United States Patent [19]

Boggs

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[54] **METHOD OF REPAIRING AND SERVICING LUBRICATED TRACK CHAINS**

[75] Inventor: **Roger L. Boggs,** E. Peoria, Ill.

[73] Assignee: **Caterpillar Tractor Co.,** Peoria, Ill.

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[52] **U.S. Cl.** **29/401,** 59/7, 305/60

[51] **Int. Cl.** **B23p 7/00**

[58] **Field of Search** 29/401, 270; 59/7, 11; 305/60

[56] **References Cited**

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Primary Examiner—Charles W. Lanham
Assistant Examiner—Donald C. Reiley
Attorney—Fryer, Tjensvold, Feix, Phillips & Lempio

[57] **ABSTRACT**

A method and apparatus for disassembling and assembling individual hinge joints of a crawler tractor track chain wherein a plurality of manually actuated portable tools are utilized to separate coacting pins, bushings and links to facilitate convenient removal and replacement of faulty joint components. The components are principally vital, sensitive, lubricant-containing seals. The invention enables reassembly of associated members without tediously disassembling all of the track sections intermediate a leaking joint and a track master joint.

11 Claims, 11 Drawing Figures

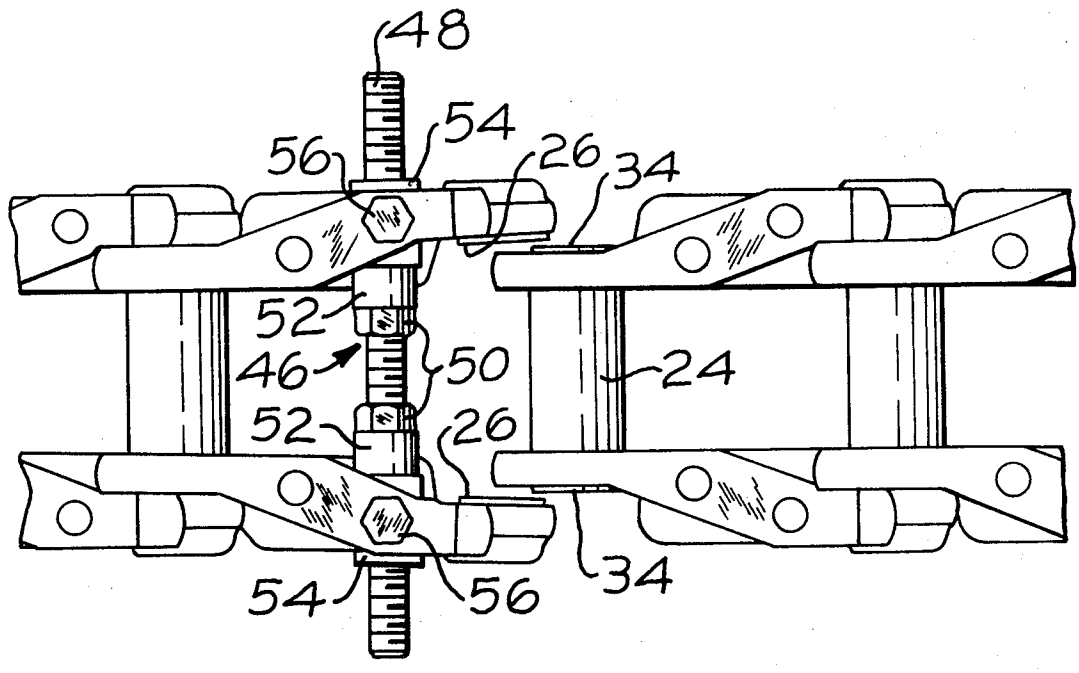

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Fig-1-

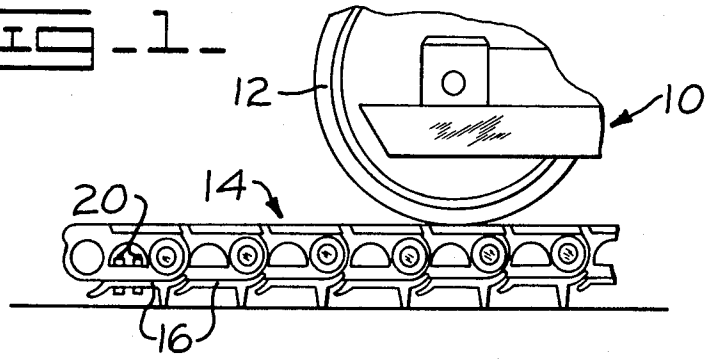


Fig-2-

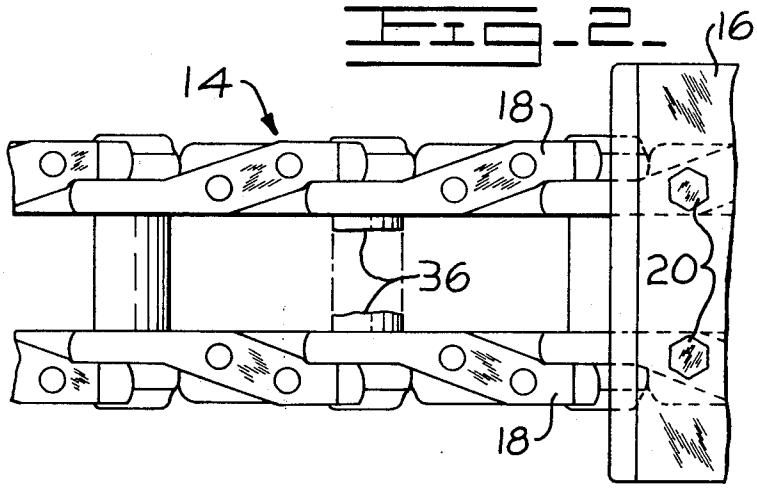
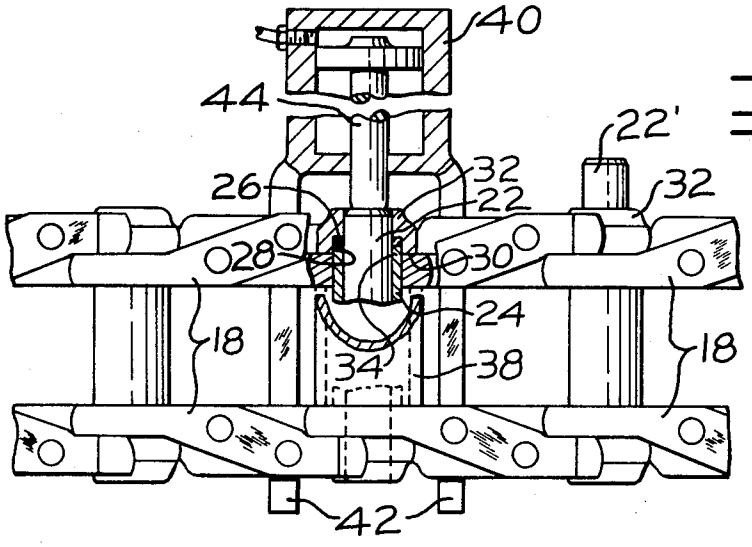


