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Kingpin Lubrication System with Self Driven Mechanism (Front Axle)

Nirbhay Pratap Singh
Engineering research and development
TATA Technologies LTD.
Pune, India - 411057

Shubhad Dash
Engineering research and development
TATA Technologies LTD.
Pune, India – 411057

Abstract:- This innovation is based on the lubrication system of the kingpin assembly of the front axle in commercial vehicles. The failure of Kingpin bush because of insufficient lubrication is a major concern in commercial vehicles which leads to a high cost of part replacement and vehicle breakdown. Insufficient lubrication reduces the self-life of kingpin bush also. In the current scenario, the lubrication of kingpin bush (at the top side of kingpin) happens by gravitational force only by which the lubrication doesn't properly. On the other hand, for the lubrication of kingpin bush (bottom side bush), grease stores below the kingpin hence the gravitational force doesn't work for lubrication of kingpin bush and resulting in no sufficient lubrication. To resolve this issue, a Self-driven mechanism is provided which pumps the grease inside the system and provides proper lubrication because of a pressurized flow of grease. This mechanism helps to improve the part's life & system performance and prevent bush failure because of insufficient lubrication.

Keywords:- *Kingpin Lubrication; Kingpin Bushing.*

I. INTRODUCTION

In current scenario, in commercial vehicles (like bus, truck, etc.), kingpin works like a pivot joint in between knuckle and beam which permit the knuckle to turn about the steering axis. Bushings are provided in between knuckle and beam to facilitate the steering movement. A thrust bearing is inserted in between knuckle and beam to support the FAW. In the above mentioned mechanism, the bushing is subjected to wear and is replaced once the wear limit exceeds the specification. Normally such types of wear are observed in heavy commercial vehicles like bus & truck. Many times it's observed that bushing is wear-out faster because of insufficient lubrication.

II. AIM OF PROJECT

The intention of this innovation is to provide positive lubrication of kingpin bushing to ensure long bushing life and to resolve the above-mentioned problem.

This innovation provides a self-pumping mechanism. This mechanism is based on movement of the knuckle about kingpin. This mechanism provides a pressurized lubricant which flows throughout the system.

➢ *Nomenclature of Components Used in System*

- Beam.
- Kingpin Bush.
- Grease nipple cap assembly.
- Kingpin.
- Pumping Element.
- Screw.
- Spring.
- Knuckle.
- Thrust bearing.

