METHOD AND APPARATUS FOR RECONDITIONING THE CONNECTION BETWEEN A RAILWAY CAR BODY AND A RAILWAY CAR TRUCK

Inventor: John P. Davidson, Duncan, Okla.
Assignee: Halliburton Company, Duncan, Okla.

Filed: Sept. 2, 1970
Appl. No.: 69,323

U.S. Cl. 29/401, 29/200 D, 105/199 C
Int. Cl. B23p 7/00
Field of Search 29/401, 200 M, 200 R, 200, 29/200 D, 105/199 C; 308/137, 241

References Cited
UNITED STATES PATENTS
1,745,150 1/1930 Chiles..........................308/137
3,599,574 8/1971 Robertson.......................105/199 C
3,326,611 6/1967 Christian..........................308/137
3,664,269 5/1972 Fillion...........................105/199 C

FOREIGN PATENTS OR APPLICATIONS
17,561 1/1930 Australia..............................308/137

OTHER PUBLICATIONS
"Center Plates Get Liners" RailwayLocomotives and Cars, July 1965 pages 44 and 46.

Primary Examiner—Charles W. Lanham
Assistant Examiner—Donald C. Reiley, Ill
Attorney—Burns, Doane, Swecker & Mathis

ABSTRACT

Method and apparatus for reconditioning the pivot connection between a railway car body and a railway car truck where the reconditioning is effected in situ on a railway track. The car body and truck are separated along the track. A cylindrical boss surface and center plate pocket wall are machined, respectively, on a center plate carried by the car body and a bolster carried by the truck. Wear rings are installed on the machined boss surface and truck bolster carried, center plate pocket wall prior to the assembly of the truck and car body.

4 Claims, 16 Drawing Figures
METHOD AND APPARATUS FOR RECONDITIONING THE CONNECTION BETWEEN A RAILWAY CAR BODY AND A RAILWAY CAR TRUCK

GENERAL BACKGROUND OF THE INVENTION

The pivot connection between a railway car body and a railway car truck may, at times, experience excessive wear as to require reconditioning. Such wear might result from a rocking motion of the truck and/or car body.

This wear may occur on the cylindrical periphery of the center plate boss carried on the underside of the railway car body and/or on the cylindrical wall of the center plate pocket carried by the railway car truck.

Attempts to repair such wear by disassembling the truck and car and removing worn components for transmittal to a machine shop seriously delay and encumber the railway car reconditioning operation.

Although the massive nature of the components involved might lead one to think that components should be disassembled and conveyed to a machine shop for precision reconditioning, it has been surprisingly discovered that effective repairs may be made on site or "in situ," i.e. on a railway track at a convenient field location.

This on site repair technique eliminates field disassembly operations herebefore considered appropriate and eliminates the necessity of transporting disassembled components to a machine shop for reconditioning operations.

The "on-site" reconditioning operations are of sufficient effectiveness that they should yield several years of additional operating life to the reconditioned pivot connection.

GENERAL SUMMARY OF THE INVENTION

An overall and basic method aspect of the invention entails a method of effecting in situ reconditioning of the pivotal connection between a railway car and a railway car truck.

In practicing this overall method, one end of a railway car is raised upwardly away from a railway car truck, with the truck and car being positioned on a railway track. The raised end of the railway car is supported in an elevated position above the railway track so as to permit the truck and car to be separated or displaced along the railway track.

From a location between the railway car and the railway track, a generally vertically extending cylindrical boss surface is machined on the center plate portion of the underside of the railway car, with the car remaining on the track. A wear resistant surface, preferably in the form of a ring member, is installed on the machined boss surface while the railway car remains on the railway track.

At some point in time, prior to the completion of the overall reconditioning operation, and either before or after the reconditioning of the center plate boss or possibly concurrently therewith, a generally vertically extending cylindrical pocket wall is machined on an upper portion of the railway track. This machining or reconditioning of the center plate pocket on the track is effected from a location above the track and above the railway track with the truck remaining on the track.

At some point in time during the overall reconditioning operation, but prior to its completion, another wear resistant surface, again preferably in the form of a ring, is installed on the machined pocket wall. This installation is effected while the truck remains on the railway track.

The track and car may then be converged along the railway track, usually by manipulation of the truck to a position between the raised end of the railway car so as to realign the raised car end and truck in superposed relation. In this superposed relation the truck pocket wall and the center plate boss of the railway car will be disposed in generally coaxial relation. Thereafter, the railway car may be lowered so as to axially converge and telescopingly assemble the wear resistant surfaces of the railway car and truck.

In certain instances it may not be necessary to recondition both the center plate and its pocket. Normally, however, wear due to rocking action will necessitate reconditioning of each of the pivot connection components.

Individually significant aspects of the invention relate to those portions of the reconditioning operation which are concerned with the reconditioning of the center plate pocket and truck carried center plate pockets, respectively.

Other significant facets of the invention are directed to unique combinations of apparatus elements and means which provide mechanisms operable to perform the reconditioning functions described above.

Other apparatus aspects of the invention worthy of particular condition entail the use of securing and centering arrangements for machining tools employed during such reconditioning operations and the use of pneumatic spring devices employed to provide proper feed control for the rotary cutting elements which effect machining of a truck carried, center plate pocket wall.

DRAWINGS

In describing the invention reference will be made to a preferred embodiment shown in the appended drawings.

