Oct. 7, 1969 R. D. PAGE ETAL 3,470,967

MOTOR GRADER BLADE CIRCLE MECHANISM

Filed Sept. 12, 1966 2 Sheets-Sheet 1

Fig. 1.

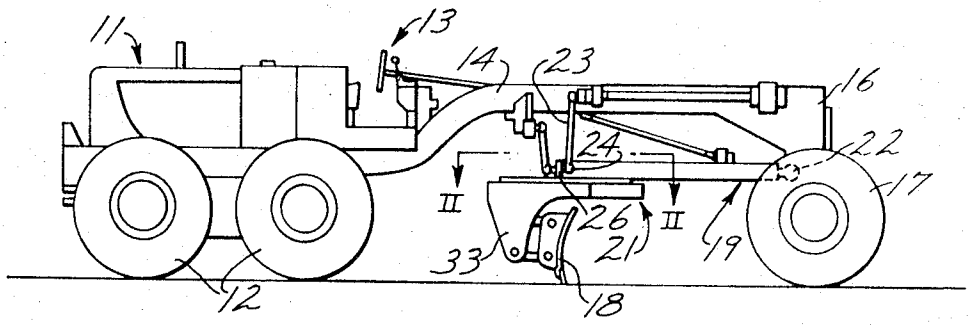
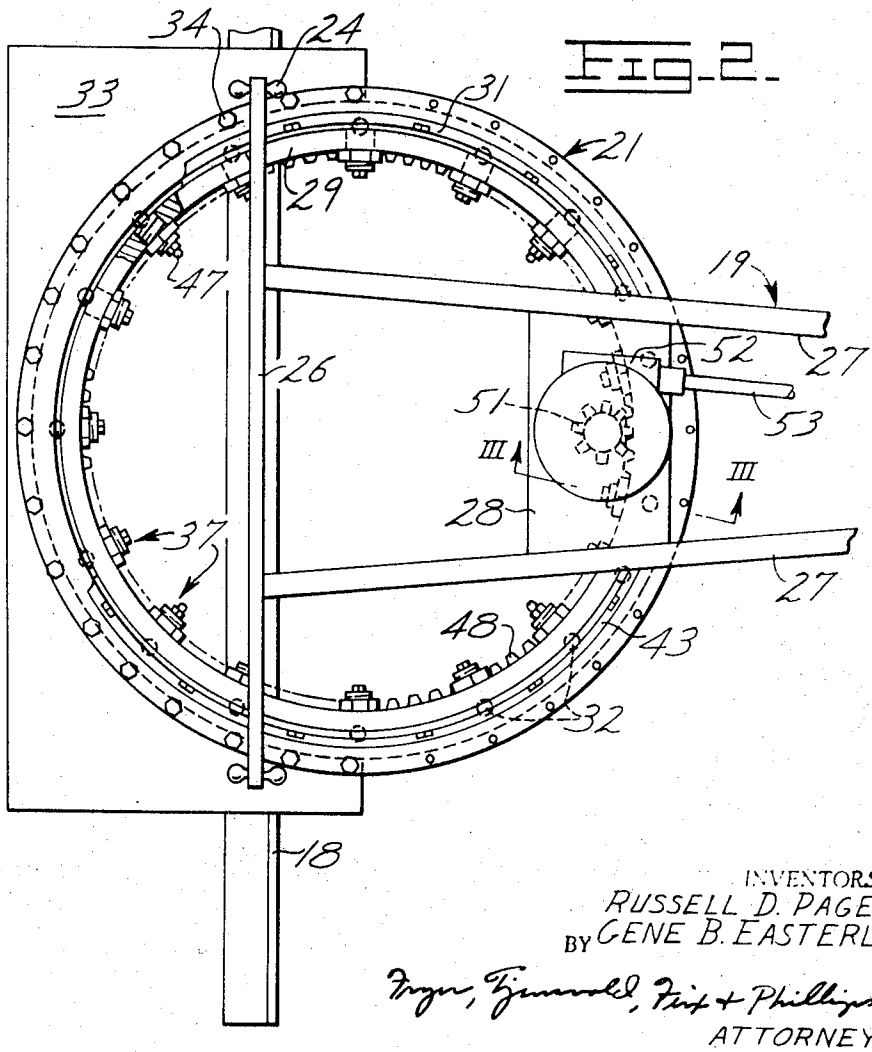


Fig. 2.



