing 24 of final drive assembly 4 may enclose and support a planetary gear arrangement 25 and an associated output shaft (not shown). The output shaft may be driven by a differential gear arrangement associated with differential assembly 2, and speed reduced by planetary gear arrangement 25 to provide a desired output speed. Although not shown in Fig. 2, it will be understood that a similar planetary gear arrangement and output shaft are associated with final drive assembly 3.

For the purposes of this disclosure, a planetary gear arrangement may have at least three elements, including a sun gear, a planet carrier having at least one set of connected planet gears, and a ring gear. The planet gears of the planet carrier may mesh with the sun gear and the ring gear, and with intermediate planet gears of the same planet carrier if intermediate planet gears are included in the planetary gear arrangement. The sun gear, planet carrier, planet gears, and ring gear may all rotate together simultaneously. Alternatively, one or more of the sun gear, planet carrier, and ring gear may be held stationary to alter a reduction ratio of the arrangement. Each planetary gear arrangement may receive one or more input rotations and generate one or more corresponding output rotations. The change in rotational speed between the inputs and the outputs may depend upon the number of teeth in the sun gear and the ring gear. The change in rotational speed may also depend upon the gear(s) that is used to receive the input rotation, the gear(s) that is selected to provide the output rotation, and which gear, if any, is held stationary.

In the exemplary embodiment of Fig. 2, planetary gear arrangement 25 may include a planet carrier 26, a sun gear (not shown), and a ring gear 27. The sun gear may be drivingly connected to rotate with a differential gear arrangement (not shown). Each ring gear 27 may be fixed stationary within leg housing 24. A plurality of planet gears 28 may be connected to rotate with planet carrier 26 and to mesh with the sun gear and with ring gear 27. Each planet carrier 26 may be connected to rotate an associated output shaft (not shown). Thus, the motion and power of a driveshaft (not shown) may be transmitted through the differential gear arrangement to the output shaft via the sun gear, planet gears 28, and planet carrier 26, with fixed ring gear 27 only affecting the reduction ratio of the motion.

Ring gear 27 may be located within a recess 29 of leg housing 24. In one embodiment, ring gear 27 may be press fitted into recess 29 until a shoulder 29a of recess 29 is engaged by an end face of ring gear 27. A snap ring

30 may then be inserted into a groove 31 located in an internal wall of recess 29 to axially constrain ring gear 27 within recess 29. That is, ring gear 27 may be free to move axially between shoulder 29a and snap ring 30. A fastener such as, for example, a dowel pin 32 may be located within a partial slot 33 of ring gear 27 and a partial slot 34 of recess 29, thereby rotationally locking ring gear 27 to leg housing 24.

Referring to Fig. 2, the drive assembly may be equipped with an internal braking system 40 configured to resist the rotation of the output shafts. Braking system 40 may include an actuator 41, one or more brake disks 42, and a reaction plate 43. Brake disks 42 may be connected to rotate with output shafts such that, when actuator 41 is acted on by pressurized fluid, brake disks 42 may be engaged between actuator 41 and reaction plate 43, creating friction that resists the rotation of the output shafts. In this configuration, a pressure of the fluid acting on actuator 41 may relate to a magnitude of the force resisting motion of the output shafts. If multiple brake disks 42 are included within braking system 40, a separator plate 44 may be disposed between brake disks 42. The thickness of housing spacer 6 may correspond to the additional number of brake disks 42 and separator plates 44 assembled. As indicated by a space 45 between actuator 41 and reaction plate 43, internal brake system 40 is capable of accommodating brake disks 42 of larger diameter. A return spring 46 may be disposed to separate actuator 41 from reaction plate 43 and cause a release of brake disks 42.

Reaction plate 43 may be assembled to engage and press against an end face of ring gear 27. Reaction plate 43 may be an annular member having a generally L-shaped cross section, with one protrusion of the L-shape engaging ring gear 27, and the other protrusion mating with, but not engaging, end face 23 of leg housing 24 (i.e., a space having an axial distance less than a width of snap ring 30 may be maintained between reaction plate 43 and end face 23). In this

arrangement, a substantially enclosed space 70 may be formed by reaction plate 43, leg housing 24, and ring gear 27.

