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DESCRIPTION

Technical Field

[0001] The present invention relates to a tapered stud used for connecting the ring gear flange provided in the final drive part of the axles of the motor vehicles to the housing of said axles.

State of the Art

[0002] In the existing applications, ring gear flange is connected to the axle housing by the spline and nut couple or by a normal bolt and bushing system. Spline and nut system is expensive and requires special bench investments for manufacturing thereof. Bolt and bushing system on the other hand is far from being reliable and often leads to costly failures. Bolt bushings are interference fitted to the housing and broken or become loose during operation, resulting in loosed slots and bolts. Therefore, shearing of a large diameter stud without threads thereon is less likely to occur. Lastly, since the diameter of the bolt is identical everywhere, same degree of material removal is required in every section of the part to which said bolt is being fixed. In this case, when the bolt is wide or a great number of bolts are present, it will cause weakening of the material since more material removal will be required. Weakening of the material can result in significant strength problems.

[0003] An example of a ring gear flange connected to the axle housing by bolts is shown in patent US 6,322,157 B1.

[0004] Although a patent application having a tapered stud connection method similar to that of the present invention is not encountered, the TPE registered utility model application number 2007/04049 relates to a hole drilling apparatus comprising a surface ball having axial and surface balls therein to compensate horizontal and vertical forces, at least two (preferably three) drill sleeves having morse taper in the center thereof and main gear and transmission gear to provide same direction rotation of said drill sleeves.

Objects of the Invention

[0005] The object of the present invention is to develop a tapered stud allowing for reliable connection of the ring gear flange located in the final drive part of the axles to the final drive housing or axle housing, having a wide pressing surface and enabling a high shear strength.

[0006] The present invention relates to the conical part of the tapered stud. This structure is defined as a morse taper. Today, morse taper structure is used in many structures. In particular, this tapered structure is employed in bit holders of lathe machines or in the bits.

[0007] The tapered stud according to the present invention will eliminate current disadvantages and will be used as a connection element for the first time in the axle system so as to provide additional advantages. Morse taper structure is defined as "self-holding". Self-holding characteristic can be explained as follows: The force that the bolt threads apply when engaged with the threads on the material is decomposed into vertical and horizontal components with respect to the tapered part and the holding characteristic is provided by the parallel one of said force components. Thus, displacement, loosening or dislocation of the tapered stud as in the case of a normal bolt does not take place. Shearing may occur on the surface where the axle housing and the ring gear flange are in contact with each other. If said surface is a non-threaded surface instead of a threaded surface, shearing possibility is considerably reduced. Therefore, tapered stud is more resistant to the shearing.

[0008] In addition, housing part is weakened less than the bolt connection thanks to the tapered structure. Since, the initial diameter and the diameter towards the end are different from each other. The diameter gradually decreases towards the interior part of the axle, thus, the amount of material removed and the weakening of the material is reduced.

Description of the Figures

[0009]

Figure 1 is the general cross-sectional view of the assembled ring gear and the axle housing.

Figure 2 is the detailed cross-sectional view of the assembled ring gear and the axle housing.

Figure 3 is the side view of the tapered connection element.

Reference Numbers

[0010]

1. 1. Sun gear
2. 2. Planet gear
3. 3. Ring gear
4. 4. Ring gear flange
5. 5. Planet carrier
6. 6. Hub
7. 7. Tapered stud
8. 8. Stud nut
9. 9. Axle housing
10. 10. Shaft
11. 11. Hub swivel

Detailed Description of the Invention

[0011] The present invention relates to the utilization of tapered studs (7) during fixing the ring gear flange (4), used to connect the ring gear (3) located in the axle part of the motor vehicles to the axle housing (9) to the hub swivel (11).

[0012] In a motor vehicle, a ring gear flange (4) is utilized for providing the connection between the hub swivel (11) and the ring gear (3). In the state of art, ring gear flange (4) is fixed to the hub swivel (11) by means of bolts. However, since the bolt threads are shear triggering structures and the bolt diameter is identical everywhere, same degree of material remove is required in every section of the part to which said bolt is being fixed. In this case, when the bolt is wide or a great number of bolts are present, undesired situations such as weakening of the material emerge due to the necessity of more material removal. Unlike the state of art, the connection between the ring gear flange (4) and the hub swivel (11) is provided by means of the tapered studs (7).