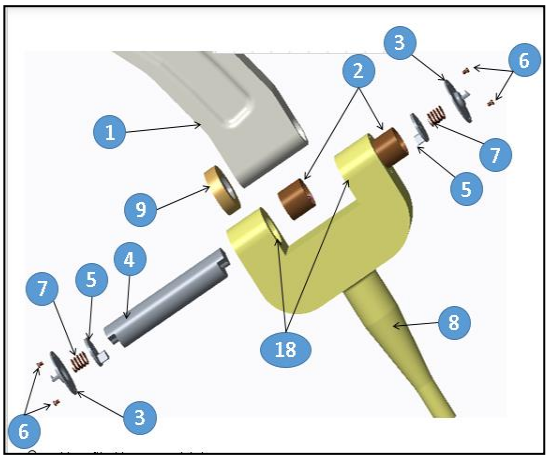

Fig 1:- Exploded View

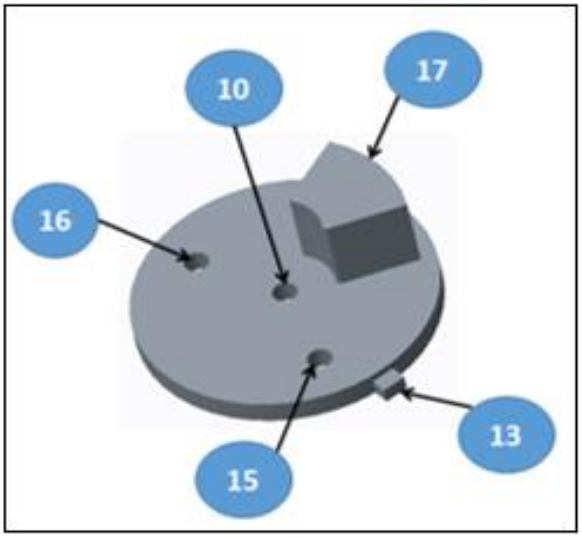

Fig 2:- Pumping Element

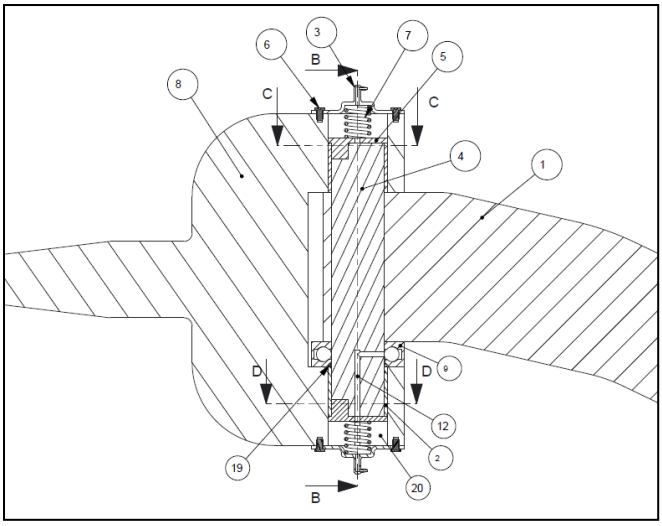

Fig 3:- Assembly Section View

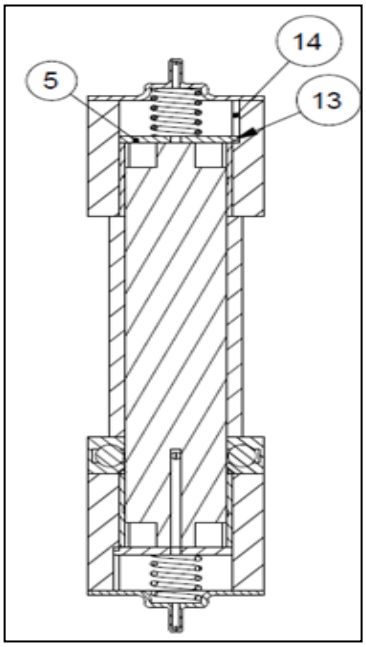

Fig 4:- Section view B-B

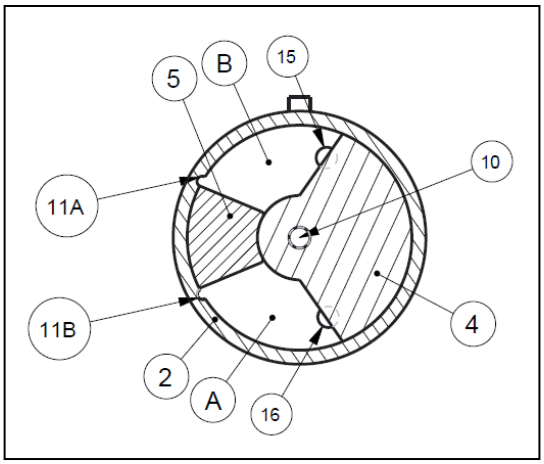

Fig 5:- Section View D-D

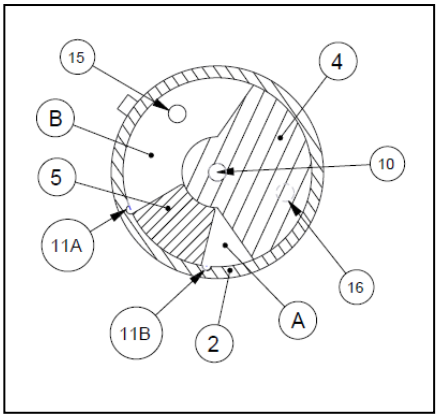

Fig 6:- Section View D-D (LH-Turn)