Fig. 3 illustrates an exemplary disclosed mounting pad 8. Located on top of leg housing 24, mounting pad 8 may have a mounting area and material-reducing windows 51 and a set of fastener bores 52. Fastener bores 52 may be positioned and configured to align with corresponding bores of a machine. In the exemplary embodiment of Fig. 3, fastener bores 52 may be positioned offset toward one side of mounting pad 8 and material-reducing windows 51. In another embodiment, fastener bores 52 may be positioned symmetrically on mounting pad 8 and centrally of material-reducing windows 51. Because mounting pad 8 may have fastener bores 52 positioned offset toward one side of mounting pad 8 and material-reducing windows 51 or have fastener bores 52 positioned symmetrically on mounting pad 8 and centrally of material-reducing windows 51, existing machine frames and different sized machine frames may be engaged to a drive assembly having a central housing that has been extended in length by a housing spacer 6. It will be understood that fastener bores 52 may be positioned offset toward either side of mounting pad 8 and material-reducing windows 51. A set of threaded fasteners 53 of suitable length may connect the leg housing 24 to housing spacer 6 and the central housing.

Industrial Applicability

The drive assembly of the present disclosure may be applicable to any drivetrain contemplated for use with different sized machine frames and where varying brake capacity may be required. The disclosed drive assembly may be used for different sized machines and brake capacities without significant component redesign or changes. Applying the disclosed drive assembly may save costs of manufacturing and operator repair costs by employing common drive assembly components with different machines.

Drive assembly 1 may be provided with increased brake capacity by assembling one or more additional brake disks 42 and one or more separator

plates 44 to brake system 40. Brake system 40 may also accommodate brake disks 42 of larger diameter. Selectively assembling housing spacers 5, 6 to central housing 20 increases a length dimension of central housing 20 to accommodate for the addition of at least one additional brake disk 42 and at least one separator plate 44. Drive assembly 1 with an increase in brake capacity may engage an existing machine frame or different machine frames. Fastener bores 52 on mounting pad 7, 8 of leg housing 24 may be positioned and configured to align with corresponding bores on a machine. Fastener bores 52 may be positioned symmetrically on mounting pads 7, 8 and centrally of material-reducing windows 51 or positioned offset toward one side or the other of mounting pads 7, 8 and material reducing windows 51.

The relation between brake disks 42, separator plate 44, central housing 20, housing spacers 5, 6, and mounting pad 7, 8 of leg housing 24 may provide versatility benefits. Specifically, the same drive assembly components may be used for different sized machine, and in circumstances where brake capacities may vary. Brake disks 42, separator plate 44, central housing 20, housing spacers 5, 6, mounting pad 7, 8 of leg housing 24 may be shared or modified to accommodate a range of brake capacities and machine frame sizes, and may also save manufacturing and operator repair costs.

It will be apparent to those skilled in the art that various modifications and variations can be made to the drive assembly of the present disclosure without departing from the scope of the disclosure. Other embodiments will be apparent to those skilled in the art from consideration of the specification and practice of the drivetrain disclosed herein. It is intended that the specification and examples be considered as exemplary only, with a true scope of the disclosure being indicated by the following claims.

Claims

1. A drive assembly (1), comprising:

a central housing (20) including a length and two lateral ends;

drive input and output elements associated with the central housing;

a brake system (40) associated with the central housing;

at least one leg housing (24) connected to one of the lateral ends of the central housing and configured to accommodate an output of the drive assembly; and

a housing spacer (5, 6) situated between the central housing and the at least one leg housing and configured to extend the length of the central housing.

2. The drive assembly of claim 1, wherein the brake system includes an actuator (41), a reaction plate (43), and at least one brake disk (42), and wherein the actuator is configured to be moved by pressurized fluid to engage the brake disk against the reaction plate.

3. The drive assembly of claim 2, including space (45) between the actuator and the reaction plate sufficient to accommodate brake disks of varying diameter.

4. The drive assembly of claim 2, including at least two brake disks and at least one separator plate (44) between the at least two brake disks.

5. The drive assembly of claim 1, wherein the at least one leg housing includes two leg housings, with one leg housing connected to each lateral

end of the central housing, and wherein a housing spacer (5, 6) is situated between the central housing and each leg housing.

6. The drive assembly of claim 5, including a mounting pad (7, 8) on top of each leg housing.

7. The drive assembly of claim 6, wherein the mounting pad has a mounting area configured to engage a machine frame, fastener bores (52), and material-reducing windows (51) associated with the fastener bores.

