

PATENT SPECIFICATION

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(54) TRACK ROLLER

(71) We, CATERPILLAR TRACTOR CO., a corporation organized and existing under the laws of the State of California, United States of America, and whose address is 100 N. E. Adams Street, Peoria, State of Illinois 61629, 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:—

The invention relates to a track roller for rotation about predetermined axis.

Track rollers used on track-type vehicles are subjected to extremely heavy duty service in operation due to exposure to deleterious, highly abrasive environmental conditions and to serve and frequent impact loads. Consequently, such track rollers are plagued with relatively high service costs, short wear life and numerous other problems associated with their operation.

One of such problems is the enlargement and flaring out of the track roller rim commonly known as bell-mouthing. While bell-mouthing is in itself a disadvantage, a more severe problem usually results therefrom because the consequent enlargement of the rim causes a loose fit between the sleeve bearings and the stationary shaft normally employed in such track rollers, resulting in premature failure of such bearings.

Another problem is caused by undue shaft deflection under high load conditions. Those skilled in the art will appreciate that such shaft deflection will cause corner loading of the bearings, as well as the sealing components employed in the track roller, which will also result in an accelerated wear rate or premature failure of such components.

In prior art constructions where the rotary seal elements are disposed between the track roller and a stationary member, such as an end cap, rigidly fixed to the track roller supporting frame, leakage of

lubricating fluid past such rotary seal elements is frequently a problem because of relative bending of the respective frame members due to severe forces imposed thereon during operation. Such bending frequently results in substantial undesired changes in the loading of the sealing faces of such seal elements which, when too loose, results in immediate leakage therepast or, when too tight, results in eventual leakage due to increased wear.

Another problem is that many track rollers do not contain a sufficient quantity of lubricating fluid to adequately lubricate and cool the bearings and sealing components of the track roller during extended periods of operation to prevent premature wear without frequent lubrication.

In the past, track roller developments have been addressed only to a single or perhaps a few of the above problems. Representative of such prior developments are those illustrated in U. S. Patents 2,963,397; 3,082,047 and 3,154,958; 3,586,398 and British Patent 1,375,473. However, the track rollers utilizing such prior developments have not been completely successful because none have fully overcome all of the above problems and because of their complexity and high repair costs.

Accordingly, it is an object of this invention to provide an improved heavy duty track roller affording high load carrying capabilities with a minimum number of components.

Another object of this invention is to provide such a track roller of relatively simple construction with easily replaceable, economically manufactured components.

Another object of this invention is to provide such a track roller having a prolonged life expectancy by minimizing undue wear and premature failure of its various components.

According to the invention a track roller for rotation about a predetermined axis comprises an elongated annular rim coaxial with said axis and including a pair of

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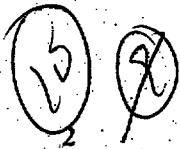
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5 opposed, axially spaced end faces and an axially extending, centrally disposed bore formed therethrough between said end faces, an elongated shaft disposed coaxially within the rim and including a center portion which has a minimum diameter larger than the diameter of the ends of the shaft and which has a pair of axially spaced cylindrical bearing surfaces formed thereon and opposite ends defining a pair of opposed, axially spaced thrust surfaces, a pair of annular retainer sleeves radially supporting said rim and positioned in axially spaced relation partially within said bore of said rim and each about a respective one of said bearing surfaces of said shaft, each of said retainer sleeves being provided with a flange formed on one end thereof having a radially outwardly extending flange portion positioned over a respective one of said end faces of said rim and a radially inwardly extending flange portion positioned over a respective one of said thrust surfaces of said shaft, and the means extending axially between said retainer sleeves to clamp said radially outwardly extending flange portions of said retainer sleeves against the opposed end faces of said rim to ensure said rim and said retainer sleeves in unitary assembly about said shaft.

The invention will now be described by way of example with reference to the accompanying drawings showing a vertical longitudinal cross section through a track roller mounted on a track roller frame.

Referring more particularly to the drawings, an improved track roller, embodying the principles of the present invention, is generally indicated by the reference numeral 10 and includes an elongated stationary shaft 12 having a longitudinal axis X. The shaft is provided with a relatively large diameter center portion 14 having a pair of longitudinally spaced cylindrical bearing surfaces 16 and 17. A pair of radially disposed shoulders or thrust surfaces 19 and 20 are formed at the opposite ends of the center portion of the shaft. A pair of opposite reduced diameter mounting end portions 22 and 23 of the shaft are individually outwardly extended from the shoulders. The shaft is secured at its mounting end portions to a track roller frame 25 by a pair of end caps 27 and bolts 29 in the usual manner.