[0013] General and detailed views of the axle structure are given in Figure 1 and Figure 2. The names and functions of the constituent parts of this structure are respectively described. The gear rotating around the inner fixed axis of the gear assembly used during transmission of the motion from the shaft (10) to the wheels for rotation thereof is called the sun gear (1). Planet gears (2) are three gears located between the inner and outer part of the gear assembly used during transmission of the motion from the shaft (10) to the wheels for rotation thereof and rotating around their axes as well as around the sun gear (1). Ring gear (3) is the fixed outer gear of the gear assembly used during transmission of the motion from the shaft (10) to the wheels for rotation thereof. Ring gear flange (4) is the part located in between in order to fix the ring gear (3) to the hub swivel (11). Planet carrier (5) is the structure connected to the hub (6) on one end, connected to the planet gears (2) on the other end and transmitting the motion to the wheels by rotating. Hub (6) is the structure connected to the hub swivel (11) by means of bearings on one end, connected to the planet carrier (5) on the other end and transmitting the motion from the planet carrier (5) to the wheels.

[0014] The tapered studs (7) according to the present invention are interconnection elements fixing the ring gear flange (4) to the hub swivel (11). After the tapered studs (7) are placed, stud nuts (8) are put on the end of the tapered studs (7) remaining outside in order to fix the ring gear flange (4).

[0015] Axle housing (9) provides bearing of the shaft (10) and serves to receive the loads transmitted from the ground to the wheels. Shaft (10) is the solid cylindrical structure enabling transmission of the motion from the engine to the wheels by means of the final drive. Hub swivel (11) is part on the side where ring gear (3) is fixed to the axle by means of the ring gear flange (4).

[0016] Axle is the part passing through the center of the wheels and located transversely under the vehicle. Axle housing (9) is casted and connected to the chassis through the cavity provided in the middle and upper part thereof. The shafts (10) located in the cavity provided in the axle housing (9) transmit the motion from the engine to the right and left wheels by means of the final drive. The motion in the right and left shafts are transmitted to the outer part and thus, to the sun gears (1) by means of the spiders. The hub (6) provides tapered bearings rotational motion around the hub swivel (11). The hub (6) and the planet carrier (5) are fixed to each other via bolts. Planet carrier (5) provides rotation of the wheels by transmitting the motion from the planet gears (2) to the wheels. Rotation of the sun gear (1) provides rotation of the planet gears (2) inside the fixed ring gear (3). Fixing of the ring gear (3) is carried out as follows. Ring gear flange (4) is fixed to the ring gear (3) and then, this assembly is fixed to the hub swivel (11) by means of the tapered studs (7). In order to explain said fixing process in a more detailed manner, when the detail of the tapered stud (7) is examined threads on the head and end (on both ends) of the tapered stud (7) are observed. The part of the tapered stud (7) entering into the hub swivel (11) is fixed to the hub swivel (11) by means of the threads. In order to limit the movement of the ring gear flange (4), stud nuts (8) are placed on the ends remaining outside of the tapered stud (7) and fixed by tightening. The shearing problem between the hub swivel (11) and the ring gear flange (4) is eliminated by providing non threaded tapered stud (7) portions contacting with said parts. The tapered structure portion of the tapered stud (7) inside the hub swivel (11) provided less material removal, thus, a more robust hub swivel (11) due to the decrease in cross-sectional area of the tapered stud (7) towards the inner portions of the hub swivel (11).

REFERENCES CITED IN THE DESCRIPTION

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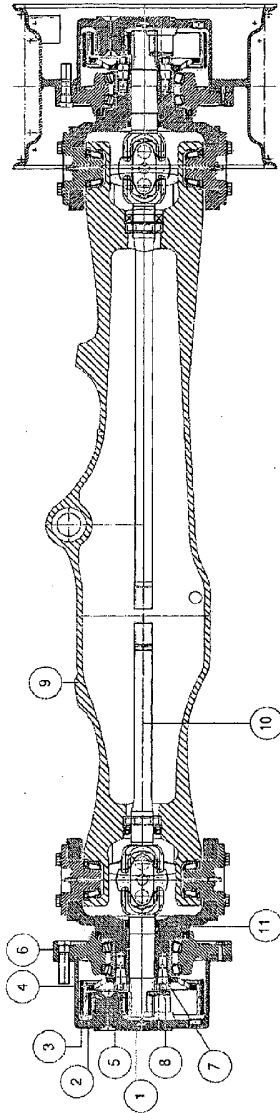
Patent documents cited in the description