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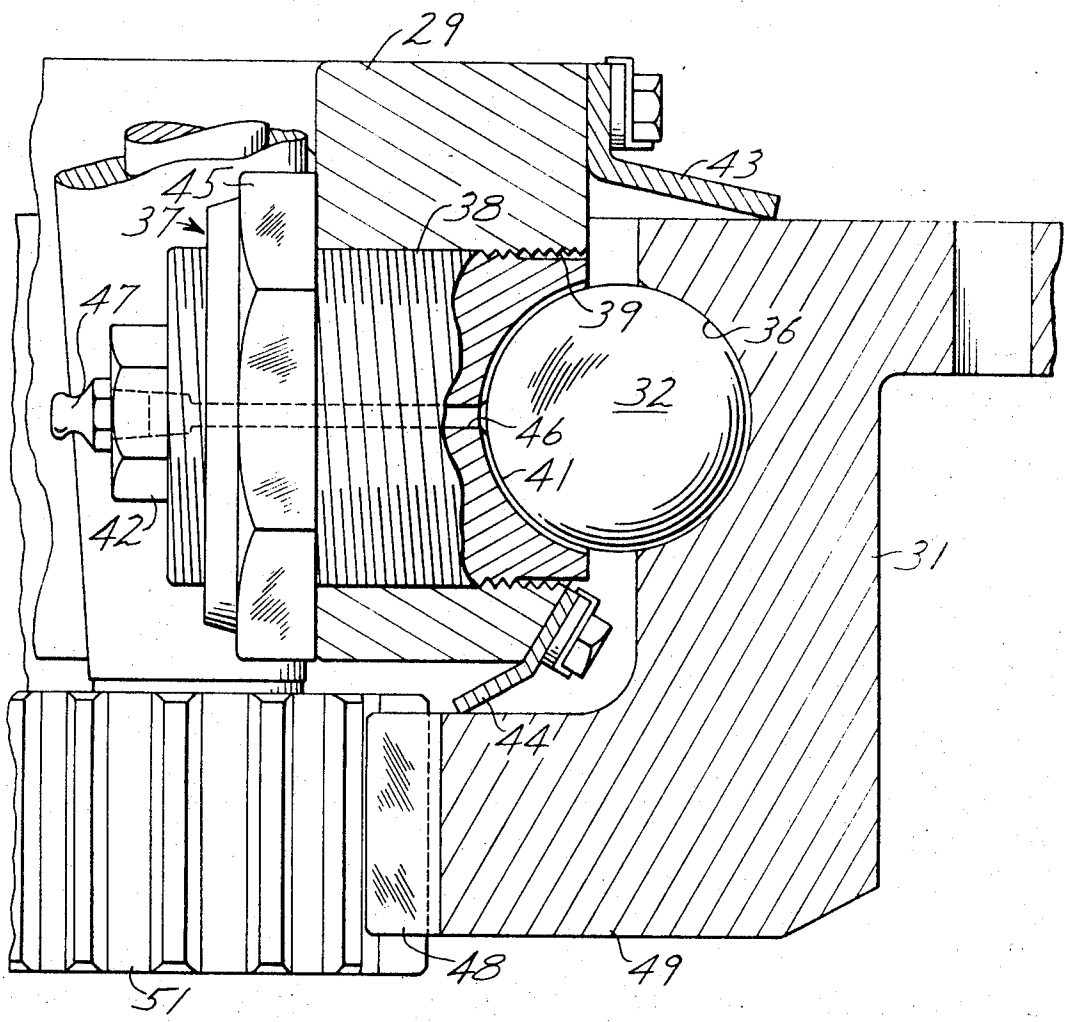
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Fig. 3.



