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(71) Applicant: **TVS MOTOR COMPANY LIMITED**
[IN/IN]; "Chaitanya", No.12 Khader Nawaz Khan Road,
Nungambakkam, Chennai 600 006, Tamil Nadu (IN).

(72) Inventors: **SARAVANARAJAN, Somasundaram**;
"Chaitanya", No.12 Khader Nawaz Khan Road, Nungam-
bakkam, Chennai 600 006, Tamil Nadu (IN). **MARA-
NOOR, Mallikarjun**; "Chaitanya", No.12 Khader Nawaz
Khan Road, Nungambakkam, Chennai 600 006, Tamil
Nadu (IN).

(74) Agent: **KHAITAN & CO**; One Indiabulls Centre, 13th
Floor, 841, Senapati Bapat Marg, Elphinstone Road, Mum-
bai 400013, Maharashtra (IN).

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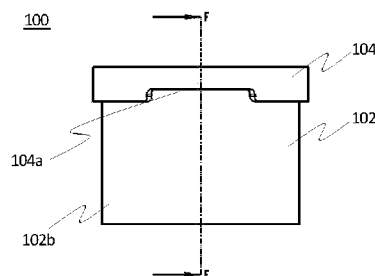


Figure 4

(57) Abstract: The present invention provides a slide bush assembly (100) for a suspension unit (202) of a vehicle (200). The assembly (100) includes a cylindrical guide member (102) disposed at a connecting junction (204) of an inner tube (206) and an outer tube (208) of the suspension unit (202). The cylindrical guide member (102) is adapted to engage with an inner surface (208a) of the outer tube (208) and surround an outer surface (206a) of the inner tube (206). A flange (104) is defined on a top portion (102a) of the cylindrical guide member (102), which is operable between a rest condition and a working condition. The flange (104) in the working condition facilitates dismantling of the cylindrical guide member (102) from the connecting junction (204) of the suspension unit (202). The assembly (100) facilitates easy access for servicing of the suspension unit (202).

TITLE OF INVENTION**Slide Bush Assembly for Suspension Unit of a Vehicle****FIELD OF THE INVENTION**

[001] The present invention relates to a suspension unit for a vehicle, more particularly relates to a slide bush assembly for the suspension unit of the vehicle.

BACKGROUND OF THE INVENTION

5 [002] Vehicle, such as a two-wheeled vehicle, typically has a front suspension assembly to act as a shock absorber for isolating road undulations and improving road holding characteristics of a front wheel with the road. A widely used front suspension assembly in two-wheeled vehicles is a telescopic suspension assembly having an inner tube slidably mounted with an outer tube. A spring and damper assembly is enclosed
10 within the tubes to isolate the road undulation and shock by absorbing and dissipating energy. Additionally, the suspension assembly also includes an oil seal, a snap ring, a dust seal, a piece oil lock and a gasket, typically mounted at a connecting junction of the inner tube and the outer tube.

[003] However, during an oil service, the internal parts such as the spring and piston
15 assembly is required to be dismantled from the conventional telescopic suspension assembly. Also, the inner tube and the outer tube is required to be separated for accessing the oil seal, which is cumbersome, tedious and time consuming. Additionally, special tools are required for removing the oil seal from the suspension assembly, which is undesirable. Further, there are chances of damaging the oil seal and/or other
20 components of the suspension assembly using the special tools, which is undesirable.

[004] Furthermore, scoring of inner tube on the outer tube during sliding movement therebetween is a common occurrence in hydraulic suspension units, particularly due

entry to dust or mud within or lack of oil for lubrication. The scoring of the inner tube results in damage of the inner tube, which is required to be replaced in the suspension assembly for effective operation, which is expensive.

[005] In view of the above, there is a need for a slide bush assembly for the suspension
5 unit of the vehicle, which addresses one or more limitations stated above.

SUMMARY OF THE INVENTION

[006] In one aspect, a slide bush assembly for a suspension unit of a vehicle is disclosed. The assembly includes a cylindrical guide member disposed at a connecting
10 junction of an inner tube and an outer tube of the suspension unit. The cylindrical guide member is adapted to engage with an inner surface of the outer tube and surround an outer surface of the inner tube. A flange defined on a top portion of the cylindrical guide member. The flange is operable between a rest condition and a working condition, wherein the flange in the working condition facilitates dismantling of the cylindrical guide
15 member from the connecting junction of the suspension unit.