8. A method of increasing the versatility of a drive assembly (1), the drive assembly including a central housing (20), at least one leg housing (24) connected to the central housing, and a brake system (40) associated with the central housing and including at least one brake disk (42), the method comprising:

increasing the brake capacity of the brake system by assembling the brake system with at least one additional brake disk; and

increasing a length dimension of the central housing to accommodate the at least one additional brake disk by assembling a housing spacer (5, 6) between the central housing and the at least one leg housing.

9. The method of claim 8, further including assembling at least one separator plate (44) between brake disks.

10. The method of claim 9, further including selectively assembling a housing spacer (5, 6) with a thickness corresponding to the number of brake disks and separator plates assembled.

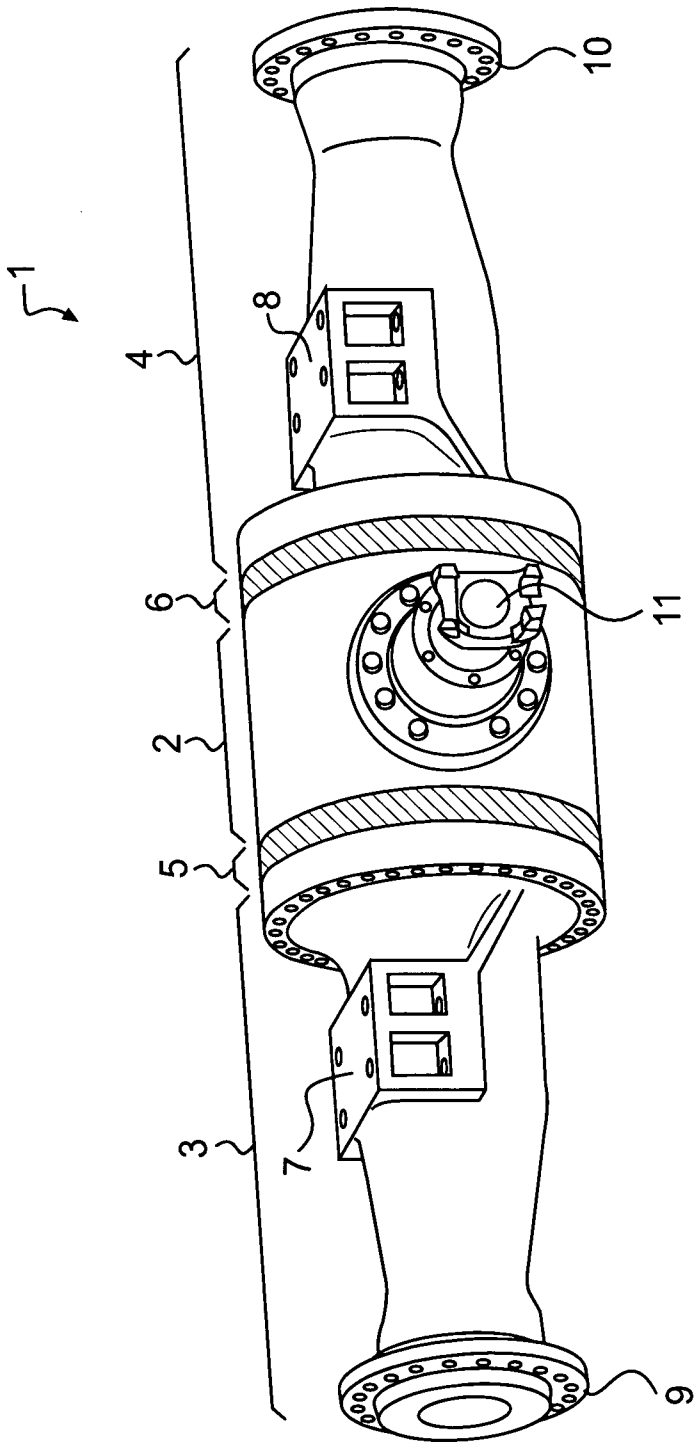


FIG. 1

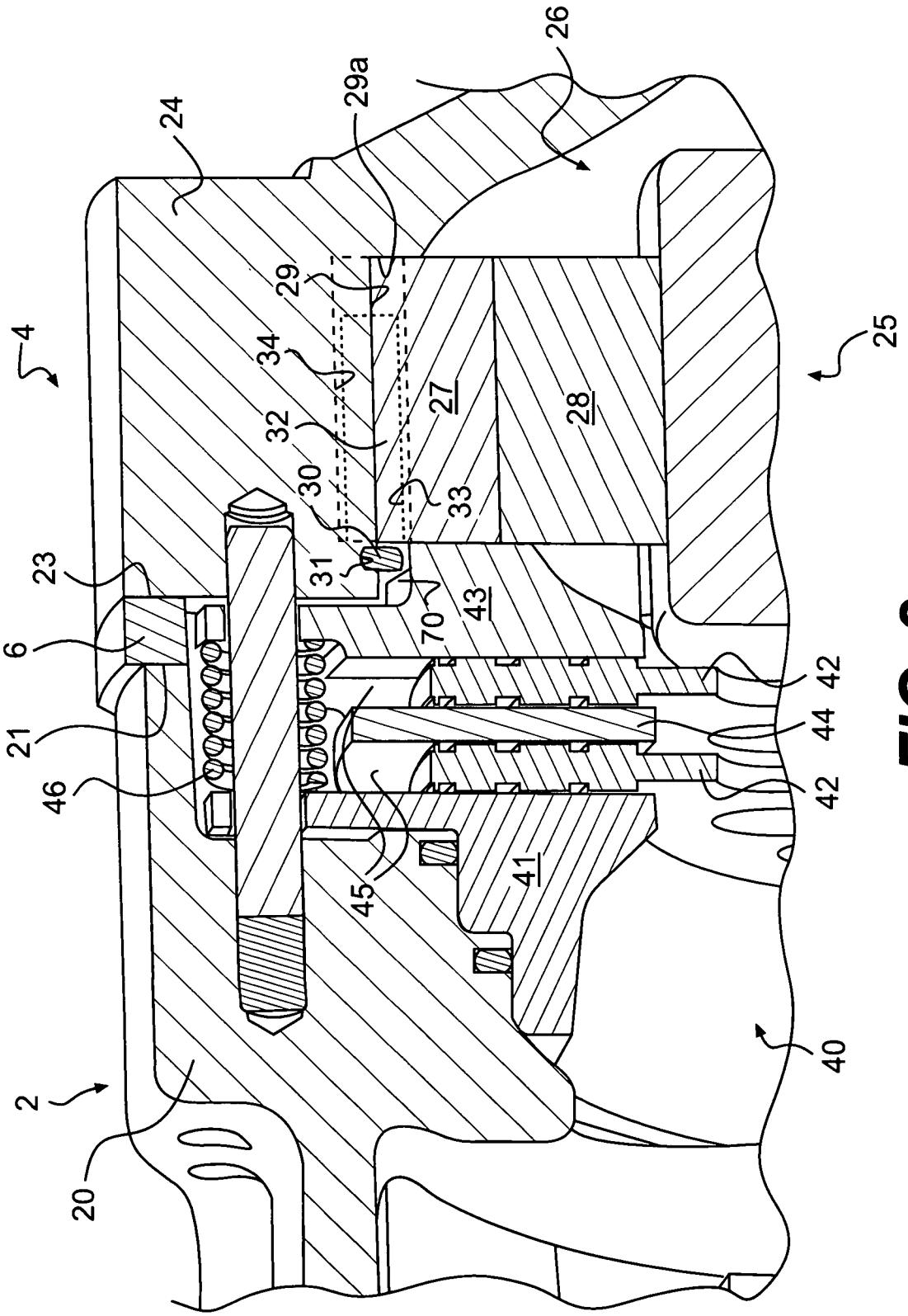

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FIG. 2

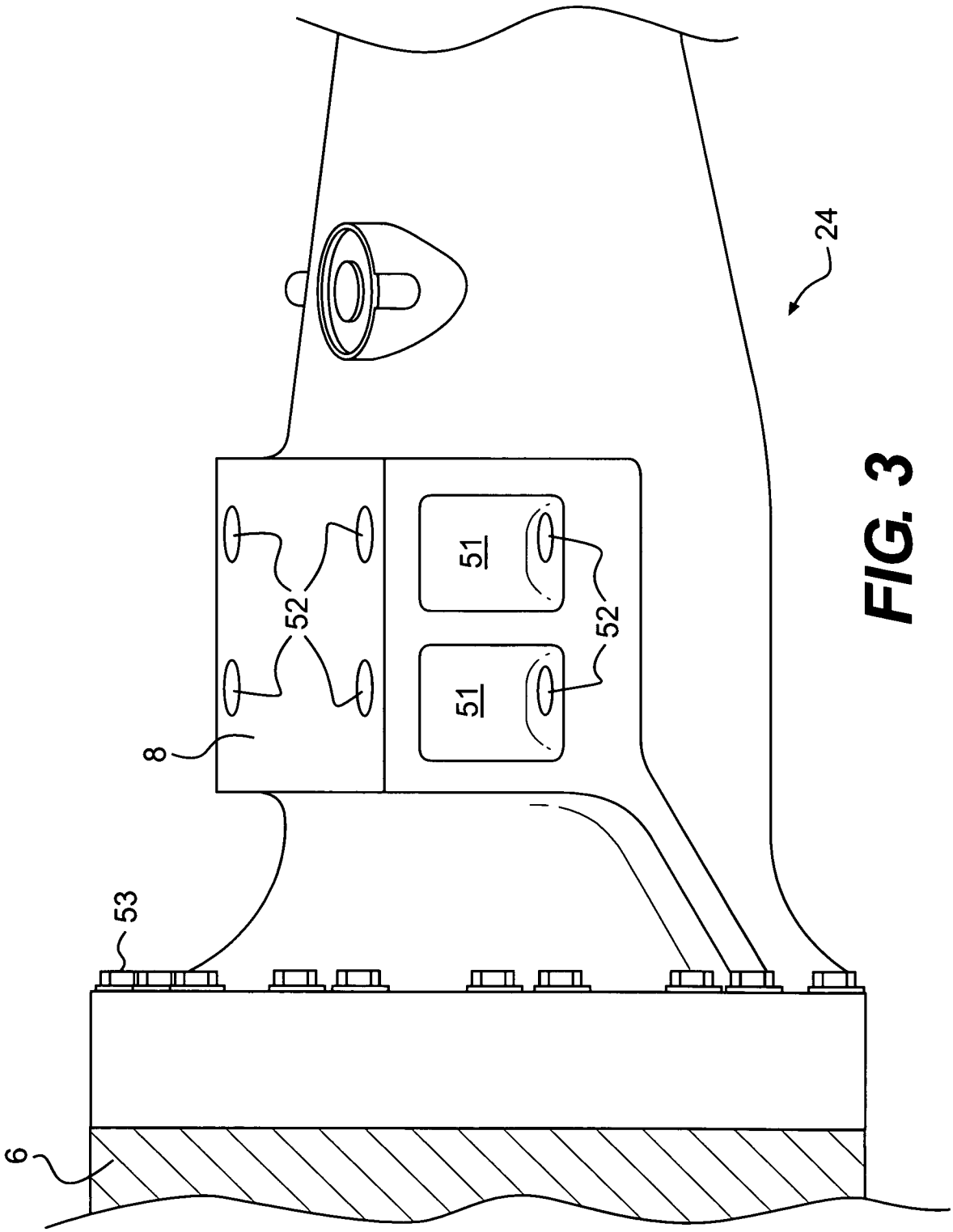


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/010164

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60T1/06 F16D55/36

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)
B60T F16D F16H

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 382 952 A (GIORGIO GRATTAPAGLIA) 14 May 1968 (1968-05-14) column 3, lines 32-65; figure 1	1-10
A	WO 88/08383 A (ZAHNRADFABRIK FRIEDRICHSHAFEN [DE]) 3 November 1988 (1988-11-03) pages 3-4; figure 1	1-10
A	GB 2 109 880 A (SOMA EUROP TRANSMISSIONS) 8 June 1983 (1983-06-08) page 1, lines 3-6 page 3, lines 103-112; figure 1	1-10
A	US 2 557 937 A (BUCKENDALE LAWRENCE R) 26 June 1951 (1951-06-26) column 3, lines 7-46 figures 2,3	1-10

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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
27 January 2009	04/02/2009

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/010164

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2003/010578 A1 (HINTON DAVID R [US] ET AL) 16 January 2003 (2003-01-16) paragraphs [0007], [0050] - [0052]; figure 1	1-10

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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