In the Drawings

FIG. 1a–1f depicts a sequence of views a-f which schematically illustrate various operations performed during the overall reconditioning technique of this invention;

FIG. 2 provides an enlarged, schematic arrangement depicting, in graphic format, the reconditioning steps performed on a center plate boss and a center plate pocket, with the center plate boss and pocket being shown in vertical section;

FIG. 2a provides a fragmentary, vertically sectioned view of one side of a center plate boss after the reconditioning operation has been completed;

FIG. 2b provides a fragmentary, vertically sectioned view of one side of the center plate pocket after the reconditioning operation has been completed;

FIG. 3 provides an enlarged elevational view of the installation of a center plate pocket reconditioning mechanism on a railway car body. FIG. 3 also provides an enlarged end view of the railway car arrangement shown in FIG. 1c;

FIG. 4 provides an enlarged, vertically sectioned view of the center plate machining mechanism shown in FIG. 3;
FIG. 5 provides a partially sectioned, top plan view of the center plate boss machining tool shown in FIG. 4 as viewed along the view direction 5—5 of FIG. 4;

FIG. 6 provides an enlarged, sectional view of the installation of a center plate pocket reconditioning mechanism on the railway car truck of FIG. 1. FIG. 6 also depicts an enlarged end view of the assembly of the truck and reconditioning tool shown in FIG. 1c;

FIG. 7 provides an enlarged, vertically sectioned, elevational view of the center plate pocket machining tool shown in FIG. 6;

FIG. 8 provides a top plan view of the center plate pocket machining tool of FIG. 7; and

FIG. 9 provides a transverse sectional view of the center plate pocket machining tool as viewed along section line 9—9 of FIG. 7.

OVERALL RECONDITIONING METHOD

FIGS. 1a—1f depict various phases of the technique of this invention which is employed to effect reconditioning the connection between a railway car body and a railway car truck in the field, and on a track site.

FIG. 1a depicts a railway car 1 including a car body 2 and a railway car truck 3. Car body 2 and truck 3 are both located on a conventional railway track 4. As will be understood with reference to FIG. 1a, another truck 3, at the right end of the body 2, will also be engaged with the track 4.

FIG. 1a illustrates the left end of the car 1 after this car end has been raised upwardly away from the truck 3, with both the truck 3 and car 2 remaining on the track 4. The raising of the left end of car body 2 as shown in FIG. 1 may be effected by conventional jacking, crane, or other hoisting or elevating equipment normally available in the field.

As will be understood, the normal pin and center plate connection between a railway car body and truck permit the separation of these car components in response to the raising of the car body. When the car body is raised, a center plate boss 5 carried on the underside of the car body 2 is raised axially upwardly out of telescoping relation with a center plate pocket 6 carried on a bolster portion 7 of the truck 3.

Center plate boss 5 cooperates with the center plate pocket 6 of the truck 3 to define a pivot connection 8 between the railway car body 2 and the truck 3.

In the usual fashion the pivot connection 8 may be provided with a vertical pin 9 which is supported in a centrally located and generally vertically extending socket disposed in the interior of the center plate pocket 6. When the center plate boss 5 is assembled with the pocket 6 the pin 9 telescopingly projects into a central and vertically extending aperture of the boss 5.

Thus, when the left end of car body 2 is raised, the pin 9 will automatically separate from the aperture portion of the boss 5 but be retained by the socket of the center plate pocket 6. After the car truck 3 has been displaced from the car body 2 along the track 4, the pin 9 may be lifted out of its socket so as not to interfere with subsequent reconditioning or machining operations.

FIG. 1b schematically illustrates the horizontal displacement of the car 2 and truck 3 along the track 4. This displacement is effected with the left end of car 2 elevated sufficiently to separate the center plate boss 5 from the center plate pocket 6. The car 3 may be rolled to the left along the track 4 so as to displace the car body 2 and truck 3 from their normal, superposed or coupled relationship. The left end of the car 2 may then be supported in an elevated position above the track 4, as for example by conventional block or shoring means 10 schematically illustrated in FIG. 1b. With shoring means 10 in place, the left end of car body 2 will be supported with the cylindrical axis of the cylindrical center plate boss 5 being substantially vertically oriented. As the term "vertically" is here utilized and as it will be subsequently utilized in connection with the cylindrical pocket wall of the center plate pocket 6, it merely means generally perpendicular extension with respect to a track 4 when the track 4 is horizontal and truck 3 and car 2 are assembled in their normal operating positions.

With the left end of the car body 2 supported as shown in FIG. 1b, a center plate machining tool 11 may be manipulated into position between the car carried center plate boss 5 and the track 4, as generally shown in FIG. 1b, and then mounted in engaged relation with the center plate boss 5 as shown in FIG. 1c. As is also shown in FIG. 1c, the machining tool 11 may be secured against or engaged with the center plate boss 5 by means of conventional jack means 12. As is shown on FIG. 1c, jack means 12 may be mounted on conventional shoring or blocks 13 positioned across the railway track 4.

The center plate boss machining tool 11 is then operated by an operator positioned beneath the car body 2 and above the track 4, so as to form a generally vertically extending cylindrical boss surface 14a on the periphery of the center plate boss 5. After this surface 14a has been formed thereby cutting away the worn boss periphery 14 as shown in FIG. 2, a new wear surface may be installed on the periphery of the boss 5 by attaching a wear ring 15. As is schematically shown in FIGS. 1b—1c and FIG. 2, the wear ring 15 may be moved upwardly into telescoping relation about the surface 14a. Ring 15 may be frictionally secured to the machined surface 14a after which it is welded in place as schematically shown in FIG. 1c and FIG. 2a.

Either before or after the reconditioning of the center plate boss 5, or possibly concurrently with the reconditioning of the center plate boss 5, the truck carried center plate pocket 6 may be reconditioned. As will be apparent from what has been said heretofore, the reconditioning of the pocket 6 and the reconditioning of the center plate boss 5 are effected while the truck 3 and car body 3 remain on the railway track 4.