[007] In an embodiment, the flange comprises a relief portion adapted to receive a tool for operating the flange to the working condition from the rest condition.

[008] In an embodiment, the flange in the working condition disengages at least a portion of the cylindrical guide member from the inner surface of the outer tube for
20 facilitating dismantling of the cylindrical guide member from the connecting junction.

[009] In an embodiment, the cylindrical guide member is defined with an annular recess at its bottom portion.

[010] In an embodiment, a bush member is mounted on the annular recess of the cylindrical guide member.

[011] In an embodiment, the bush member is made by one of plastic material and a metallic material.

[012] In an embodiment, an annular seal member is mounted on the flange, which is adapted to provide ingress protection at the connecting junction of the suspension unit.

5 The annular seal member includes an extending lip having a first portion adapted to engage with the flange and a second portion adapted to engage with the inner tube.

[013] In an embodiment, the cylindrical guide member is made of a thermoplastic material.

[014] In an embodiment, the suspension unit is a telescopic suspension unit.

10 [015] In another aspect, the telescopic suspension unit of a vehicle is disclosed. The telescopic suspension unit includes the outer tube, the inner tube telescopically mounted within the outer tube and a slide bush assembly. The slide bush assembly includes a cylindrical guide member that is disposed at a connecting junction of the inner tube and the outer tube. The cylindrical guide member is adapted to engage with
15 the inner surface of the outer tube and surround an outer surface of the inner tube. The flange is defined on the top portion of the cylindrical guide member. The flange is operable between a rest condition and a working condition, wherein the flange in the working condition facilitates dismantling of the cylindrical guide member from the connecting junction.

20 [016] In an embodiment, the inner tube includes a distal bush member mounted on its distal end.

BRIEF DESCRIPTION OF THE DRAWINGS

[017] Reference will be made to embodiments of the invention, examples of which may
25 be illustrated in accompanying figures. These figures are intended to be illustrative, not

limiting. Although the invention is generally described in context of these embodiments, it should be understood that it is not intended to limit the scope of the invention to these particular embodiments.

Figure 1 is a schematic view of a vehicle, in accordance with an embodiment of the present invention.

Figure 2 is a sectional view of a suspension unit of the vehicle, in accordance with an embodiment of the present invention.

Figure 3 is an enlarged view of portion A of Figure 2 depicting a connecting junction in the suspension unit, in accordance with an embodiment of the present invention.

Figure 4 is a side view of a cylindrical guide member of a slide bush assembly, in accordance with an embodiment of the present invention.

Figure 5 is a sectional view of the cylindrical guide member, in accordance with an embodiment of the present invention.

Figure 6 is a top view of an annular seal member of the slide bush assembly, in accordance with an embodiment of the present invention.

Figure 7 is a sectional view of the annular seal member, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[018] Various features and embodiments of the present invention here will be discernible from the following further description thereof, set out hereunder.

[019] Figure 1 illustrates a schematic view of a vehicle 200, in accordance with an embodiment of the present invention. As an example, the vehicle 200 is a two-wheeled vehicle. The vehicle 200 comprises a prime mover 210 that is adapted to provide motive

force for movement of the vehicle. In an embodiment, the prime mover 210 is an internal combustion engine, which is preferably a single-cylinder engine. In an embodiment, the prime mover 210 is an electric motor. The vehicle 200 comprises a front wheel 212, a rear wheel 214, a frame member (not shown), a seat 216 and a fuel tank 218. The frame member includes a head pipe (not shown), a main tube (not shown), a down tube (not shown), and seat rails (not shown). The head pipe supports a steering shaft (not shown) and a telescopic suspension unit 202 attached to the steering shaft through a lower bracket (not shown). The telescopic suspension unit 202 supports the front wheel 212. Also, the suspension unit 202 includes a slide bush assembly 100 (for e.g, as shown in Figure 3), which would be described in description pertaining to Figures 2-7.