Fig-3-



INVENTOR
ROGER L. BOGGS

BY
Fryer, Tjensvold, Feix, Phillips & Lempio
ATTORNEYS

Fig-4-

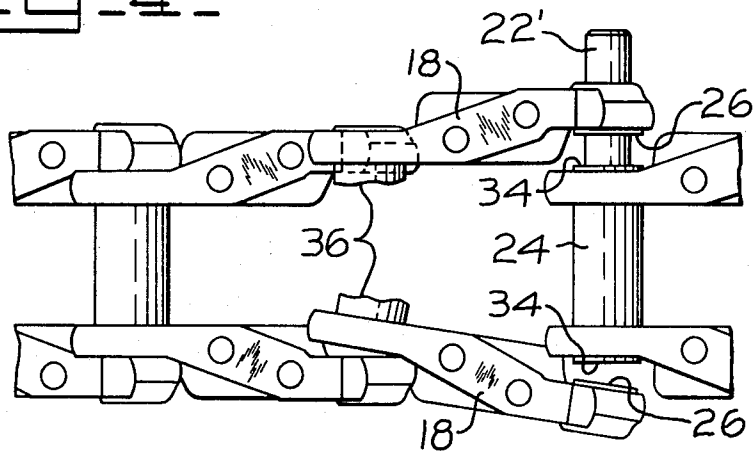
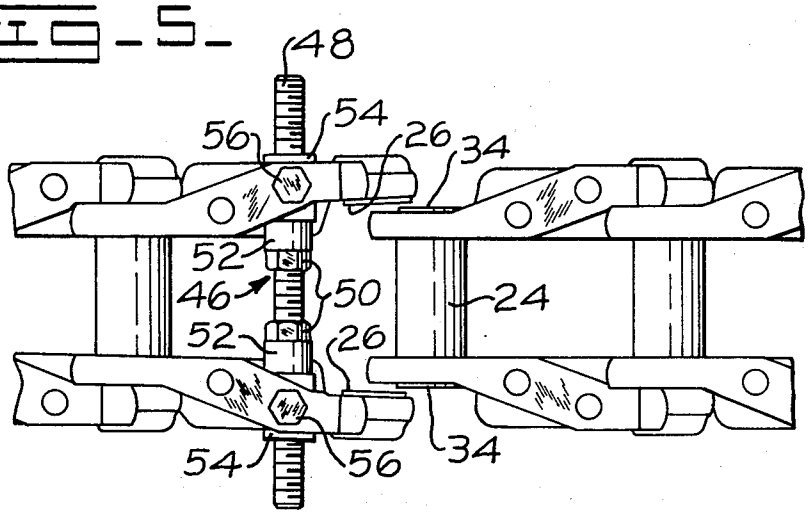


Fig-5-



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ROGER L. BOGGS

BY
Fryer, Tjensvold, Feix, Phillips & Lempio
ATTORNEYS

Fig-6-

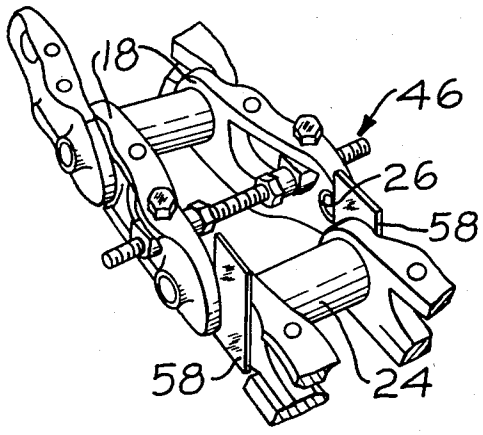


Fig-7-

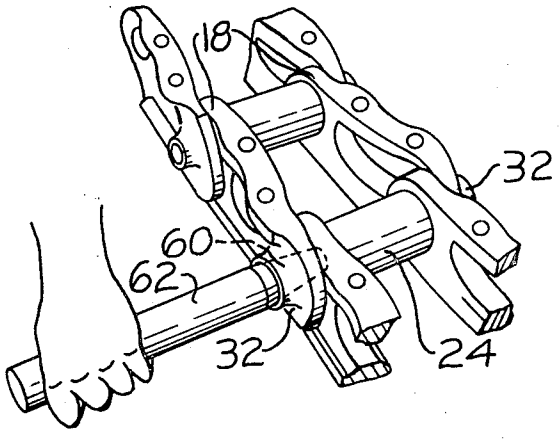
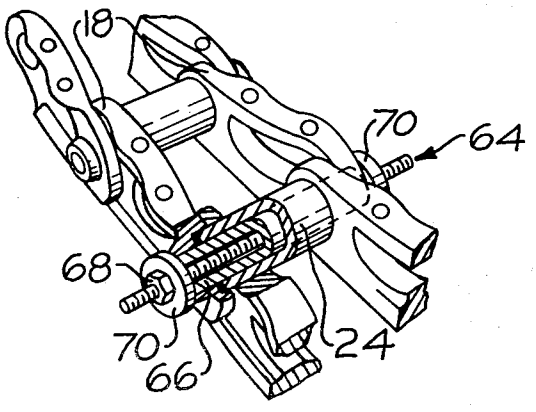