The wear surface of the pocket 6 to be reconditioned comprises an inner, generally vertically extending cylindrical wall 16 shown for example in FIG. 2.

As is illustrated in FIGS. 1b and 1c, a center plate pocket machining tool 17 may be manipulated into position in superposed relationship with the pocket 6, i.e., disposed above the track 3 and the track 4.

The center plate pocket reconditioning mechanism 17 may then be operated to machine a new cylindrical wall or pocket surface 16a in the center plate pocket. The forming of a machined cylindrical surface 16a having a generally vertically extending axis ("vertically," extending being broadly defined as heretofore indicated), serves to machine away the worn wall 16 as generally and schematically shown in FIG. 2.
After the new surface 16a has been formed, the original dimensions of the center plate pocket 6 may be reached by telescoping into another wear ring 18. As is generally shown in FIGS. 1a and FIGS. 2 and 2b, the wear ring 18 will be moved downwardly into telescoping relationship with the wall 16a. Ring 18 may be frictionally engaged with the wall 16a so that it will be secured in position to facilitate its being welded in place, as schematically shown in FIG. 1e and FIG. 2b.

With the various operations depicted in FIGS. 1a–1e having been completed, the cooperating or mutually telescoping surfaces of the boss 5 and pocket 6 will have been restored to an unworn condition, approximating the new condition of the pivot connection 8. The reconditioned, cooperating surfaces of the boss 5 and pocket 6 may be telescopingly assembled by horizontally reconverging the car 2 and truck 3 to a superposed relation, as generally shown in FIG. 1f. This reconvergence will ordinarily be effected by rolling the truck 3 along the track 4 until the pocket 6 is positioned generally axially beneath the center plate boss 5. Conventional hoisting or jack equipment may be then utilized to temporarily support the raised end of the car 2 so that the shoring or blocking 10 may be removed.

After the shoring or blocking 10 has been removed, the left end of the car 2 shown in FIG. 1f may be lowered by the hoisting or jack equipment so as to permit the cooperating wear surfaces of the center plate boss ring 15 and the center plate pocket ring 18 to telescopingly assemble. In other words, during this reassembly the outer wear surface 15a defined by the wear ring 15 will telescopingly enter the inwardly facing, wear surface 18a defined by the wear ring 18.

Prior to this telescopic assembly, the pin 9 will ordinarily have been reinserted in the central socket 19 of the truck 3. The pin 9, in the usual fashion, will be supported by the socket 19 so as to project upwardly out of the pocket, as shown generally in FIG. 1a. When the left end of the car 2 is then lowered over the truck 3, as depicted generally in FIG. 1f, the pin 9 projecting upwardly out of the socket 19 will telescopingly enter the central pin receiving aperture 20 of the center plate boss 5.

As will be understood, in the conventional fashion, the connection defined by the pin 9 telescopingly extending through the apertures 19 and 20 will be loose fitting in nature such that the pivot connection 8 will be primarily defined by the cooperating wear surfaces 15a and 18a.

Having described the general and basic aspects of the railway car reconditioning technique, it now becomes appropriate to consider structural and operational details of the center plate boss and center plate pocket reconditioning aspects of the invention.

RECONDITIONING OF CAR-CARRIED, CENTER PLATE BOSS

FIGS. 3, 4 and 5, in conjunction with FIG. 1, illustrate the technique and apparatus employed in reconditioning the center plate boss 5, as generally indicated in the preceding discussion.

Referring in particular to FIGS. 3, 4 and 5, the center plate machining mechanism 11 includes a body 21 defined by a generally cylindrical column 22 and a transverse head plate 23. Head plate 23 is fixedly connected with the columnar body portion 22 by a weld joint 24.

As is shown in FIGS. 3 and 4, column portion 22 of the body 21 abuttingly engages the downwardly facing surface 5a of the center plate boss 5.

The upper end of column 22 is forced against the surface 5a through the upwardly urging influence of the jack means 12 shown in phantom line in FIG. 4. As shown in FIG. 4, jack means 12, which may comprise two or more jacks, engage the outer surface of the head plate 23 so as to transmit holding force through the column wall 22.

The jacks 12 act on the head plate 23 so as to fixedly secure the body 21 relative to the center plate boss 5, with the column 22 being coaxially related to the wear surface 14. With this fixed mounting, the body 21 is prevented from rotating relative to the center plate boss 5.

A rotary drive means 25 is mounted on the body 21 as generally shown in FIG. 4. The rotary drive means 25 includes a generally annular plate 26 within which a drive gear means 27 is journaled by bearing means 28. Drive gear means 27 includes a pinion gear 29 and a polygonal drive coupling 30. A key 31 carried by plate 26 is slidably disposed in a longitudinal slot 32 in the body column 22. This key-type connection, provided by the sliding interengagement of the key 31 and slot 32, prevents rotation of the rotary drive means 25 relative to the body 21, but permits axial sliding movement of the drive means 25 along the body 31, toward the boss 5.

In order to advance the drive means 25, and the rotary cutting means to be subsequently described, toward the boss 5, an advancing collar 33 is provided. Collar 33 is threadably mounted by a threaded connection 34 on the exterior of column portion 22 of body 21, as generally shown in FIG. 4. An annular bushing or bearing plate 35 may be interposed axially between the upper end of the advancing collar 33 and the base plate 26 of the rotary drive means.

By threadably advancing the collar 33 toward the boss 5, the rotary drive means 25 will be urged toward, and moved in the direction of, the boss 5.

Advancing or retracting movement of the collar 33 may be effected by inserting one or more handles 36 into sockets 37 projecting radially outwardly of the collar 33. Four such sockets 37 may be distributed about the periphery of collar 37.