[020] Further, the upper portion of the front wheel 212 is covered by a front fender 220 mounted to the lower portion of the telescopic suspension unit 202 at the end of the steering shaft. A handlebar 222 is fixed to upper bracket (not shown) and can rotate about the steering shaft for turning the vehicle. A headlight 224, a visor guard (not shown) and instrument cluster 238 is arranged on an upper portion of the head pipe. The frame member comprises a down tube (not shown) that may be positioned in front of the prime mover 210 and extends slantingly downward from head pipe. The main tube of the frame member is located above the prime mover 210 and extends rearward from head pipe.

[021] The fuel tank 218 is mounted on the main tube. Seat rails are joined to main tube and extend rearward to support the seat 216. A rear swing arm (not shown) is connected to the frame member to swing vertically, and the rear wheel 214 is connected to rear end of the rear swing arm. Generally, the rear swing arm is supported by a mono rear suspension 226 (as illustrated in the present embodiment) or through two

suspensions on either side of the vehicle 200. A taillight unit 228 is disposed at the end of the vehicle 200 and at the rear of the seat assembly 216. A grab rail 230 is also provided to the seat rails. The rear wheel 214 arranged below the seat 216 rotates by the motive force of the prime mover 210 transmitted through a chain drive (not shown).

5 [022] Further, a rear fender 232 is disposed above the rear wheel 214. An exhaust pipe 234 of the vehicle 200 extends vertically downward from the prime mover 210 and then extends below the prime mover 210, longitudinally along length of the vehicle 200 before terminating in a muffler 236. The muffler 236 is typically disposed adjoining the rear wheel 214.

10 [023] Figure 2 illustrates the telescopic suspension unit 202 including the slide bush assembly 100, in accordance with an embodiment of the present invention. The telescopic suspension unit 202 includes an inner tube 206 having a fore end 206b mounted onto the head pipe (for e.g. as shown in Figure 1) and a distal end 206c. An outer tube 208 having a first end 208b receives the distal end 206c for slidable
15 engagement therebetween. As such, the inner tube 206 and the outer tube 208 are slidable relative to one another. In the present embodiment, the distal end 206c is inserted within the outer tube 208 via the first end 208b. Further, the outer tube 208 includes a second end 208c adapted to be mounted onto the front wheel 212.

[024] Additionally, a damper 240 is disposed within the inner tube 206. The damper 240
20 has one end 240a engaged to a stopper 242 within the inner tube 206 and an other end 240b engaged to a rebound stopper 244 fixed to a second end 208c of the outer tube 208 via a connecting rod 248. The damper 240 enables the inner tube 206 and the outer tube 208 to be operable between a jounce motion and a rebound motion, when the vehicle 200 travels over an undulation. In an embodiment, the jounce motion is a
25 bounce or vertical motion between the inner tube 206 and the outer tube 208, when the

front wheel 212 travels over an undulation on a road surface. Thus, the telescopic suspension unit 202 attenuates the undulations encountered by the vehicle 200 during movement. In an embodiment, the rebound motion is a recovery motion between the inner tube 206 and the outer tube 208 subsequent to the jounce motion. In an embodiment, the shape, dimensions and configuration of the inner tube 206 and the outer tube 208 are selected based on the damping requirements of the vehicle 200.

[025] Referring to Figures 3-5 in conjunction with Figure 2, the slide bush assembly 100 is mounted at a connecting junction 204 of the inner tube 206 and the outer tube 208. The slide bush assembly 100 is adapted to provide ingress protection at the connecting junction 204 of the suspension unit 202, while also ensuring high performance lubrication thereto. Additionally, the slide bush assembly 100 facilitates an oil free design of the suspension unit 202, thereby mitigating use of oil therein and also the issues that arise with use of the oil in the suspension unit 202.

[026] The slide bush assembly 100 includes a cylindrical guide member 102 disposed at the connecting junction 204. The cylindrical guide member 102 is an annular member, whose inner peripheral surface is adapted to surround an outer surface 206a of the inner tube 206, while an outer peripheral surface is adapted to engage with an inner surface 208a (shown in Figure 3) of the outer tube 208. As such, the cylindrical guide member 102 is adapted to surround the inner tube 206, while also engaging with the inner surface 208a of the outer tube 208. In an embodiment, the cylindrical guide member 102 is defined with a slot or a counter bore 116 (for e.g. as shown in Figure 5) for enabling mounting or surrounding the inner tube 206. In an embodiment, the cylindrical guide member 102 is made of thermoplastic material, such as a Polyoxymethylene material, which reduces friction between the inner tube 206 and outer tube 208.