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MOTOR GRADER BLADE CIRCLE MECHANISM

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ABSTRACT OF THE DISCLOSURE

The blade of a motor grader is attached to a blade circle which fits around a concentric ring fixed to the motor grader drawbar. A raceway groove around the blade circle receives a plurality of spherical bearing elements which couple the circle to the ring in a rotatable manner. An adjustable seat element is threadably engaged in the ring at angular intervals therearound to form a seat for an associated one of the bearing elements and the region between the blade circle and ring in which the bearing elements are situated is sealed and lubricated.

This invention relates to motorized earthworking equipment and more particularly to a more rigid and durable mechanism for mounting an earthworking blade on a motor grader in an adjustable manner.

The blade of a motor grader is customarily carried on the vehicle by means which provide for various adjustmenst in blade position and orientation. Typically, controls are provided to vary the elevation of the blade relative to the surface over which the grader travels and to vary the vertical and horizontal angles between the blade and direction of travel. To provide for these adjustments, the blade is secured to an annular blade circle at the rearward end of a drawbar which is attached to a forward portion of the vehicle by a universal joint. The blade circle is rotatable relative to the drawbar to provide for angling the blade and means are provided for selectively raising one or both sides of the circle to tilt or elevate the blade.

It has heretofore been the practice to attach the blade circle to the drawbar structure by means of several shoes which are secured to the drawbar at angularly spaced positions around the circle and which extend thereunder. The shoes secure the blade circle to the drawbar while allowing rotation of the circle for blade adjustment purposes.

The attachment of the blade circle to the drawbar by means of such shoes has not proved to be fully satisfactory and the blade circle support structure has been a prominent source of problems in the field operation of motor graders. The shoe connection is structurally weak, in that the circle is supported at a limited number of spaced points, and the connection is subject to excessive wear. Slack rapidly develops to the point where the accuracy of grading and sloping operations is seriously affected. Frequent maintenance is necessary and the required operations are difficult. Corrective adjustments for wear, for example, involve the removal of shims from the shoes and the frequent replacement of parts. Further,

the structure is not readily susceptible to being designed as a sealed lubricated system.

Thus motor grader operations can be greatly facilitated by providing a blade circle and support mechanism which is stronger, durable and more precise and which is less subject to maintenance difficulties. The present invention provides such a mechanism by a construction in which, in a preferred form, a raceway is formed around the blade circle to receive a plurality of rotatable bearing elements which couple the circle to a concentric ring secured to the drawbar. Each bearing element may be separately and adjustably mounted and the region around the blade circle which contains the bearings is sealed and lubricated.

Accordingly, it is an object of this invention to provide a stronger and more durable connection between a motor grader and the earthworking blade thereof.

It is an object of this invention to reduce maintenance requirements and difficulties associated with the blade circle of a motor grader.

It is another object of the invention to provide greater precision in the positioning of the blade of a motor grader.

It is a further object of the invention to reduce wear in the support structure of the blade of a motor grader.

It is still another object of this invention to provide mechanism for joining the rotatable blade circle of a motor grader to the drawbar thereof which is readily susceptible to being operated as a sealed lubricated system.

The invention, together with further objects and advantages thereof, will best be understood by reference to the following specification together with the accompanying drawings of which:

FIGURE 1 is a side elevation view of a motor grader embodying the invention;

FIGURE 2 is a partially broken out plan view taken along line II—II of FIGURE 1 illustrating the blade circle and associated structure of the motor grader; and

FIGURE 3 is a section view taken along line III—III of FIGURE 2 and showing the details of an individual ball bearing and mounting structure therefor within the blade circle assembly.