A rotary cutter means 38 is journaled on the exterior of the column 22. A bushing or bearing sleeve 39 may be radially interposed between a cylindrical body 40 of the cutter means and the outer periphery of the column portion 22 of the body unit 21. Body 40 is rotatably and axially slidably mounted on body unit 21.

Rotary cutting means 38 is also provided with a ring gear 41 which is fixedly connected with, and extends radially outwardly from, the cutter assembly body 40.

As is shown in FIG. 4, pinion gear 29 meshesly engages ring gear 41 so as to transmit rotation from the polygonal connection 30 to the cutter body 40, and cause the body 40 to rotate about the main body 22.

The gear connection between the pinion gear 29 and the ring gear 41 may be shielded by a generally axially extending, cylindrical wall 42 carried by the base plate
Rotary cutting means 38 additionally includes a plurality of cutter receiving sockets 44 circumferentially spaced about and connected with the body 40.

As is shown in FIGS. 4 and 5, cutter sockets 44 open upwardly and each is adapted to receive a conventional, cylindrical surface forming cutter 45. In the embodiment shown in FIGS. 4 and 5, four such sockets 44 and associated cutters 45 are included. Each such cutter 45 is fixedly secured within its respective socket 44 by a plurality of threaded securing fasteners 46.

As will now be appreciated, rotation of the drive shaft portion 30 will induce rotation of the cutters 45 about the cylindrical axis of the boss 5. Upward or advancing rotation of the collar 33 will move the drive assembly 25 and the cutter assembly 38 in unison toward the boss 5, with an annular and radially extending bushing or bearing 47 offsetting or minimizing the frictional interaction between the assemblies 25 and 38 caused by the rotation of the assembly 38 relative to the assembly 25.

As is apparent from FIG. 4, the column portion 22 of base 21 is radially inset for the surface 14, and provides clearance between the cutters 45 and the outer periphery of body portion 22. The cutter sockets 44 position the sockets 45 so as to remove the desired amount of material and form the cylindrical surface 14a, previously discussed, having a desired and predetermined radius, operable to receive the wear ring 15.

A portable drive or motor means 48 may be employed to drive or rotate the shaft portion 30 as shown in FIG. 3.

The term "motor means" as used in conjunction with the drive unit 48 is utilized in a broad sense to encompass what may be termed engines, motors, or other power sources.

As shown in FIG. 3, the motor 48 may comprise a conventional electric motor 49 portably mounted on a frame 50. A torque transmitting drive 51 provides a right angle drive connection from the shaft of the drive motor 49, extending generally upwardly when the unit is oriented upright, as shown in FIG. 3.

As shown in FIG. 3, an articulated or universal drive coupling 52 provides a flexible drive connection between the shaft portion 30 and the drive mechanism 51. The articulated coupling 52 may be defined by a pair of double hinged or "universal" coupling units 53 and 54, each having their two pivot axes mutually inclined at right angles. Pivot couplings 53 and 54 may be interconnected by a telescoping, but torque transmitting, coupling portion 55.

With this coupling arrangement, the drive unit 48 may be manipulated into appropriate position on the track 4 adjacent the shoring 13. The articulated coupling 52 may then be installed, with an upper end portion 56 of the coupling 52 being frictionally engaged with the polygonal end portion 30 of the drive means 25 and operable to transmit torque to the gear means 27. This arrangement provides a power package located between the railway car and the track and operable to drive the cutter means 38.

As the cutter means 38 rotates and advances axially, the telescoping portion 55 of the articulated coupling 52 will accommodate this advancing movement. The flexible nature of the coupling 52 as provided by the elements 53 and 54 will permit misalignment between the output shaft 57 of the drive mechanism 51 and the coupling portion 30 of the drive means 25.

With this arrangement, the articulated coupling means 52 is operable to continuously transmit torque from the motor means 48 to the rotary drive means 25, while the drive means 25 is rotating and while the advancing means 33 is moving either toward or away from the boss 5.

After the machining of the new surface 14a has been completed, the advancing collar may be lowered or retracted. The jacks 12 may be lowered or retracted and the mechanism 11 then removed.

The removal and installation of the mechanism 11 may be facilitated by handles 58 and 59 connected with and extending downwardly from the head plate 23. Such handles may be generally U-shaped. As shown in edge view in FIG. 3, these handles may project downwardly from the base plate 23 sufficiently so as to be able to support the mechanism 11 on the shoring 13 when the jacks 12 have been retracted. In this manner, such handles 58 and 59 facilitate the installation and removal of the mechanism 11 from the operative position shown in FIG. 3.

With the mechanism 11 removed, the wear ring 15 may be installed.

As is shown in FIG. 2, the ring 15 may be split, i.e., provided with a gap 15b. The relaxed condition of the ring 15 may be such that it would have an interference fit with the machined surface 14a, i.e., the relaxed inner diameter of the ring 15 would be somewhat smaller than the diameter of the surface 14a. By spreading the ring 15, as permitted by the gap 15b, the ring may be manipulated into telescoping engagement with the surface 14a as generally shown in FIG. 2a.

It is contemplated that ring 15 may be positioned on surface 14a so as to provide clearance between the lower end 15c of the ring and the boss surface 5a. This clearance would provide a fillet zone where welding could be effectuated as illustrated in FIG. 2a. A clearance zone 60 may also be provided between the upper end 15d of the ring 15 and the downwardly facing surface 61 of the center plate which surrounds the boss surface 14.

It is also contemplated that the gap 15b of the ring 15 will be welded once the ring is installed, with this welded joint being machined so as to yield a continuously smooth wear surface 15a.

The use of the split ring 15 facilitates the ring installation in that it permits the ring 15 to be frictionally secured to the boss surface 14a during the welding operation, i.e., a separate ring holding mechanism need not be employed.

