

PATENT SPECIFICATION

(11) 1 443 482

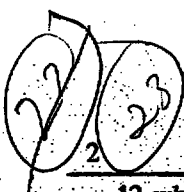
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(54) BEVEL GEAR DRIVE ASSEMBLY

- (71) We, CATERPILLAR TRACTOR CO., a corporation organised and existing under the laws of the State of California, United States of America, of 100 N.E. Adams Street, Peoria, State of Illinois 61602, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- This invention relates to a bevel gear drive assembly for driving a track-type vehicle.
- Conventional bevel gear casings for track-type earth-moving vehicles are usually divided into three compartments by means of a pair of centrally disposed laterally spaced walls. The central compartment formed by such walls usually contains a bevel gear and a shaft therefor which has end portions extending axially through such walls into oppositely disposed outer compartments. Within the central compartment, the main bevel gear meshes with another bevel gear, conveniently referred to as a bevel pinion, which is driven by the vehicle transmission for imparting driving torque to the bevel gear shaft. The axially opposite ends of the bevel gear shaft are usually operatively connected to left and right track steering clutches and brakes which are individually disposed within the opposed outer compartments. Such steering clutches and brakes are, in turn, coupled to their respective final drives for driving the oppositely disposed tracks of the vehicle.
- Conventionally, a pair of tapered roller bearings are mounted individually within the laterally spaced central walls of the casing for rotatably supporting the opposite ends of the bevel gear shaft and for absorbing the usually high axial thrust loads caused by the natural tendency for the bevel gear and pinion to separate during meshing. Such separating is caused by a component of the driving force being transmitted between the bevel gear and pinion due to the pressure angle of such a force, as well known in the art. This separating force causes one or the other of the tapered roller bearings to run under high loading and for the oppositely disposed tapered roller bearing to run lightly loaded.
- Such an imbalance in loading can cause deflection in the casing walls which could result in a premature failure of the bearing or wall components.
- Some examples of prior art bevel gear mounting arrangements are found in U.S. Patents No. 1,033,102, 1,937,950, 3,194,083, 3,364,791, and 3,442,444.
- The present invention provides a bevel gear assembly having a gear shaft mounting arrangement which neutralizes thrust loading caused by the tendency for the gears of such assembly to separate during meshing. The bevel gear casing may be made of lighter and more economically manufactured structure because of such thrust neutralization. The bevel pinion of the assembly is so arranged with respect to the bevel gear that the thrust forces generated thereby will balance those developed by the bevel gear.
- According to the invention we provide a bevel gear drive assembly including a casing having a first wall and having second and third spaced-apart walls extending from said first wall, a bevel gear mounted upon a shaft extending between said second and third walls, a bevel pinion including a pinion shaft mounted within said first wall and extending normally thereto for engagement with said bevel gear, said bevel gear and said bevel pinion being mounted between said first, second, and third walls for balancing thrust forces developed by said bevel gear and said bevel pinion such that the forces upon said third wall are substantially balanced.
- Other advantages of the present invention will become apparent from the following description of the accompanying drawing which is a sectional elevation of a bevel gear drive casing showing the operative parts mounted within a centrally disposed compartment.
- With reference to the drawing, the bevel gear drive assembly is indicated generally at 10. The assembly is mounted within a casing



12 which includes a first structural wall 14 and a pair of laterally extending opposite second and third walls 16 and 17 which are attached to the first wall by suitable means such as bolts 18 or the like.

The drive assembly 10 includes a bevel gear 20 which meshes with a bevel pinion 22. The bevel pinion is integrally formed with a shaft 24. One end of the shaft 24 is rotatably journaled within a double tapered roller bearing assembly 26 which assembly is mounted within a bearing housing 27 fixed to the first wall 14. The other end of the shaft 24 is supported within a roller bearing 29 which bearing is mounted within a bearing support assembly 30. Such support assembly includes a base member 31 which extends from the third wall 17 and which is integrally formed therewith. A bearing clamp 32 is secured to the base 31 by means of bolts 33 or the like to retain the bearing and shaft in operative position.