Referring now to the drawing and particularly to FIGURE 1 thereof, salient elements of a motor grader vehicle are an engine **11** riding on wheels **12**, an operator's station **13**, and an arched main frame member **14** extending forwardly to a bolster **16** and front wheels **17**.

The earthworking moldboard or blade **18** is attached to the rearward portion of a drawbar structure **19**, by a blade circle assembly **21**, with the forward end of the drawbar being connected to bolster **16** by means such as a ball and socket joint **22** which provides for swiveling and pivoting of the drawbar relative to the body of the vehicle. Owing to the ball and socket connection **22**, the blade **18** may be raised, lowered or tilted in either direction by control linkages **23** which connect through ball and socket joints **24** to opposite ends of a cross member **26** of the drawbar structure **19**, suitable constructions for such controls being well known to the art.

In addition to attaching the blade **18** and associated elements to the drawbar **19**, blade circle assembly **21** functions to provide for angling of the blade relative to the direction of travel of the grader. Referring now to FIGURES 2 and 3 in conjunction, tthe drawbar structure

19 in this embodiment is formed by a pair of diverging beams 27 which are spanned at the rearward end by cross member 26 and by a gusset plate 28 situated forwardly therefrom. To attach the assembly 21 to the drawbar 19 a support structure is secured against the underside of beams 27 and cross member 26 and in this embodiment is a continuous ring 29.

To carry the blade 18 an annular blade circle member 31 is disposed coaxially with respect to the support ring 29, the blade circle being spaced a small distance from the support ring to provide for the disposition of bearing balls 32 between the two members as will hereinafter be described in greater detail. The blade circle 31 is of greater diameter than the support ring 29 in this embodiment and thus is outermost although a reverse arrangement is feasible. A blade beam structure 33 is secured to the underside of blade circle 31 by bolts 34 and carries the blade 18 as best shown in FIGURE 1.

Considering now the connection between the blade circle 31 and support ring 29 which provides for rotation of the circle, and with reference to FIGURE 3, the blade circle may be roll formed and is provided with a continuous bearing raceway groove 36 around the outer surface to receive the bearing balls 32. As shown in FIGURE 2, a plurality of balls 32 are uniformly distributed around the blade circle 31 each being retained in position by an associated one of a plurality of adjustable bearing seal elements 37 transpierced through the support ring 29. Seventeen bearings 32 are utilized in this example however greater or lesser numbers may be employed as determined by the severity of loading on the structure, cost considerations and other relevant factors.

Referring now to FIGURE 3, each of the bearing seats 37 has a threaded portion 38 extending through a bore 39 in the support ring 29 and threadably engaged therein, the bore being aligned along a radius of the support ring and blade circle 31. Each ball 32 seats in a conforming concavity 41 in the end of the associated seat element 37. A hexagonal head 42 at the opposite end of each seat element 37 provides for turning the element during assembly and disassembly for adjusting bearing clearances. A lock nut 45 engaged on the seat element 37 provides for maintaining the selected adjustment.

While the raceway 36 is formed on tthe rotatable blade circle 31 and the bearing seat elements 37 are carried on the fixed support ring 29 in this embodiment of this invention, and such construction is particularly advantageous, it will be apparent that a reverse arrangement is possible.

To seal the bearing region, a first annular seal 43 is secured to support ring 29 and projects therefrom to contact blade circle 31 above the bearings 32. A second such seal 44 extends from the support ring 29 to contact the blade circle 31 below the bearings 32. To provide for lubrication of the bearing region, passages 46 may extend through the seating elements 37 communicating a standard fitting 47 at the inner end thereof with concavity 41. Generally, such provisions for lubrication need not be provided on all of the seating elements 37, four uniformly spaced fittings 47 being employed in the present instance as shown in FIGURE 2.