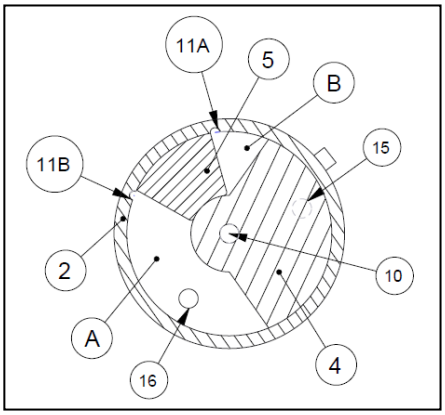

Fig 7:- Section View D-D (RH Turn)

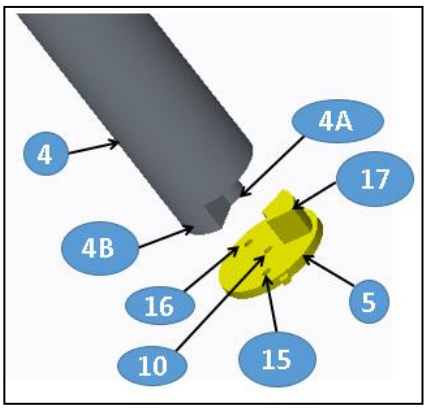

Fig 8:- Pumping Element detail View

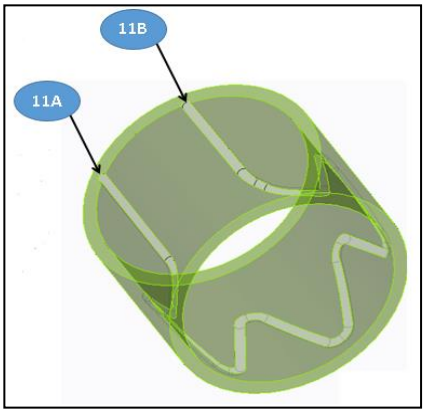

Fig 9:- Bushing View

- Fig- 1:- A systematic arrangement of kingpin and steering knuckle assembly including the kingpin and bushing according to present innovation.
- Fig- 2:- View of features of intermediate disc used in mechanism.
- Fig- 3:- Sectional view of assembly for reference of internal structure.
- Fig- 4:- View of section B-B as shown in fig-3.
- Fig- 5:- View of section D-D as shown in fig-3.
- Fig- 6:- Another view of fig-5 in condition of LH turn.
- Fig- 7:- Another view of fig-5 in condition of RH turn.
- Fig- 8:- View in exploded form showing the manner in which components are assembled.
- Fig- 9:- View of groove on internal surface of bush.

III. METHOLODOGY

Now referring the drawing for a better understanding of innovation. Figure- 1 illustrates the assembly manner in which components are assembled. As shown in figure-3, the knuckle-8 is pivotally connected to beam 1 with the help of kingpin. A hole is provided in the outer end of the beam through which the kingpin-4 is inserted. Kingpin-4 is secured with beam-1 by means of a locking pin (not shown).

Knuckle-8 is pivotally engaged with kingpin with the help of upper and lower branches having two holes 18 as shown in figure 3. A bronze bushing 2 is provided in hole 18 about kingpin which provides a smooth moment to knuckle about the steering axis. A thrust bearing 9 is inserted about kingpin and in between beam and a lower branch of the knuckle as shown in figure-3. The thrust bearing 9 sustain the vehicle's front weight and permit to knuckle to turn about the steering axis. An O-ring 19 is provided in thrust bearing which sealed the bushing from upper end and prevents seepage of lubricant.

The unique construction of bushing is provided at both ends to ensure proper lubrication. As the bushing, construction, and function of the mechanism are substantially identical at both ends so that the lubrication mechanism of the lower bushing will be described in detail.