Fig-8-



INVENTOR
ROGER L. BOGGS

BY
Fryer, Tjensvold, Feix, Phillips & Lempio
ATTORNEYS

Fig-9-

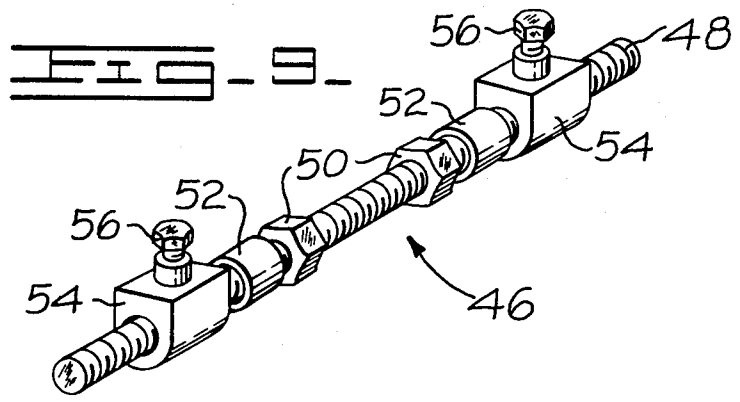


Fig-10-

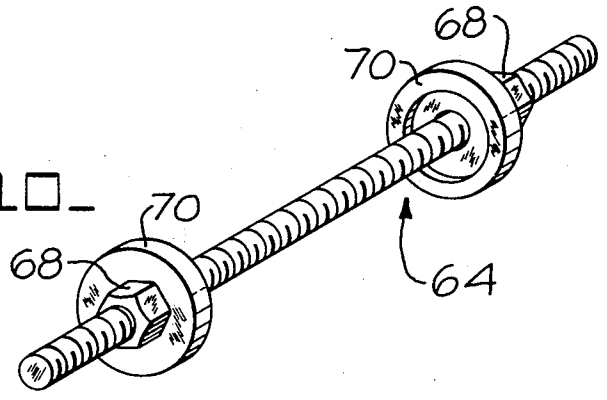
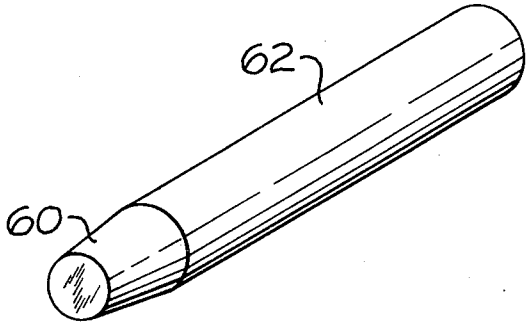


Fig-11-



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ROGER L. BOGGS

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ATTORNEYS

METHOD OF REPAIRING AND SERVICING LUBRICATED TRACK CHAINS

BACKGROUND OF THE INVENTION

The severe operating environment of earthmoving equipment, and in particular crawler tractors, requires maximum quality in components if satisfactory service life is to be realized. Specifically, the track chains employed for motivating and steering such crawler tractor vehicles encounter some of the highest loads and wear rates experienced by the tractor components. Even though considerable effort has been expended to increase the service life of these components, only recently have technological advances in metallurgy, chemistry and applied sciences made it possible to construct successful, long-life sealed and lubricated hinge joints. Although there are many other less demanding applications for such hinge joints, their use in track chains still leaves related problems to be solved.

In spite of excellent quality control, natural and chemically created synthetic materials used to form long-life seals still are subject to occasional premature failure. Because manufacturers and customers must face this reality, alternate means of servicing track chains disabled by one or a few leaking seals is urgently needed to complement sophisticated long-life lubricated hinge joints.