**RECONDITIONING OF TRUCK-CARRIED, CENTER PLATE POCKET**

FIGS. 6, 7, 8 and 9, in conjunction with FIG. 1, illustrate the technique and apparatus employed in reconditioning the center plate pocket 6, as generally indicated in the preceding discussion.

The center plate pocket machining mechanism 17 includes basic components which closely correspond in structure and function to the basic components of the center plate boss machining mechanism 11.
To facilitate correlation with respect to similar components of these machining tools, the mechanism 17 will now be described, with those components of the mechanism 17 which are similar to components of the mechanism 11 being assigned reference numerals equivalent to those employed in the mechanism 11, but having a “prime” notation appended thereto.

Referring in particular to FIGS. 6, 7, 8 and 9, the center plate pocket machining mechanism 17 includes a body 21' defined by a generally cylindrical column 22' and a transverse head plate 23'. Head plate 23' is fixedly connected with the columnar body portion 22' by a weld joint 24'.

As is shown in FIGS. 6 and 7, column portion 22' of the body 21' abuttingly engages the upwardly facing surface 71 of the center plate pocket 6.

The lower end of column 22' is forced against the surface 71 through the downwardly urging influence of the draw bolt means 12' shown in FIGS. 6 and 7. As shown in FIG. 7, draw bolt means 12' engages the upper surface of the head plate 23' so as to transmit holding force through the column wall 22'.

The draw bolt means 12' acts on the head plate 23' so as to fixedly secure the body 21' relative to the center plate pocket 6, with the column 22' being coaxially related to the wear surface 16. With this fixed mounting, the body 21' is prevented from rotating relative to the center plate pocket 6.

A rotary drive means 25' is mounted on the body 21' as generally shown in FIG. 7. The rotary drive means 25' includes a generally annular plate 26' within which a drive gear means 27' is journaled by bearing means 28'. Drive gear means 27' includes a bevel gear means 29' and a polygonal drive coupling 30'. A key 31' carried by plate 26' is slidably disposed in a longitudinal slot 32' in the body column 22'. This key-type connection, provided by the sliding interengagement of the key 32' and slot 32', prevents rotation of the rotary drive means 25' relative to the body 21', but permits axial sliding movement of the drive means 25' along the body 32', toward the pocket 6.

In order to advance the drive means 25', and the rotary cutting means to be subsequently described, toward the pocket 6, an advancing collar 33' is provided. Collar 33' is threadably mounted by a threaded connection 34' on the exterior of column portion 22' of body 21', as generally shown in FIG. 7. An annular bushing or bearing plate 35' may be interposed axially between the lower end of the advancing collar 33' and the base plate 26' of the rotary drive means.

By threadably advancing the collar 33' toward the pocket 6, the rotary drive means 25' will be urged toward, and moved in the direction of, the pocket 6.

Advancing or retracting movement of the collar 33' may be effected by inserting one or more handles 36' into sockets 37' projecting radially outwardly of the collar 33'. Four such sockets 37' may be distributed about the periphery of collar 37'.

A rotary cutter means 38' is journaled on the exterior of the column 22'. A bushing or bearing sleeve 39' may be radially interposed between a cylindrical body 40' of the cutter means and the outer periphery of the columnar portion 22' of the body unit 21'. Body 40' is rotatably and axially slidable mounted on body unit 21'.

Rotary cutting means 38' is also provided with a ring gear 41' which is fixedly connected with, and extends radially outwardly from, the cutter assembly body 40'.

As is shown in FIG. 7, bevel gear means 29' includes a pinion gear 29' which meshingly engages ring gear 41' so as to transmit rotation from the polygonal connection 30' to the cutter body 40', and cause the body 40' to rotate about the main body 22'.

The gear connection between the pinion gear 29' and the ring gear 41' may be shielded by a housing 42' carried by the base plate 26 and a generally axially extending, annular wall 43', both carried by the plate 26'.

Rotary cutting means 38' additionally includes a plurality of cutter receiving sockets 44' circumferentially spaced about and connected with the body 40'.

As is shown in FIGS. 6 and 7, cutter sockets 44' open downwardly and each is adapted to receive a conventional, cylindrical surface forming cutter 45'. In the embodiment shown in FIGS. 6 and 7, four such sockets 44' and associated cutters 45' are included. Each such cutter 45' is fixedly secured within its respective socket 44' by a plurality of threaded securing fasteners 46'. Two diametrically opposite cutters are operable to cut the cylindrical surface 16a while the other two diametrically opposite cutters are operable to cut the chamfer 16b. Surface 16b cooperates with ring 18 to yield a weld fillet zone, as shown in FIGS. 2 and 2b.

As will now be appreciated, rotation of the drive shaft portion 30' will induce rotation of the cutters 45' about the cylindrical axis of the pocket 6. Downward or advancing rotation of the collar 33' will move the drive assembly 25' and the cutter assembly 38' in unison toward the pocket 6, with an annular and radially extending bushing or bearing 47' offsetting or minimizing the frictional interaction between the assemblies 25' and 38' caused by the rotation of the assembly 38' relative to the assembly 25'.

As is apparent from FIG. 7, the column portion 22' of base 21' is radially inset for the surface 16 and provides clearance between the cutters 45' and the outer periphery of body portion 22'. The cutter sockets 44' position the sockets 45' so as to remove the desired amount of material and form the cylindrical surface 16a and chamfer 16b, previously discussed, the surface 16a having a desired and predetermined radius and being operable to receive the wear ring 18.

The portable drive or motor means 48 may be employed to drive or rotate the shaft portion 30 as shown in FIG. 6.