The Bushing-2 has a groove on its internal surface in a zig-zag manner to ensure proper lubrication on the entire surface. The bushing 2 is inserted in between Kingpin & knuckle in such a way that the internal surface of the bushing is in sliding contact with the outer surface of the kingpin. The endpoint 11A & 11B of internal groove together form passageways of lubrication

The lower portion of kingpin 4 is machined in such a way that it forms an extending semi-cylindrical shape 4B which forms a pumping surface 4A.

The pumping element 5 having an extending portion 17 (pumping surface) is positioned on the lower end of bushing 2.

The clamping end 13 of pumping element 5 is inserted in slot-14 of knuckle-8 as shown in figure-4. This holds the pumping element-5 with knuckle-8.

This pumping element 5 has two holes 15 & 16 which interacts with open chamber A & B during the operation. Third hole 10 interacts with internal passageway 12 inside the kingpin which helps to supply the lubricant inside the thrust bearing.

A cap assembly 3 including grease nipple is assembled on the lower arm of knuckle 8 with the help of two screws 6.

A compressed spring is positioned in between cap assembly 3 and pumping element 5 along depressed portion of pumping element 5. This spring pushes the pumping element 5 to engage with semi-cylindrical portion 4B of kingpin 4.

A rubber O-ring 19 encloses the kingpin and seals the upper end of the bushing.

The various components are designed to provide a chamber-20 in between pumping element-5 & cap assembly-3. This chamber contains the lubricant and communicates with chamber A & B (either side of Pi-shaped extended portion 4B) through the holes 15 & 16 as shown in figure 5.

To understand the working principle of system illustrated in figure 3, the three views 5, 6 & 7 are referred.

Referring to figure-5, all shown components are situated when the vehicle is in a straight-ahead position. The components are dimensioned in such a manner that the upstanding portion 17 of pumping element 5 divides the semi-cylindrical void portion adjacent to pumping surface 4A of kingpin 4 into two chamber A & B equally. Chamber-A communicates with chamber-20 (Lubricant reservoir) through the passageway 16 and the chamber-B communicates with chamber-20 through passageway 15.

When the knuckle turns in RH side, the all components move accordingly as shown in figure-7.

As shown in figure-7, the hole 15 is sealed by extending portion 4B of kingpin 4.the size of chamber-B has been gradually reduced by which the lubricant is compressed and evacuated upwardly through passageway 11A. At the same time the chamber-A is gradually increased in size and create a vacuum which pulls the lubricant through passageway 11A. This way, the pressurized force generated in chamber B & vacuum force created in chamber-A helps to flow the lubricant from passageway 11A to 11B.

On other hand, when the steering knuckle turns in left side, the components creates the image as shown in figure-6.

In this view, the lubricant flows on the reverse path as compared to view -7. The passageway 16 is sealed by extending semi-cylindrical portion 4B. The size of chamber A is gradually reduced by which the lubricant is compressed and evacuated upwardly through passageway 11B. At the same time the chamber-B is increased gradually and create a vacuum inside the chamber-B. Because of this pressurized force generated in chamber A and the vacuum generated in chamber A, the lubricant flows from chamber-B to chamber-A through passageway 11B to 11A. This way a pressurized lubricant flows throughout the system and provide an effective lubrication. In this complete system, no external power is required to run this system. It's completely self-driven system.

This pressurized lubrication enhance the system performance and bushing life.

IV. RESULT

Below are some benefits which are achieved by this project.

- The proper lubrication is considered because of pressurised flow of lubricant throughout the system.
- Bushing life is increased by proper pressurized lubrication.
- Overcome the failures of the bushing which is happened by insufficient lubrication.
- System performance enhanced.

V. CONCLUSION

As mentioned earlier, this innovation provides a self-driven mechanism which works with moment of steering knuckle and corresponding components.

This system provides a pressurized lubricant throughout the system and ensure a proper lubrication of bushing.

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