The close tolerances and intricacies of a labyrinth-type sealed joint often necessitate expensive special-purpose tools. However, with the present method and apparatus, the cost and complexity of servicing individual joints with leaking seals are greatly simplified.

SUMMARY AND OBJECTS OF THE INVENTION

A principal object of the present invention is the provision of a safe, simple and efficient method for individually servicing faulty track hinge joints.

A further object is the provision of simple and efficient tooling that facilitates individual disassembly, removal, and replacement of faulty labyrinth bushings and seals.

Still another object is the specific method of adapting manually actuated portable tools to spaced, cooperating track links for application of substantial force for spreading and separation of link ends from complementing coacting bushings.

An additional object is the provision of a hollow master pin to complement the force application tool and allow efficient assembly and service of a track joint.

A further object is the provision of a method by which the hollow pin is plugged to serve as a lubricant-distributing reservoir for internal bearing surfaces.

Still another object is the provision of a hollow pin which is constructed to afford ease of assembly and disassembly of a hinge joint.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a portion of track chain that has been separated for service proximate the track idler;

FIG. 2 is a bottom plan view of a section of a portion of track with the central portion of a pin and bushing of a faulty joint shown removed as by a cutting torch;

FIG. 3 is a plan view of a track section wherein one end of an adjoining pin has been freed from its coacting link end by a portable press shown attached, and a complementing U-shaped spacer bracket has been inserted intermediate and coaxially about the interrupted portions of the faulty joints, link, pin and bushing ends;

FIG. 4 is a plan view with the loosened track components further separated;

FIG. 5 is also a plan view of a length of track chain in which the pin in the faulty joint has been removed and the overlapping ends of an adjacent link have been spread for complete separation by a simple, manually actuated force application tool;

FIG. 6 is a perspective view of a separated track hinge joint being reassembled, assisted by a pair of flat guide plates that protect the seal faces;

FIG. 7 is a perspective view illustrating how a reduced diameter, tapered dummy pin can be used to facilitate alignment of link and bushing bores;

FIG. 8 also is a perspective view showing how nuts at each end of a threaded force applicator disposed within a hollow master pin would be used to secure aligned links on the pin ends to minimize end play;

FIG. 9 shows in greater detail the manually actuated force application tool or link separator with adapter brackets used for joint disassembly;

FIG. 10 depicts the alternate configuration of the force application tool as used for reassembly of the track joints;

FIG. 11 is an enlarged view of a tapered dummy pin used for aligning and temporarily holding an assembled joint.

DETAILED DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates the front portion of a roller frame of a crawler tractor generally shown at 10 including an idler 12 and a separated section of track chain generally shown at 14 upon which such vehicles are supported and by which they are steered. Normally when track trouble occurs, the chains are broken or separated proximate the idler to allow convenient use of tools and expedient servicing of the faulty component.

As shown in FIGS. 1 and 2, the track chain 14 comprises a plurality of ground-engaging plates or track shoes 16 each of which is rigidly secured to a pair of spaced, parallel, interconnected track links 18, as by bolts 20. As shown in FIG. 3, each pair of track links 18 is pivotally connected by means of a track pin 22 and bushings 24 to an adjacent and cooperating pair of links in such manner that an articulated chain is formed. The end links of such chains are normally connected by means of a master pin or a two-piece master link (not shown) to facilitate breaking or separating and servicing of the track chain.

In FIG. 3, the track joint shown in section illustrates how a typical seal, such as indicated at 26, is disposed in a counterbore 28 in the inner face 30 of each overlapping link end 32. The axial dimensions of such seals vary; however, each is normally precisely designed to function under optimum loading parameters when assembled. As shown, a labyrinth hinge joint with bushing ends 34 protruding into a receiving counterbore is often employed in heavy duty chains because the closely nested ends serve to prevent detrimental entry of foreign debris as well as to provide loading of the seals.

As shown in FIG. 2, the damaged bushing is cut in two places leaving bushing stubs 36 extending about three-fourths inch inward of the inner links 18. The center section of the damaged bushing is thereupon removed. It should be noted that this step of removing the damaged bushing by cutting may be eliminated in some applications where sufficient play is inherent in a track to permit joint separation without the necessity of destruction of a bushing.