A quill shaft 35 extends between the second and third walls 16 and 17. This quill shaft is provided with an annular flange 36 at one end thereof for mounting the teeth structure of bevel gear 20 thereupon by means of bolts 37. The end of the shaft upon which the bevel gear 20 is disposed is rotatably journaled within a straight roller bearing 40 which is carried by a bearing housing 41 fixed to the wall 16 by appropriate fastening means. The opposite end of the quill shaft 35 is rotatably journaled within a large tapered roller bearing 44 and a smaller tapered roller bearing 45. The bearings 44 and 45 are mounted respectively within bearing housings 47 and 48 which are fixed to the wall 17 by appropriate fastening means.

A lock nut 50 is threadably mounted upon the quill shaft 35 as shown. This lock nut secures the bearings 44 and 45 between itself and an annular shoulder 52 formed on the quill shaft. With this arrangement, axial thrust loads imparted to the quill shaft are transmitted through the bearings 44 and 45 to the third wall 17.

The outwardly extending shaft end portions 58 and 59 for the respective track final drive assemblies are provided with externally splined ends 60 and 61 which abut within the hollow interior of the quill shaft 35 and mate with an internal spline connection 64 formed within the quill shaft.

Power transmission through the bevel gear drive assembly produces a separating force between the teeth of the bevel gear 20 and bevel pinion 22 which force tends to load the shafts of both members. With the apparatus as disposed in the drawing, an upwardly directed axial thrust load would be exerted on the bevel gear 20 and would be transmitted by the quill shaft 35 to the underside of the wall 17 to exert an up-

wardly directed force upon the tapered roller bearing 44 and the bearing housing 47.

A downwardly directed equal and opposite thrust load would be exerted by the bevel pinion 22 and would be transmitted through the roller bearing 29 and support assembly 30 upon the upper portion of the third wall 17 which force would substantially cancel the upwardly directed axial force exerted by the bevel gear shaft 35.

Thus, the summation of forces exerted upon the third wall 17 and the second wall 16 would be substantially zero and such walls would not tend to deflect.

WHAT WE CLAIM IS:—

1. A bevel gear drive assembly including a casing having a first wall and having second and third spaced-apart walls extending from said first wall, a bevel gear mounted upon a shaft extending between said second and third walls, a bevel pinion including a pinion shaft mounted within said first wall and extending normally thereto for engagement with said bevel gear, said bevel gear and said bevel pinion being mounted between said first, second, and third walls for balancing thrust forces developed by said bevel gear and said bevel pinion such that the forces upon said third wall are substantially balanced.

2. An assembly as claimed in Claim 1 wherein said bevel gear shaft includes portions journaled within tapered roller bearings supported by said third wall.

3. An assembly as claimed in Claim 2 wherein said tapered roller bearings are retained within bearing housing means fixed to said third wall.

4. An assembly as claimed in Claims 1, 2, or 3 wherein said bevel gear shaft includes a quill shaft and a coaxially disposed second shaft spline connected to said quill shaft for rotation therewith.

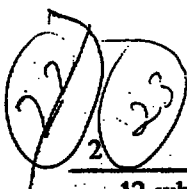
5. An assembly as claimed in Claim 4 wherein said second shaft extends through said second wall and said third wall and wherein said second shaft is received within the hollow interior of said quill shaft.

6. An assembly as claimed in Claim 4 or 5 wherein said bevel gear includes an annular toothed member, said quill shaft having an annular flange thereupon, said toothed member being removably mounted upon said annular flange.

7. An assembly as claimed in Claim 4, 5 or 6 wherein said second shaft has first and second separate portions received in abutting engagement within said quill shaft.

8. An assembly as claimed in any preceding claim wherein said bevel gear shaft includes a portion journaled within straight roller bearings supported by said second wall.

9. An assembly as claimed in any preceding claim wherein a portion of said



12 which includes a first structural wall 14 and a pair of laterally extending opposite second and third walls 16 and 17 which are attached to the first wall by suitable means such as bolts 18 or the like.

The drive assembly 10 includes a bevel gear 20 which meshes with a bevel pinion 22. The bevel pinion is integrally formed with a shaft 24. One end of the shaft 24 is rotatably journaled within a double tapered roller bearing assembly 26 which assembly is mounted within a bearing housing 27 fixed to the first wall 14. The other end of the shaft 24 is supported within a roller bearing 29 which bearing is mounted within a bearing support assembly 30. Such support assembly includes a base member 31 which extends from the third wall 17 and which is integrally formed therewith. A bearing clamp 32 is secured to the base 31 by means of bolts 33 or the like to retain the bearing and shaft in operative position.