The track roller 10 also includes an elongated annular track engaging rim 30. Such rim is preferably constructed of steel which is hardened by heat treatment and includes a pair of annular recesses 32 and 33 defining a pair of opposed radially extending end faces 35 and 36 through which a longitudinal centrally disposed bore 38 is formed.

A pair of longitudinally spaced

cylindrical retainer sleeves 40 and 41 are provided with outer peripheries 43 and 44, respectively, dimensioned to be slidably received within the opposite ends of the bore 38 of the rim and are utilized for radially supporting the rim upon the shaft in a manner to be hereinafter described. The retainer sleeves are also provided with cylindrical inner peripheries 45 and 46. A pair of sleeve bearings 47 and 48 are press fitted into the inner peripheries for rotatably mounting the retainer sleeves about the respective bearing surfaces 16 and 17 of the shaft 12.

A pair of flanges 50 and 51 are individually formed on the outer ends of the retainer sleeves 40 and 41, respectively. Each of such flanges are provided with a radially outwardly extending flange portion 53 which is positionable in abutting relation with a respective one of the end faces 35, 36 of the rim and a radially inwardly extending flange portion 55 positioned over a respective one of the thrust surfaces 19, 20 of the shaft.

A pair of thrust bearings 57 are secured in any conventional manner, such as by bonding or by pins, not shown, to the inwardly extending portions 55 in radially abutting relation with the respective thrust surfaces of the shaft.

A pair of annular seals 59, preferably of elastomeric material, are disposed in grooves formed in the outwardly extending flange portions 53 of the retainer sleeves 40 and 41 to abut the corresponding end faces 35 and 36 of the rim for sealing purposes. A pair of rotary seal elements 60 are disposed between the inwardly extending flange portions 55 and the respective mounting end portions 22 and 23 of the shaft for retaining lubricating fluid within the track roller.

A lubricating system 62 for the track roller includes a relatively large, annular shaped fluid reservoir 64 defined between the bore 38 and the periphery of the center portion 14 of the shaft 12 and the inner ends of the retainer sleeves 40 and 41. Such fluid reservoir is adapted to be filled with a standard lubricating fluid through an axially disposed passage 65 formed through the retainer sleeve 41. The outer end of such passage is normally closed by a removable plug 66. A similar axial passage 67 is formed in the other retainer sleeve 40. A pair of radial passages 68 and 69 individually intersect their respective associated passages 67 and 65 for directing lubricating fluid from the reservoir 64 to the thrust bearings 57 and rotary seal elements 60. While other filling structures and procedures are known to those skilled in the art, the above-described arrangement is beneficial because it eliminates the need for

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lubricating grooves and passages in the shaft or the rim. It will be appreciated that such passages and grooves would tend to weaken the shaft and complicate its construction. Also, tapped holes are nearly impossible to machine in hardened material, such as the rim 30.

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A plurality of circumferentially spaced, axially disposed bores, one of which is shown at 71, are formed through the retainer sleeve 41. A like plurality of threaded apertures, one of which is shown at 72, are formed into the inner end of the retainer sleeve 40 and are positionable in axial alignment with the bores 71 of the retainer sleeve 41 for individually receiving one of a plurality of elongated tie bolts 74. Elastomeric seals 75 are disposed in grooves formed about the outer ends of the bores 71 in abutting relation with the heads of the bolts 74 for sealing purposes.

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While the operation of the illustrated track roller is believed to be clearly apparent from the foregoing description, further amplification will be made in the following brief description of such operation. The track roller 10 is assembled by firstly mounting the thrust bearings 57, seals 59, and rotary seal elements 60 to their respective retainer sleeves 40 and 41 and by press fitting the sleeve bearings 47, 48 into the inner peripheries 45 and 46, respectively, thereof. Next, the shaft 12 is inserted through the rim 30 and the sub-assembled retainer sleeves 40 and 41 mounted into their respective ends of the bore 38 of the rim. It should be noted that the outer peripheries of the retainer sleeves are dimensioned to slide into the bore rather than being press fitted thereinto which greatly facilitates the serviceability of the track roller. More importantly, the retainer sleeves are not deformed inwardly upon their assembly into the rim and therefore are not subject to stresses in the area where bell-mouthing of the rim usually occurs. Consequently, the normal tendency of the retainer sleeves to expand with the rim when bell-mouthing occurs is greatly minimized and longer bearing life is realized through maintaining the proper fit between the bearings and the shaft.

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The assembly of the track roller is completed by inserting the tie bolts 74 through the bores 71 and by screw threadably engaging them into their respective threaded apertures 72. Tightening of the tie bolts is effective in bringing the outwardly extending flange portions 53 of the retainer sleeves into clamped engagement against the end faces 35 and 36 of the rim 30 to secure the rim and retainer sleeves in unitary assembly.