[027] Further, a flange 104 is defined on a top portion 102a (as shown in Figure 5) of the cylindrical guide member 102. The flange 104 is operable between a rest condition and a working condition, wherein the flange 104 in the working condition facilitates dismantling of the cylindrical guide member 102 from the connecting junction 204 of the suspension unit 202. The flange 104 also includes a relief portion 104a (as shown in Figure 4) capable of receiving a tool (not shown) for operating between the rest condition and the working condition. In an embodiment, the relief portion 104a is a cut-out portion on the flange 104 configured for receiving the tool. In an embodiment, the tool engaging with the relief portion 104a is a screwdriver.

[028] In an embodiment, the flange 104 in the rest condition is unstrained, and is in contact with the inner surface 208a of the outer tube 208. In an embodiment, the flange 104 in the working condition is strained, so that the cylindrical guide member 102 deforms and disengages from the inner surface 208a of the outer tube 208. Thus, in the working condition of the flange 104, the cylindrical guide member 102 is easily dismantled from the outer tube 208, thereby facilitating servicing of the suspension unit 202. In an embodiment, the flange 104 is strained via the tool which engages with the relief portion 104a via a slot (not shown) provisioned on the outer tube 208.

[029] In the present embodiment, the flange 104 is provided to axially extend beyond the outer tube 208 (as shown in Figure 3). Such a construction of the flange facilitates access to the tool, thereby enabling operation between the rest condition and the working condition. Additionally, the area of contact of the flange 104 with the inner tube 206 and the outer tube 208 is lubricated with grease for reducing friction therebetween. In other words, grease is applied on contact surfaces of the cylindrical guide member 102, the outer surface 206a and the inner surface 208a, prior to mounting of the cylindrical guide member 102 in the outer tube 208. In an embodiment, the cylindrical

guide member 102 is press-fitted in the outer tube 208, inherently eliminating the requirement of a snap-ring (not shown).

[030] Further, at a bottom portion 102b of the cylindrical guide member 102, an annular recess 106 (as shown in Figure 5) is provided. The annular recess 106 is adapted to receive a bush member 108. As such, the bush member 108 is provided between the outer surface 206a and the cylindrical guide member 102 (as shown in Figure 3). The bush member 108 facilitates sliding movement between the inner tube 206 and the outer tube 208, while ensuring sealing or ingress protection. In an embodiment, the bush member 108 is made of a material having a low-friction co-efficient. In another embodiment, the bush member 108 is a bi-metallic bush member made of steel and being coated with Teflon material. In another embodiment, the bush member 108 is also made of a plastic material, as per design feasibility and requirement.

[031] Referring to Figures 6 and 7 in conjunction with Figures 2 and 3, the slide bush assembly 100 further includes an annular seal member 110 adapted to be mounted onto the flange 104. The annular seal member 110 includes an extending lip 112 which enables mounting onto the flange 104. The extending lip 112 includes a first portion 112a defined on its bottom portion. The first portion 112a is adapted to engage with the flange 104, thereby ensuring engagement with the cylindrical guide member 102. The extending lip 112 also includes a second portion 112b defined on its top portion. The second portion 112b is adapted to engage with the outer surface 206a of the inner tube 206. Such a configuration of the annular seal member 112 acts as a sealing member or cover to the suspension unit 202 at the connecting portion 204, thereby providing ingress protection. The extending lip 112 also includes a protruding portion 112c which protrudes laterally therefrom. The protruding portion 112c is adapted to engage with a

cover member 246 (as shown in Figure 3), thereby ensuring a snug-fit engagement within the outer tube 208.

[032] In an embodiment, the inner tube 206 is provided with a distal bush member 114 at its distal end. The distal bush member 114 is made of a material having low friction co-efficient, thereby preventing scoring of inner tube 208 during sliding movement with the outer tube 208.