As shown in FIG. 6, the motor means 48 is oriented on its side, with coupling 52 extending generally horizontally toward mechanism 17. Motor means 48 is shown in FIG. 6 supported on board means 13', with the board means 13' in turn resting on wheel supporting side frame portion 62 of bolster 3.

As shown in FIG. 6, the articulated or universal drive coupling 52 provides a flexible drive connection between the shaft portion 30' and the drive mechanism 51. The drive unit 48 may be manipulated into appropriate position on the frame 62 and board means 13'. The articulated coupling 52 may then be installed, with the end portion 56 of the coupling 52 being frictionally engaged with the polygonal end portion 30' of the drive means 25' and operable to transmit torque to the gear means 27'. This arrangement provides a power
package located on the truck and operable to drive the cutter means 38'.

As the cutter means 38' rotates and advances axially, the telescoping portion 55 of the articulated coupling 52 will accommodate this advancing movement. The flexible nature of the coupling 52 as provided by the elements 53 and 54 will permit misalignment between the output shaft 57 of the drive mechanism 51 and the coupling portion 30' of the drive means 25'.

With this arrangement, the articulated coupling means 52 is operable to continuously transmit torque from the motor means 48 to the rotary drive means 25', while the drive means 25' is rotating and while the advancing means 33' is moving either toward or away from the pocket 6. As means 33' thus advances, two conventional cylinder forming cutters 45' will start to form surface 16a. As surface 16a is being completed, the other two cutters will form chamfer 16b.

After the machining of the surfaces 16a and 16b has been completed, the advancing collar may be raised or retracted. The draw bolt means 12' may be removed and the mechanism 17 then removed.

With the mechanism 17 removed, the wear ring 18 may be installed.

As is shown in FIG. 1, the ring 18 may be split, i.e., provided with a gap 18b. The relaxed condition of the ring 18 may be such that it would have an interference fit with the machined surface 16a, i.e., the relaxed outer diameter of the ring 18 would be somewhat larger than the diameter of the surface 16a. By contracting the ring 18, as permitted by the gap 18b, the ring may be manipulated into telescoping engagement with the surface 16a as generally shown in FIG. 2b.

It is contemplated that ring 18 may be positioned on surface 16a so that chamfer 16b will cooperate with the outer periphery of ring 12 to provide a fillet zone where welding can be effected as illustrated in FIG. 2b. A clearance zone 60' may also be provided between the lower end of the ring 18 and the upwardly facing surface 71 of the center plate pocket 6.

It is also contemplated that the gap 18b of the ring 18 will be welded once the ring is installed, with this welded joint being machined so as to yield a continuously smooth wear surface 18a.

The use of the split ring 18 facilitates the ring installation in that it permits the ring 18 to be frictionally secured to the pocket wall 16a during the welding operation, i.e., a separate ring holding mechanism need not be employed.

From the foregoing discussion, it will be clear that the machining mechanisms 11 and 17 are characterized by many generic similarities. However, because the tool 17 is intended to machine in a downwardly facing direction, it presents certain unique operating characteristics which require particular attention. Other modifications must be considered because the mechanism 17 is located on the bolster or transverse framing member 63 of the truck 3, recognizing that the center plate pocket 6 may be considered as a portion of the bolster 63.

One such modification, heretofore discussed, entails the laying of the motor assembly 48 on its side, with torque being transmitted generally horizontally and radially to the rotary drive assembly 25' as opposed to the generally longitudinal and vertical torque transmis-

sion imparted to the drive assembly 25 of the mechanism 11.

In lieu of the jack system 12 employed to secure the mechanism 11, the truck machining mechanism 17 is provided with a draw bolt securing system 12' as earlier noted. In this system the securing bolt 12' is connected at its lower end with the pin socket 19. The connection of the draw bolt 12' with the socket 19 may be affected by a variety of conventional techniques including the use of a conventional, expansible head on the bolt 12' secured within the socket 19.

Alternatively, and as is contemplated in connection with the present embodiment, and as is shown generally in FIG. 6, the lower end of the pin 12' may be inserted in the pin socket 19 and be provided at its lower end with a slot portion 64. Draw bolt 12' would be positioned in socket 19 with the slot portion 64 aligned with conventionally included slots 65 and 66 of the socket 19. A drift pin or key 67 would be manipulated through bolster opening means 68 and inserted through the aligned openings 64, 65 and 66 so as to secure the lower end of the draw bolt 12' within the socket 19.

With the draw bolt 12' thus anchored in the socket 19, the mechanism 17 may be lowered over the pin 12' so that the upper end of the pin 12' telescopes through an aperture 69 in the head plate 23'. A threaded nut 70 may be engaged with a threaded upper end of the draw bolt 12' so as to engage the upper surface of the plate 23' and force the column portion 22' of the body 21' into firm abutting engagement with the base 71 of the pocket 6. This engagement will securely anchor the mechanism 17 to the pocket 6 and prevent rotation of the body means 21' relative to the pocket 6. The use of the draw bolt 12' as above indicated will also tend to automatically center the mechanism 17 in coaxial relationship with the pocket 6, at least to a substantial extent, so as to minimize subsequent minor alignment manipulations.

Instead of the key and slot arrangement, draw bolt 12' might pass through frame member 63 and be anchored at its lower end by a nut which engages the underside of member 63. A collar may be disposed axially between nut 70 and wall 23' so as to position nut 70 above spider assembly 73, to be subsequently described.

Because the weight of the rotary drive means 25' and the rotary cutter means 38' will tend to move these machine components downwardly under the influence of gravity toward the center plate pocket 6, and because the key and slot connection provided by the key means 31' and the slot means 32' would permit free downward movement, it is considered desirable to provide a restoring mechanism continuously acting on the components 25' and 38', sufficient at least to offset their weight. With such upward biasing acting on these components 25' and 38', the cutting and advancing action of the cutter elements 45' will be governed by the torque imparted through the rotary drive means 25' and the axial advancing force exerted by the advancing collar 33'.