A quill shaft 35 extends between the second and third walls 16 and 17. This quill shaft is provided with an annular flange 36 at one end thereof for mounting the teeth structure of bevel gear 20 thereupon by means of bolts 37. The end of the shaft upon which the bevel gear 20 is disposed is rotatably journaled within a straight roller bearing 40 which is carried by a bearing housing 41 fixed to the wall 16 by appropriate fastening means. The opposite end of the quill shaft 35 is rotatably journaled within a large tapered roller bearing 44 and a smaller tapered roller bearing 45. The bearings 44 and 45 are mounted respectively within bearing housings 47 and 48 which are fixed to the wall 17 by appropriate fastening means.

A lock nut 50 is threadably mounted upon the quill shaft 35 as shown. This lock nut secures the bearings 44 and 45 between itself and an annular shoulder 52 formed on the quill shaft. With this arrangement, axial thrust loads imparted to the quill shaft are transmitted through the bearings 44 and 45 to the third wall 17.

The outwardly extending shaft end portions 58 and 59 for the respective track final drive assemblies are provided with externally splined ends 60 and 61 which abut within the hollow interior of the quill shaft 35 and mate with an internal spline connection 64 formed within the quill shaft.

Power transmission through the bevel gear drive assembly produces a separating force between the teeth of the bevel gear 20 and bevel pinion 22 which force tends to load the shafts of both members. With the apparatus as disposed in the drawing, an upwardly directed axial thrust load would be exerted on the bevel gear 20 and would be transmitted by the quill shaft 35 to the underside of the wall 17 to exert an up-

wardly directed force upon the tapered roller bearing 44 and the bearing housing 47.

A downwardly directed equal and opposite thrust load would be exerted by the bevel pinion 22 and would be transmitted through the roller bearing 29 and support assembly 30 upon the upper portion of the third wall 17 which force would substantially cancel the upwardly directed axial force exerted by the bevel gear shaft 35.

Thus, the summation of forces exerted upon the third wall 17 and the second wall 16 would be substantially zero and such walls would not tend to deflect.

WHAT WE CLAIM IS:—

1. A bevel gear drive assembly including a casing having a first wall and having second and third spaced-apart walls extending from said first wall, a bevel gear mounted upon a shaft extending between said second and third walls, a bevel pinion including a pinion shaft mounted within said first wall and extending normally thereto for engagement with said bevel gear, said bevel gear and said bevel pinion being mounted between said first, second, and third walls for balancing thrust forces developed by said bevel gear and said bevel pinion such that the forces upon said third wall are substantially balanced.

2. An assembly as claimed in Claim 1 wherein said bevel gear shaft includes portions journaled within tapered roller bearings supported by said third wall.

3. An assembly as claimed in Claim 2 wherein said tapered roller bearings are retained within bearing housing means fixed to said third wall.

4. An assembly as claimed in Claims 1, 2, or 3 wherein said bevel gear shaft includes a quill shaft and a coaxially disposed second shaft spline connected to said quill shaft for rotation therewith.

5. An assembly as claimed in Claim 4 wherein said second shaft extends through said second wall and said third wall and wherein said second shaft is received within the hollow interior of said quill shaft.

6. An assembly as claimed in Claim 4 or 5 wherein said bevel gear includes an annular toothed member, said quill shaft having an annular flange thereupon, said toothed member being removably mounted upon said annular flange.

7. An assembly as claimed in Claim 4, 5 or 6 wherein said second shaft has first and second separate portions received in abutting engagement within said quill shaft.

8. An assembly as claimed in any preceding claim wherein said bevel gear shaft includes a portion journaled within straight roller bearings supported by said second wall.

9. An assembly as claimed in any preceding claim wherein a portion of said



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pinion shaft is journaled for rotation within further bearings supported by said third wall.

- 5 10. An assembly as claimed in Claim 9 wherein forces exerted by said bevel gear shaft are transmitted to said third wall in a first direction and forces exerted by said pinion shaft are transmitted through said further bearings to said third wall in a second direction opposite to said first direction.

11. A bevel gear assembly substantially as described with reference to the accompanying drawings.

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