[033] Advantageously, the present invention provides the slide bush assembly 100 which facilitates servicing of the suspension unit 202, without the requirement of completely dismantling the suspension unit 202. Also, the construction of the slide bush assembly 100 eliminates requirement of oil, snap ring and the like, thereby reducing the number of parts involved and making the construction of the suspension unit 202 simple. Additionally, the construction of the flange 104 on the cylindrical guide member 102 ensures easy access and removal of the cylindrical guide member 102, thereby facilitating servicing of the suspension unit 202. Further, due to elimination of use of oil in the suspension unit 202 for lubrication, requirement of oil seals and issues pertaining to oil leakage are eliminated. Furthermore, due to use of bush members, the scoring or damage of the inner tube 206 during sliding movement in the outer tube 208 is eliminated, while ensuring optimum performance.

[034] While the present invention has been described with respect to certain embodiments, it will be apparent to those skilled in the art that various changes and modification may be made without departing from the scope of the invention as defined in the following claims.

CLAIMS:

1. A slide bush assembly (100) for a suspension unit (202) of a vehicle (200), the assembly (100) comprising:
a cylindrical guide member (102) disposed at a connecting junction (204) of an
5 inner tube (206) and an outer tube (208) of the suspension unit (202), the cylindrical guide member (102) adapted to engage with an inner surface (208a) of the outer tube (208) and surround an outer surface (206a) of the inner tube (206); and
a flange (104) defined on a top portion (102a) of the cylindrical guide member
10 (102), the flange (104) operable between a rest condition and a working condition, wherein the flange (104) in the working condition facilitates dismantling of the cylindrical guide member (102) from the connecting junction (204) of the suspension unit (202).
15
2. The slide bush assembly (100) as claimed in claim 1, wherein the flange 104 comprises a relief portion 104a adapted to receive a tool for operating the flange 104 to the working condition from the rest condition.
3. The slide bush assembly (100) as claimed in claim 1, wherein the flange (104) in
20 the working condition disengages at least a portion of the cylindrical guide member (102) from the inner surface of the outer tube.
4. The slide bush assembly (100) as claimed in claim 1, wherein the cylindrical
25 guide member (104) is defined with an annular recess (106) at its bottom portion (102b).

5. The slide bush assembly (100) as claimed in claim 4 comprises a bush member (108) mounted on the annular recess (106) of the cylindrical guide member (102).

5

6. The slide bush assembly (100) as claimed in claim 5, wherein the bush member (108) is made by one of plastic material and a metallic material.

10

7. The slide bush assembly (100) as claimed in claim 1 comprises an annular seal member (110) mounted on the flange (104), the annular seal member (110) adapted to provide ingress protection at the connecting junction (204) of the suspension unit (202).

15

8. The slide bush assembly (100) as claimed in claim 7, wherein the annular seal member (110) comprises an extending lip (112), the extending lip (112) having a first portion (112a) adapted to engage with the flange (104) and a second portion (112b) adapted to engage with the inner tube (206).

20

9. The slide bush assembly (100) as claimed in claim 1, wherein the cylindrical guide member (104) is made of a thermoplastic material.

10. The slide bush assembly (100) as claimed in claim 1, wherein the suspension unit (202) is a telescopic suspension unit.

11. A telescopic suspension unit (202) of a vehicle (200), the telescopic suspension unit (202) comprising:

an outer tube (208);

an inner tube (206) telescopically mounted within the outer tube (208); and

5 a slide bush assembly (100) comprising:

a cylindrical guide member (102) disposed at a connecting junction (204) of the inner tube (206) and the outer tube (208), the cylindrical guide member (102) adapted to engage with an inner surface (208a) of the outer tube (208) and surround an outer surface (206a) of the inner tube (206); and

10 a flange (104) defined on a top portion (102a) of the cylindrical guide member (102), the flange (104) operable between a rest condition and a working condition, wherein the flange (104) in the working condition facilitates dismantling of the cylindrical guide member (102) from the connecting junction (204).

15 12. The telescopic suspension unit (100) as claimed in claim 11, wherein the flange 104 comprises a relief portion 104a adapted to receive a tool for operating the flange 104 to the working condition from the rest condition.

20 13. The telescopic suspension unit (202) as claimed in claim 11, wherein the flange (104) in the working condition disengages at least a portion of the cylindrical guide member (102) from the inner surface (208a) of the outer tube (208) for facilitating dismantling from the connecting junction (204).

14. The telescopic suspension unit (202) as claimed in claim 11, wherein the cylindrical guide member (104) is defined with an annular recess (106) at its bottom portion (102b).