Turning now to FIG. 3, a generally U-shaped spacer member 38 is inserted between the inner links concentric with the axis of the damaged joint to permit external application of force to remove the two pin stubs from the links as will be hereinafter described.

A portable pin press 40, normally used to service track components, grips the spaced links as shown by fingers 42 as a plunger 44 is hydraulically extended to expel the stubs. The pin adjacent the faulty joint is only partially removed, as shown at 22', to facilitate service. As best seen in FIG. 4, separation of the adjoining links 18 for removal and reassembly of the track seals may then be accomplished. Bushing stubs 36 may be conveniently removed with a press and a new bushing installed and a new pin inserted therein.

Turning now to FIG. 5, a modified link separator or force applicator means 46 comprising a threaded rod 48 to which a pair of nuts 50, annular sleeves 52 and adapter brackets 54 with auxiliary attaching screws 56 are attached in a manner that allows rotation of the inwardly disposed nuts to apply an outwardly acting force. Attention is further directed to FIG. 9 for a more complete showing of the force applicator means. After removal of the pin in the faulty joint, such a simple portable tool suitably attached to the links would allow sufficient spreading of the complementing links that they can be readily detached from the extending bushing ends 34. The force applicator means provides the substantial force required to hold the links in a spread condition for reinstallation, as described below.

As best seen in FIG. 6, a track section with the spread links is reconnected to an adjacent track joint with the assistance of a pair of shim-like guide plates 58. Such plates are desirable to temporarily shield and protect the sensitive seals during assembly since, if the heavy track sections should be dropped or should move unexpectedly, seal damage could rapidly occur from the sharp edges of the overlapping link and bushing surfaces. Such shim-like guide plates also serve to compress the seals (not shown) in links 18 as the bushing 24 slides between the adjoining links 18.

When approximate alignment is achieved, the shim-like guide plates are removed. Turning to FIG. 7, the tapered end 60 of dummy track pin 62 is inserted through link end 32 and bushing 24. The dummy pin is then driven into place to temporarily hold the links together. The force applicator means 46 is then removed. A more complete showing of dummy pin 62 may be gotten by referring to FIG. 11. After insertion of the dummy pin, a hollow pin (not shown) is pressed into place with a pin press (now shown) thereby displacing dummy pin 62 as will hereinafter be described.

Turning now to FIG. 8, a second threaded coupling means 64, best shown in FIG. 10, is used coaxially in conjunction with a hollow track pin 66 to secure the two spaced links and chain ends which eliminate detrimental hinge joint end play. To achieve this connection, applicator 46 and the shim-like guide plates 58 are removed prior to insertion of the dummy pin, which is subsequently expelled by assembly of the hollow hinge pin, as aforementioned. The hollow pin is diametrically sized to afford a slightly lower interference fit than a standard track pin. To achieve such a fit and to facilitate assembly, the central portion of the hollow pin is relieved (not shown), leaving an enlarged head portion on each end of the pin. Such a design will effectively serve as a primary or auxiliary master pin or joint when and wherever it is assembled in the track chain.

Tightening two nuts 68 and washers 70 on coupling means 64 creates thousands of pounds of force sufficient to assure elimination of end play of the links on the pin ends. The open pin remaining after removal of the coupling means can be conveniently plugged and filled with oil, which will flow to pin and bushing bearing surfaces through one or more radial ports in the pin to afford lubrication so necessary for a long service life.

It is to be understood that the foregoing description is merely illustrative of preferred embodiments of the invention and that the scope of the invention is not to be limited thereto, but is to be determined by the scope of the appended claims.