This restoring or lifting mechanism 72 is illustrated in FIGS. 7, 8 and 9.

As there shown, mechanism 72 includes a spider-like component 73 disposed above the head plate 23'. Spider mechanism 73 includes a central cylindrical rim
portion 74 disposed in coaxial relationship with the draw bolt 12' and spaced outwardly from the nut 70. A plurality of spider arms 75 radiate outwardly from the rim 74. Each such spider arm 75 is connected with a spline-like member 76 which extends longitudinally of the outer periphery of the columnar portion 22'. Each such spline-like member 76 is slidably mounted in a longitudinally extending groove 77 formed in the columnar element 221. Thus, the spline-like members 76 and grooves 77 cooperate to define an assembly constraining the spider mechanism 74 to move longitudinally and slidably relative to the columnar portion 221 but be non-rotatable relative thereto.

Downward movement of the spider mechanism 74 is limited by stop blocks 78 which are secured to the spline-like members 76 as generally shown in FIG. 7. Each such block member 78 is mounted as to be engageable with an annular recess 79 formed in the upper end of the advancing collar 23'. The function of the blocks 78 is to limit the downward movement of the spider mechanism 74 and maintain the mechanism spaced above the head plate 23'.

The lower ends of the spline members 76 are connected with an annular ring 80 which encircles the outer periphery of column portion 22' and is longitudinally slideable thereon. As is shown in FIG. 7, the ring 80 is positioned so as to engage the underside of the body portion 40' of the rotary cutting means 38'. In this manner the weight of the rotary cutting means 38' and the rotary drive means 25' is carried by the ring 80 and transmitted upwardly through the spline members 76 to the spider 74.

Mounted within the interior of the body component 22' are a plurality of air cylinders 81. One air cylinder 81 is mounted on the inner wall of column 22' beneath each spider arm 75, three such cylinders and arms being shown in FIG. 8. A piston rod 82 of each such pneumatic cylinder 82 projects upwardly into supporting and abutting engagement with the underside of its respectively associated spider arm 75 as generally shown in FIGS. 7 and 8. As is also shown in FIG. 7, a manifold arrangement 83 may be mounted within the body means 21' so as to distribute air at uniform pressure to each of the pneumatic cylinders 81.

With this arrangement, pressurized air, transmitted from a source of compressed air not shown but conventionally available in the field, will act on pistons within the cylinders 81 so as to urge the piston rods 82 uniformly upwardly with yieldable force.

This force, acting through the rods 82 on the spider arm 75, will urge the spider assembly upwardly and thus exert a lifting force through the elements 76 and 80 on the downwardly movable cutting means 38' and drive means 25'. This lifting force will tend to offset the weight of these components such that downward movement of these components will be effective only in response to the controlled manipulation of the advancing collar 33' via handles 36'. This offsetting of the weight of the components 25' and 38' will tend to ensure that the cutting action of the cutters 45' will be controlled and will thus tend to eliminate gouging and erratic cutting action.

SUMMARY OF MAJOR ADVANTAGES AND SCOPE OF INVENTION

While various preferred embodiments of components have been described, and various preferred manipulative techniques discussed in detail, it will be recognized that the inventive contribution herein presented may be implemented in a variety of modified forms.

For example, power transmitting and coupling arrangements substantially different from that described may be utilized. Cutting mechanisms of a widely varying nature may be employed as well. Arrangements for securing and mounting the machining mechanisms may also vary in substantial detail.

Such variations may be effected while maintaining basic advantages of the invention, one of the most significant of which entails the effecting of on site or in situ reconditioning of the pivot connection of a railway car.

In effecting the reconditioning operation in the field, the necessity of disassembling truck and car components is eliminated and the delay involved in transmitting disassembled components to a machine shop or factory repair station is eliminated.

The portable nature of the machining tools and the power package enable the components to be readily manipulated in the field and conveniently installed and removed. The manner in which the power package may be utilized, if desired, to sequentially drive each of the car and truck machining tools contributes to overall efficiency and simplicity in the reconditioning operation.

The articulated drive coupling eliminates the necessity for absolute precision in positioning of the power package or motor means relative to either of the machining tools described.

The handle arrangement described in connection with the car machining tool body contributes to ease of installation and removal of this mechanism and promotes overall safety.

The draw bolt arrangement employed in connection with the truck machining tool offers the advantage of facilitating the centering and alignment of the truck machining tool. The pneumatic air spring arrangement employed in conjunction with the restoring spring of the truck machining tool provides an effective system for ensuring positive control during the center plate pocket machining operation.

The use of split wear rings provides a simple, yet readily controllable technique, for installing new wear surfaces on the center plate boss and center plate pocket and eliminates the necessity for ring holding devices during fielding operations. As will be recognized, in certain situations, it may be advantageous or possible to utilize only one such wear ring or reconditioned wear surface. It might also be possible to recondition machined wear surfaces by resurfacing techniques differing from the use of wear rings.

As will be recognized, the reconditioning of the pivot connection between the railway car body and the railway car truck may be effected by reconditioning surfaces not necessarily of a cylindrical configuration and not necessarily of a vertical orientation. Thus, the reconditioning concept of this invention is substantially broader in application than described with reference to the preferred embodiment.
The wear rings described above which provide additional or replacement surface means for the center plate boss and center plate pocket would desirably be fabricated from wear resistant steel so as to prolong the operating life of the railway car pivot connection. Indeed, it is contemplated that in many instances the rings would possess wear resistant properties greater than possessed by the original worn out materials of the center plate boss and/or center plate pocket. However, regardless of their composition or metallurgical properties, the rings will provide some appreciable resistance to wear in the pivot connection, desirably sufficient to insure several years of operating life.