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The particular construction of the present track roller 10 permits the complete

assembly of the track roller as a unit, including the lubricating fluid, before being mounted on the track roller frame. As a completely sealed unit, the track roller is more conveniently stored in inventory without fear of contamination by dirt or the like or suffering the loss of loose parts. Furthermore, removal or replacement of the track roller or the track frame is possible without sacrificing the integrity of the sealed unit.

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The advantages of the present track roller 10 should be readily apparent to those skilled in the art. Firstly, the rim 30 is provided with a relatively thin, uniform cross section requiring no tapped holes or other difficult machining, which enables the rim to be hardened to minimize bell-mouthing and provide better wearability. This also makes the rim a less costly replacement item. Secondly, the rim and retainer members are secured by the relatively long tie bolts 74 which exhibit sufficient elasticity to prevent loosening during operation.

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Another advantage is the prevention of undue shaft deflection which results from the relatively large diameter center portion 14 of the shaft 12. However, the relatively small diameter rotary seal elements 60 are provided about the reduced diameter end portions 22 and 23 to reduce the heat generated by such seal elements during operation and extend their wear life. Also, unlike many prior art track rollers, such rotary seal elements are carried solely by the retainer sleeves 40 and 41, respectively, instead of being disposed between the end caps 27 and the retainer sleeves or any such analogous parts of conventional track roller constructions. Consequently, the relative bending of the respective frame members to which such end caps are rigidly secured, resulting in the leakage problem denoted earlier, does not affect the integrity of such seal elements.

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While the invention has been described and shown with particular reference to the preferred embodiment, it will be apparent that variations might be possible that would fall within the scope of the present invention as defined in the accompanying claims.

WHAT WE CLAIM IS:—

1. A track roller for rotation about a predetermined axis, comprising an elongated annular rim coaxial with said axis and including a pair of opposed, axially spaced end faces and an axially extending, centrally disposed bore formed there-through between said end faces, an elongated shaft disposed coaxially within the rim and including a center portion which has a minimum diameter larger than the



lubricating grooves and passages in the shaft or the rim. It will be appreciated that such passages and grooves would tend to weaken the shaft and complicate its construction. Also, tapped holes are nearly impossible to machine in hardened material, such as the rim 30.

A plurality of circumferentially spaced, axially disposed bores, one of which is shown at 71, are formed through the retainer sleeve 41. A like plurality of threaded apertures, one of which is shown at 72, are formed into the inner end of the retainer sleeve 40 and are positionable in axial alignment with the bores 71 of the retainer sleeve 41 for individually receiving one of a plurality of elongated tie bolts 74. Elastomeric seals 75 are disposed in grooves formed about the outer ends of the bores 71 in abutting relation with the heads of the bolts 74 for sealing purposes.

While the operation of the illustrated track roller is believed to be clearly apparent from the foregoing description, further amplification will be made in the following brief description of such operation. The track roller 10 is assembled by firstly mounting the thrust bearings 57, seals 59, and rotary seal elements 60 to their respective retainer sleeves 40 and 41 and by press fitting the sleeve bearings 47, 48 into the inner peripheries 45 and 46, respectively, thereof. Next, the shaft 12 is inserted through the rim 30 and the sub-assembled retainer sleeves 40 and 41 mounted into their respective ends of the bore 38 of the rim. It should be noted that the outer peripheries of the retainer sleeves are dimensioned to slide into the bore rather than being press fitted therein which greatly facilitates the serviceability of the track roller. More importantly, the retainer sleeves are not deformed inwardly upon their assembly into the rim and therefore are not subject to stresses in the area where bell-mouthing of the rim usually occurs. Consequently, the normal tendency of the retainer sleeves to expand with the rim when bell-mouthing occurs is greatly minimized and longer bearing life is realized through maintaining the proper fit between the bearings and the shaft.

The assembly of the track roller is completed by inserting the tie bolts 74 through the bores 71 and by screw threadably engaging them into their respective threaded apertures 72. Tightening of the tie bolts is effective in bringing the outwardly extending flange portions 53 of the retainer sleeves into clamped engagement against the end faces 35 and 36 of the rim 30 to secure the rim and retainer sleeves in unitary assembly.

The particular construction of the present track roller 10 permits the complete

assembly of the track roller as a unit, including the lubricating fluid, before being mounted on the track roller frame. As a completely sealed unit, the track roller is more conveniently stored in inventory without fear of contamination by dirt or the like or suffering the loss of loose parts. Furthermore, removal or replacement of the track roller or the track frame is possible without sacrificing the integrity of the sealed unit.

The advantages of the present track roller 10 should be readily apparent to those skilled in the art. Firstly, the rim 30 is provided with a relatively thin, uniform cross section requiring no tapped holes or other difficult machining, which enables the rim to be hardened to minimize bell-mouthing and provide better wearability. This also makes the rim a less costly replacement item. Secondly, the rim and retainer members are secured by the relatively long tie bolts 74 which exhibit sufficient elasticity to prevent loosening during operation.