5 15. The telescopic suspension unit (202) as claimed in claim 14 comprises a bush member (108) mounted on the annular recess (106) of the cylindrical guide member (102).

10 16. The telescopic suspension unit (202) as claimed in claim 15, wherein the bush member (108) is made by one of plastic material and a metallic material.

15 17. The telescopic suspension unit (202) as claimed in claim 11 comprises an annular seal member (110) mounted on the first relief member (104), the annular seal member (110) adapted to provide ingress protection at the connecting junction (204) of the suspension unit (202).

20 18. The telescopic suspension unit (202) as claimed in claim 17, wherein the annular seal member (110) comprises an extending lip (112), the extending lip (112) having a first portion (112a) adapted to engage with the flange (104) and a second portion (112b) adapted to engage with the inner tube.

19. The telescopic suspension unit (202) as claimed in claim 11, wherein inner tube (206) comprises a distal bush member (114) mounted on its distal end (206c).

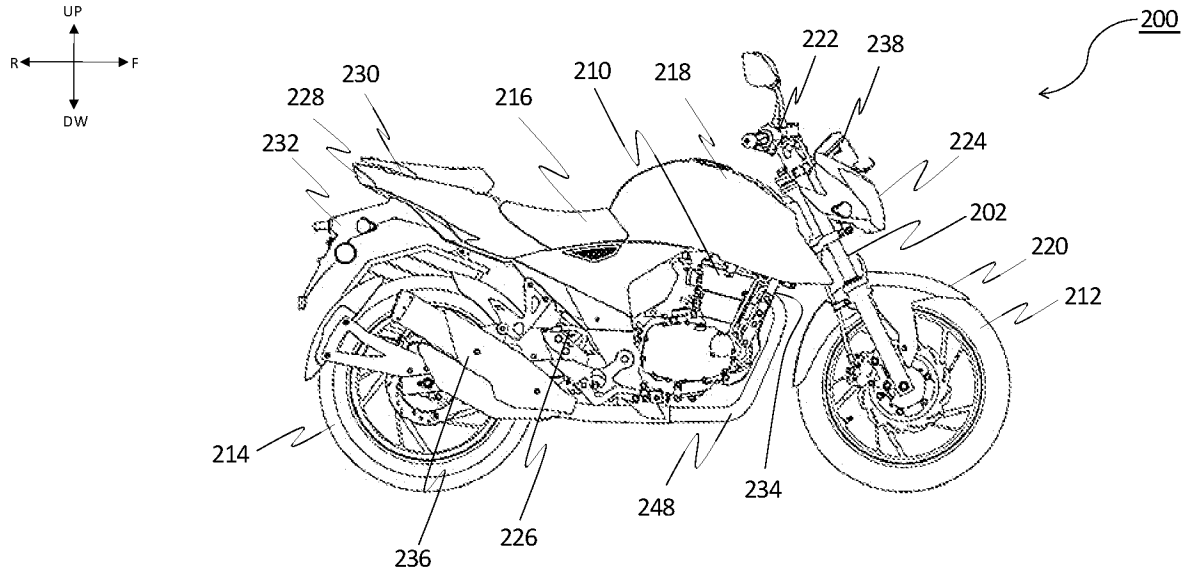


Figure 1

202

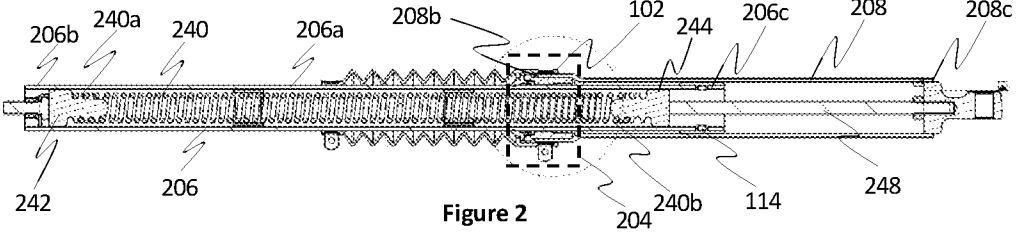


Figure 2