In operation, the above described structure provides a high strength, rigid, durable and easily serviced rotatable connection between the blade 18 and drawbar 19. Rotation of the blade circle 31, for selectively angling the blade 18 with respect to the direction of movement of the motor grader, is readily controlled by the operator by means understood within the art. Teeth 48, for example, may be provided on an inwardly extending lip 49 on the blade circle 31, the teeth being engaged by a pinion gear 51 journalled to the support ring 29 and operated through a gearbox 52 and drive shaft 53 controlled from the operator's station. Seating elements 37 also provide a means whereby the fit, or backlash, between pinion 51 and blade circle teeth 31 may be adjusted.

What is claimed is:

1. Mechanism for connecting the earthworking blade of a motor grader to the drawbar structure thereof comprising an annular blade circle member having said blade secured thereto, support means secured to said drawbar structure and extending adjacent said blade circle member at least at spaced apart points therearound, and a plurality of rotatable bearing elements disposed between said support means and said blade circle member at spaced apart points therearound and engaging each thereof to retain said blade circle member on said support means while providing for rotation of said member relative thereto, and a plurality of bearing seating and adjusting elements each being disposed at a separate one of said bearing elements and being selectively movable in a radial direction relative to said blade circle member.

2. Mechanism for connecting the earthworking blade of a motor grader to the drawbar structure thereof comprising an annular blade circle member having said blade secured thereto, support means secured to said drawbar structure and extending adjacent said blade circle member at least at spaced apart points therearound, and a plurality of rotatable bearing elements disposed between said support means and said blade circle member at spaced apart points therearound and engaging each thereof to retain said blade circle member on said support means while providing for rotation of said member relative thereto, sealing elements extending between said blade circle member and said support means to seal the region of said bearing elements, and means for introducing lubricant into said region.

3. Mechanism for connecting the earthworking blade of a motor grader to the drawbar structure thereof as defined in claim 1 wherein said support means comprises a second annular member disposed coaxially with respect to said blade circle member and wherein said bearing elements are spherical, said blade circle member having a raceway groove therearound to receive said bearing elements, and wherein said bearing seating and adjusting elements define bearing element seats disposed at spaced apart positions around said annular support means to retain said spherical bearing elements at fixed positions therearound.

4. Mechanism for connecting the earthworking blade of a motor grader to the drawbar structure thereof comprising an annular blade circle member having said blade secured thereto, support means secured to said drawbar structure and extending adjacent said blade circle member at least at spaced apart points therearound, wherein said support means is a second annular member coaxial with said blade circle member, a plurality of rotatable bearing elements disposed between said support means and said blade circle member at spaced apart points therearound and engaging each thereof to retain said blade circle member on said support means while providing for rotation of said member relative thereto, wherein said bearing elements are spherical, and a plurality of adjustable bearing element seating members transpierced through said support means at angularly spaced positions therearound, each of said seating members having a concavity in the end thereof for receiving one of said spherical bearing elements and being threadably engaged in said support means whereby bearing clearances may be readily adjusted.

5. Mechanism for connecting the earthworking blade of a motor grader to the drawbar structure thereof as defined in claim 4 wherein at least a portion of said bearing element seating members have passages therethrough communicating with said concavities thereof for admitting lubricant to said concavities and the associated bearing elements.

6. Mechanism for connecting the earthworking blade of a motor grader to the drawbar structure thereof comprising an annular blade circle member having said blade secured thereto, support means secured to said drawbar

structure and extending adjacent said blade circle member at least at spaced apart points therearound, wherein said support means is a second annular member coaxial with said blade circle member, a plurality of rotatable bearing elements disposed between said support means and said blade circle member at spaced apart points therearound and engaging each thereof to retain said blade circle member on said support means while providing for rotation of said member relative thereto, and further comprising a pair of annular seals extending between said support means and said blade circle member on opposite sides of said bearing elements.

References Cited

UNITED STATES PATENTS

1,329,669 2/1920 McKnight ---------- 172—793

FOREIGN PATENTS

912,878 12/1962 Great Britain.

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