- [US6322157B1 \[0003\]](#)
- [US200704049B \[0004\]](#)

PATENTKRAV

- 5 1. Akselstruktur omfattende et solhjul (1), der roterer omkring den indre faste akse af tandhjulsenheden, der anvendes under transmission af bevægelsen fra akslen (10) til hjulene for rotation deraf, planethjul (2), der er placeret mellem den indre og ydre del af tandhjulsenheden, der anvendes under transmission af bevægelsen fra akslen (10) til hjulene for rotation deraf, hvilke hjul roterer omkring deres akser såvel som omkring solhjulet (1), hvilket ringhjul (3) der er det ydre faste hjul af tandhjulsenheden, der anvendes under transmission af bevægelsen fra akslen (10) til hjulene for rotation deraf, tandkransflange (4), der er placeret med henblik på at fastgøre ringhjulet (3) til navaksen (11), planethjulsholder (5), der er forbundet med navet (6) på én ende, og som er forbundet med planethjulet (2) på den anden ende og transmitterer bevægelsen til hjulene ved rotation, nav (6), der er forbundet med navaksen (11) ved hjælp af lejer på én ende, og som er forbundet med planethjulsholderen (5) på den anden ende og transmitterer bevægelsen fra planethjulsholderen (5) til hjulene, akselhus (9), der tilvejebringer et leje for akslen (10) og tjener til at modtage belastningerne transmitteret fra underlaget til hjulene, aksel (10), der transmitterer bevægelsen fra motoren til hjulene, og navaksel (11) tilvejebragt på siden, hvor ringhjulet (3) er fastgjort til akslen ved hjælp af tandkransflangen (4), koniske bolte (7) anvendes til at fastgøre tandkransflangen (4) til navaksen (11), kendetegnet ved, at den del af den koniske bolt (7), der går ind i navaksen(11),omfatter en konisk struktur, og at boltens tværsnitsareal aftager mod de indre dele af navaksen (11).
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2. Akselstruktur ifølge krav 1, kendetegnet ved, at der er dannet gevind på hovedet og enden af (på begge ender af) den koniske bolt (7).
3. Akselstruktur ifølge krav 1, kendetegnet ved, at den koniske bolt- (7) del, der er i kontakt med navaksen (11), og den koniske del, der er i kontakt med tandkransflangen (4), er dannet uden gevind.
4. Akselstruktur ifølge krav 1, kendetegnet ved, at den omfatter en boltmøtrik (8), der er placeret på enden, der forbliver uden for den koniske bolt (7).

DRAWINGS



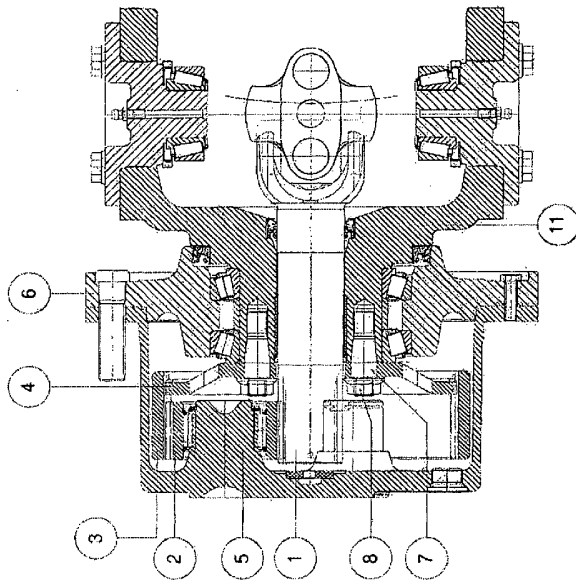


Figure - 2

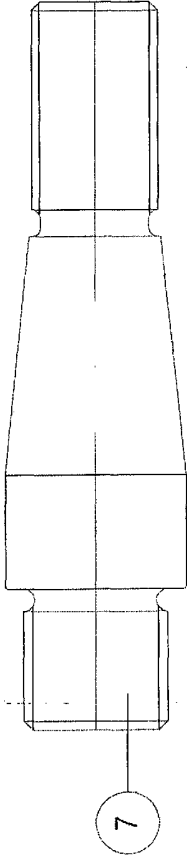


Figure - 3