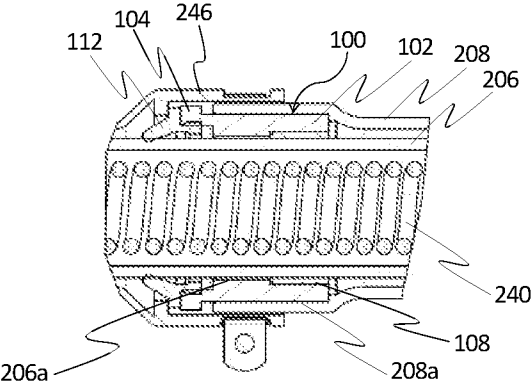


Figure 3

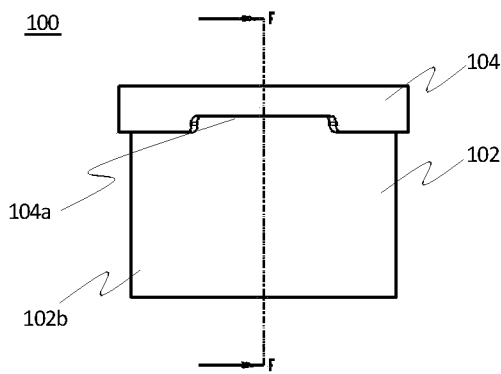


Figure 4

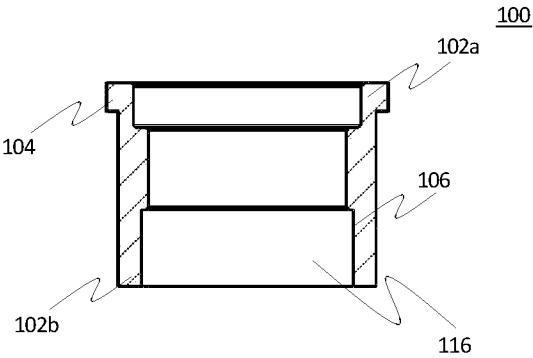


Figure 5

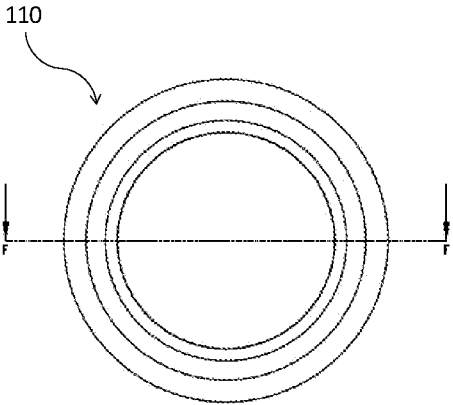


Figure 6

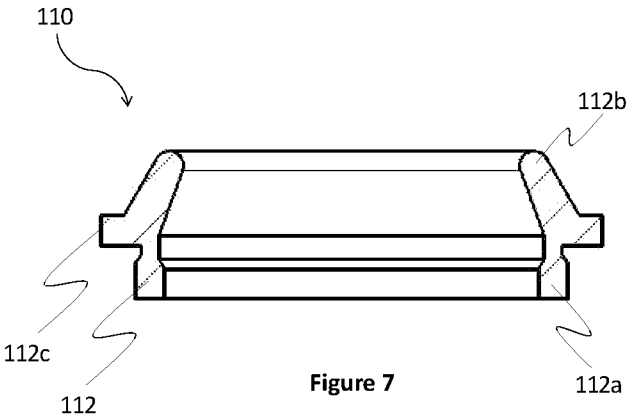


Figure 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2022/050591

A. CLASSIFICATION OF SUBJECT MATTER
F16F13/14, B60G7/02 Version=2022.01

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)

F16F13/00, B60G7/00

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

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

PatSeer, IPO Internal Database

Keywords: bush, suspension, slide, flange, guide, tube, seal, telescopic

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP2008249081A (FUJI HEAVY IND LTD (JP)) 16 October 2008 (16.10.2008) Abstract, Para 0020, 0023 & 0025 (as per English translation on Espacenet) & No Family	1-6 & 9
Y	Abstract, Para 0020, 0023 & 0025	7-8, 10-19
Y	US2021039740A1 (KTM AG (AT)) 11 February 2021 (11.02.2021) Abstract	7-8, 10-19

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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		JP 2021512259 A	13-05-2021
		WO 2019145130 A1	01-08-2019