Another advantage is the prevention of undue shaft deflection which results from the relatively large diameter center portion 14 of the shaft 12. However, the relatively small diameter rotary seal elements 60 are provided about the reduced diameter end portions 22 and 23 to reduce the heat generated by such seal elements during operation and extend their wear life. Also, unlike many prior art track rollers, such rotary seal elements are carried solely by the retainer sleeves 40 and 41, respectively, instead of being disposed between the end caps 27 and the retainer sleeves or any such analogous parts of conventional track roller constructions. Consequently, the relative bending of the respective frame members to which such end caps are rigidly secured, resulting in the leakage problem denoted earlier, does not affect the integrity of such seal elements.

While the invention has been described and shown with particular reference to the preferred embodiment, it will be apparent that variations might be possible that would fall within the scope of the present invention as defined in the accompanying claims.

WHAT WE CLAIM IS:—

1. A track roller for rotation about a predetermined axis, comprising an elongated annular rim coaxial with said axis and including a pair of opposed, axially spaced end faces and an axially extending, centrally disposed bore formed there-through between said end faces, an elongated shaft disposed coaxially within the rim and including a center portion which has a minimum diameter larger than the

diameter of the ends of the shaft and which
 has a pair of axially spaced cylindrical
 bearing surfaces formed thereon and
 opposite ends defining a pair of opposed,
 5 axially spaced thrust surfaces, a pair of
 annular retainer sleeves radially supporting
 said rim and positioned in axially spaced
 relation partially within said bore of said
 10 rim and each about a respective one of said
 bearing surfaces of said shaft, each of said
 retainer sleeves being provided with a
 flange formed on one end thereof having a
 radially outwardly extending flange portion
 15 positioned against a respective one of said
 end faces of said rim and a radially inwardly
 extending flange portion positioned over a
 respective one of said thrust surfaces of said
 shaft, and tie means extending axially
 20 between said retainer sleeves to clamp said
 radially outwardly extending flange
 portions of said retainer sleeves against the
 opposed end faces of said rim to secure said
 rim and said retainer sleeves in unitary
 25 assembly about said shaft.
 2. A track roller as claimed in Claim 1,
 including a pair of cylindrical sleeve bear-
 ings individually press fitted into a
 respective one of said retainer sleeves and
 engaged with a corresponding one of said
 30 bearing surfaces of said shaft for rotatably
 supporting said retainer sleeves there-
 around, and a pair of annular thrust
 bearings individually mounted to a re-
 spective one of said radially inwardly
 35 extending flange portions of said retainer
 sleeves in thrust engaging relation with a
 corresponding one of said opposed thrust
 surfaces of said shaft to limit axial move-
 40 ment of the unitary assembly relative to said
 shaft.
 3. A track roller as claimed in Claim 2,
 wherein one of said retainer sleeves is
 provided with a plurality of circumferen-
 45 tially spaced bores formed therethrough
 intermediate said rim and said shaft, and the
 other of said retainer sleeves is provided
 with a like plurality of threaded apertures

formed in its other end opposite said flange
 portions and positioned in axial alignment
 with said circumferentially spaced bores, 50
 and said tie means includes a plurality of
 elongated tie bolts individually extended
 through said circumferentially spaced bores
 and screw threadably engaging with said
 threaded apertures.

4. A track roller as claimed in Claim 3, in
 which the ends of the shaft individually
 axially extending from the opposite ends of
 said center portion of said shaft, are
 provided with a pair of end caps partially
 60 embracing each of the ends of the shaft for
 attaching said shaft to a supporting frame.

5. A track roller as claimed in Claim 4,
 including lubricating means comprising an
 annular shaped fluid reservoir defined
 between said shaft and the rim and in-
 65 mediate said retainer sleeves to contain a
 supply of lubricating fluid for lubricating
 said bearings during extended periods of
 operation.

6. A track roller as claimed in Claim 5,
 including seal means to prevent the escape
 of said lubricating fluid from said track
 roller comprising a pair of rotary seal
 elements disposed between the radially
 75 inwardly extending flange portions of each
 of said retainer sleeves and the respective
 one of the mounting ends of the shaft, and a
 pair of static seals disposed between the
 radially outwardly extending flange
 80 portions of each of said retainer sleeves and
 respectively associated end faces of said
 rim.

7. A track roller substantially as
 described with reference to the accom-
 85 panying drawings.

Agents for the Applicants,
 NPM NEW PRODUCT
 MANAGEMENT,
 5, Stone Buildings,
 Lincoln's Inn,
 London WC2A 3XT.