The invention has been described with respect to preferred embodiments which are believed to possess particularly unique advantages and unobvious characteristics, with the elements of the invention uniquely and synergistically interacting to provide a reliable field repair technique. Those skilled in the art and familiar with this disclosure may envision additions, deletions, substitutions or other modifications which would fall within the scope of the invention as defined in the appended claims.

I claim:

1. A method of effecting in situ reconditioning of the pivotal connection between a railway car and a railway car truck, said method comprising:
   raising an end of a railway car, upwardly away from a railway car truck, with the truck and car being positioned on a railway track;
   supporting said end of said railway car in a position elevated above said railway track;
   separating the railway car and truck along the track so as to displace the car and truck from a superposed relationship;
   from a location between said car and said railway track machining a generally vertically extending cylindrical boss periphery on a center plate on the underside of the railway car, with the car remaining on the track, said machining of said cylindrical boss periphery being effected by supporting one end of said railway car with a center plate boss exposed and positioned over said railway track;
   positioning first rotatable cutting means generally beneath said center plate boss while rotatably supporting said rotatable cutting means on a first central body and supporting said first central body over said railway track;
   engaging said first central body with said center plate boss and preventing rotation of said first central body relative to said center plate boss by pressing said first central body away from said railway track and toward said center plate boss; and
   rotating said first rotatable cutting means about said first central body and machining a generally vertically extending, cylindrical periphery on said center plate boss;
   installing a first wear-resistant ring on said machine cylindrical boss periphery while said car remains on said railway track;
   prior to the completion of said reconditioning, and from a location above said truck and railway track, machining a generally vertically extending, cylindrical pocket wall on a center plate pocket on an upper portion of said truck, with said truck remaining on said railway track, said machining of said cylindrical pocket wall being effected by positioning second rotatable cutting means generally above said center plate pocket of said truck and above said railway track, while supporting said second rotatable cutting means on a second central body;
   engaging said second central body with said truck and preventing rotation of said second central body relative to said truck;
   rotating said second rotatable cutting means about said second central body and machining said generally vertically extending, cylindrical pocket wall in said center plate pocket;
   prior to the completion of said reconditioning installing a second wear-resistant ring on said machined pocket wall while said truck remains on said railway track;
   converging said truck and car along said railway track to position said car and truck in superposed relationship, with said truck pocket wall and car cylindrical boss surface being generally coaxially related; and
   lowering said railway car to axially converge and telescoping assembly said first and second wear-resistant rings of said car and truck.

2. A method as described in claim 1 further comprising:
   generally centering said second central body on said center plate pocket and effecting said engaging by connecting draw bolt means between said center plate pocket and said second central body; and
   pneumatically urging said second rotatable cutting means away from said center plate pocket and manually inducing and controlling axial advancing of said second rotatable cutting means during said machining of said cylindrical pocket wall.

3. An apparatus for effecting in situ reconditioning of the pivotal connection between a railway car and a railway car truck, said apparatus comprising:
   means for raising an end of a railway car, upwardly away from a railway car truck, with the truck and car being positioned on a railway track;
   means for supporting said end of said railway car in a position elevated above said railway track, while separating the railway car and truck along the track so as to displace the car and truck from a superposed relationship;
   car machining means operable from a location between said car and said railway track to machine a generally vertically extending cylindrical boss periphery on a center plate on the underside of the railway car, with the car remaining on the track, said car machining means including
   means for supporting one end of said railway car with a center plate boss exposed and positioned over a railway track;
   first rotatable cutting means positioned generally beneath said center plate and over said railway track;
   a first central body rotatably supporting said first rotatable cutting means,
pressing means for engaging said first central body with said center plate boss and preventing rotation of said first central body relative to said center plate boss, said pressing means being operable to press said first central body away from said railway track and toward said center plate boss;
means for rotating said first rotatable cutting means about said first central body and machining a generally vertically extending, cylindrical periphery on said center plate boss;
means operable to provide a first wear-resistant ring on said machined cylindrical boss periphery while said car remains on said railway track;
truck machining means operable prior to the completion of said reconditioning, and from a location above said truck and railway track, to machine generally vertically extending, cylindrical pocket wall on a center plate on an upper portion of said truck, with said truck remaining on said railway track, said truck machining means including:
means for positioning said railway truck on said railway track, displaced from said railway car to which said truck is adapted to be attached,
second rotatable cutting means positioned generally above said center plate pocket of said truck and above said railway track,
a second central body rotatably supporting said second rotatable cutting means,
engaging means for engaging said second central body with said truck and preventing rotation of said second central body relative to said truck,
means for rotating said second rotatable cutting means above said second central body and machining a generally vertically extending, cylindrical pocket wall in said center plate pocket;
means operable prior to the completion of said reconditioning to install a second wear-resistant ring on said machined pocket wall while said truck remains on said railway track;
said truck and car being convertible along said railway track to position said car and truck in superposed relationship, with said first and second wear-resistant rings being generally coaxially related and operable to be telescopingly assembled; and
means operable to lower said railway car to axially converge and telescopingly assemble said first and second wear-resistant rings of said car and truck.
4. An apparatus as described in claim 3 wherein said engaging means of said truck machining means includes:
draw bolt means operable to be connected between said center plate pocket and said second central body and generally center said second central body on said center plate pocket and effect said engaging;
pneumatic means operable to urge said second rotatable cutting means away from said center plate pocket; and
manually operable means for controlling and inducing axial advancing of said second rotatable cutting means during said machining of said cylindrical pocket wall.

* * * *