What is claimed is:

1. A method of servicing a chain consisting of a plurality of track shows secured to pairs of spaced parallel interconnected track links that are articulately joined by coacting, concentrically disposed pin and bushing means, said method comprising:

a. Positioning the chain so that each hinge joint in need of repair is afforded continuous support;

b. Removing at least a portion of the pin and spreading links of the faulty joint having a faulty bushing by detaching with suitable link separator means the overlapping ends of spaced cooperating sets of links from projecting bushing ends;

c. At least partially detaching the pin in the adjoining hinge connection from one of the successive overlapping link ends;

d. Removing said faulty bushing with suitable tool means from the underlying ends of spaced cooperating sets of links;

e. Assembling a new bushing into complementing bores in said underlying link ends such that the ends thereof project substantially equally a finite degree beyond the laterally outward surfaces thereof;

f. Shifting the ends of the overlapping links, still in an abnormally spread condition, longitudinally sufficiently such that the pin bores therein are coaxially aligned with the bushing secured in the underlying adjoining links while disposing thin plate means adjacent each end of said bushing to guide said link ends together;

g. Assembling with suitable tooling a hollow hinge pin, upon removal of said guide plates and alignment of the overlapping track pin and bushing bores, into said joint until the pin's forward end engages the pin bore of the adjacent links;

h. Installing a coupling means through said hollow pin, said coupling means having complementing, coaxially disposed retainer plates at each end generating a compressive axial force under the influence of an external regulating force and upon

the spaced overlapping link ends to afford a rigid, nonrotative fit upon respective supporting ends of said hollow hinge pin.

2. The method as set forth in claim 1 wherein the mid portions of the bushing and pin of said faulty hinge joint are removed by cutting with a cutting torch.

3. The method as set forth in claim 2 in which a temporary spacer means is placed coaxially intermediate the remaining pin and bushing portions to facilitate inward displacement and removal of same by application of an external force.

4. The method as set forth in claim 1 wherein the overlapping links of said faulty joint are spread by a link separator means in the form of a mechanically attached, manually actuated force application tool disposed intermediate said spaced associated links.

5. The method as set forth in claim 1 including the step of aligning said overlapping track and bushing bores with an auxiliary pin smaller in diameter than standard hinge pin having a long taper at one end to facilitate shifting, alignment and temporary coupling of the link ends into an endless articulated track.

6. The method as set forth in claim 1 in which said hollow hinge pin is used to durably couple the overlapping coacting track links.

7. The method as set forth in claim 1 wherein said link separator means used for spreading said links is a threaded rod with complementing pairs of nuts, spacers and adapter brackets with integral link attaching means.

8. The method as set forth in claim 1 wherein the coupling means is a threaded force application tool to create a final compressive force to eliminate all end play in the hinge joint.

9. The method as set forth in claim 1 in which the hollow hinge pin is of an optimum diameter to effect a relatively light interference fit with the ends of its associated spaced links.

10. The method as set forth in claim 9 wherein said hollow pin has an intermediate portion of a reduced diameter leaving an enlarged head portion on each end of the pin.

11. A method of servicing a chain consisting of a plurality of track shoes secured to pairs of spaced parallel interconnected track links that are articulately joined by coacting, concentrically disposed pin and bushing means, said method comprising:

a. Positioning the chain so that each hinge joint in need of repair is afforded continuous support;

b. Removing at least a portion of the pin and spreading links of the faulty joint by detaching with suitable tool means the overlapping ends of spaced cooperating sets of links from projecting bushing ends;

c. Detaching the pin in the adjoining hinge connection at least in part from one of the successive overlapping link ends;

d. Removing faulty seal or seals from counterbores in overlapping link ends;

e. Installing new seals in link counterbores;

f. Shifting the overlapping link ends still in an abnormally spread condition longitudinally sufficiently such that the pin bores therein are coaxially aligned with the bushing secured in the underlying adjoining links while thin plates disposed adjacent each end of said bushing function to guide said link ends together;

g. Assembling with suitable tooling a hollow hinge pin, upon removal of said guide plates and alignment of the overlapping track pin and bushing bores into said joint until the forward end of the pin engages the pin bore of the remote links;

h. Installation of a coupling means with force application means through said hollow pin, said coupling means having complementing coaxially disposed retainer plates at each end, generating a compressive axial force under the influence of an external regulating force and upon the spaced, overlapping link ends to afford a rigid, nonrotative fit upon respective supporting ends of said hollow hinge pin.

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