Dec. 12, 1967 R. K. REYNOLDS ET AL 3,357,750

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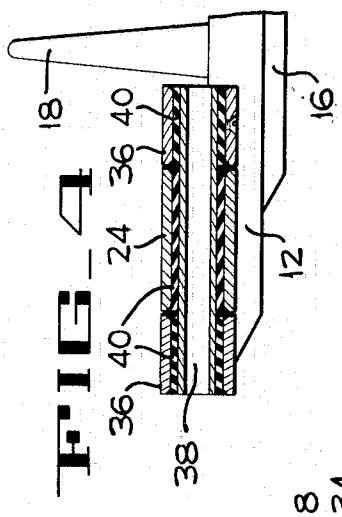


FIG_4

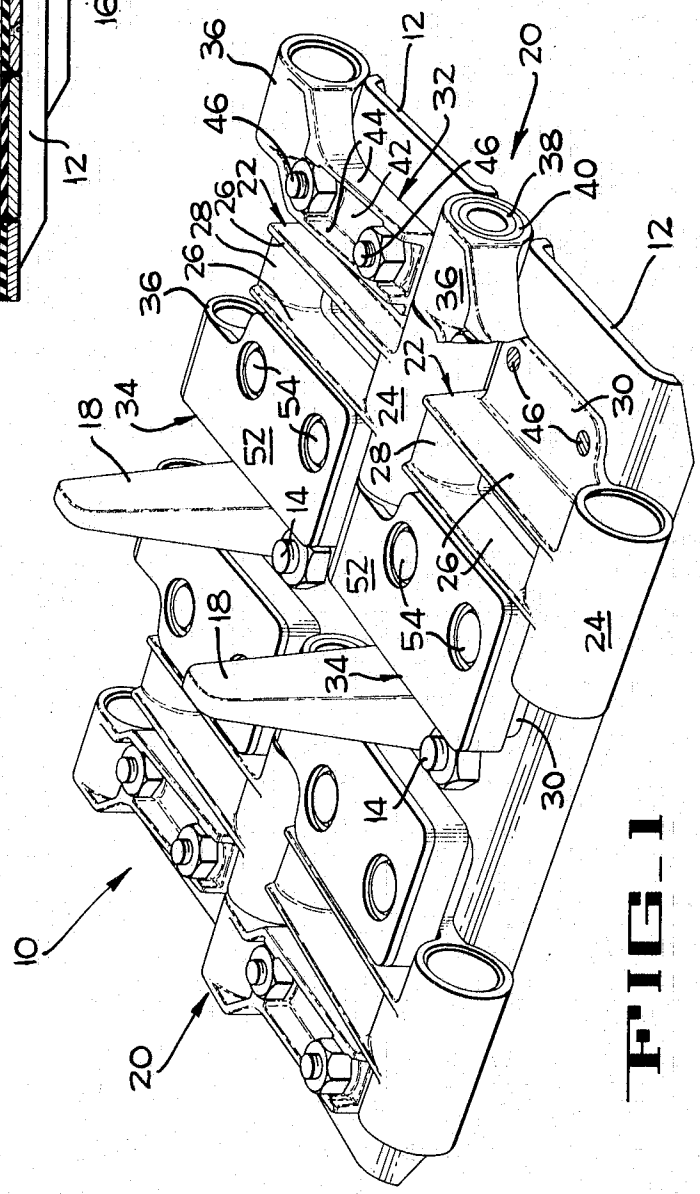


FIG_1

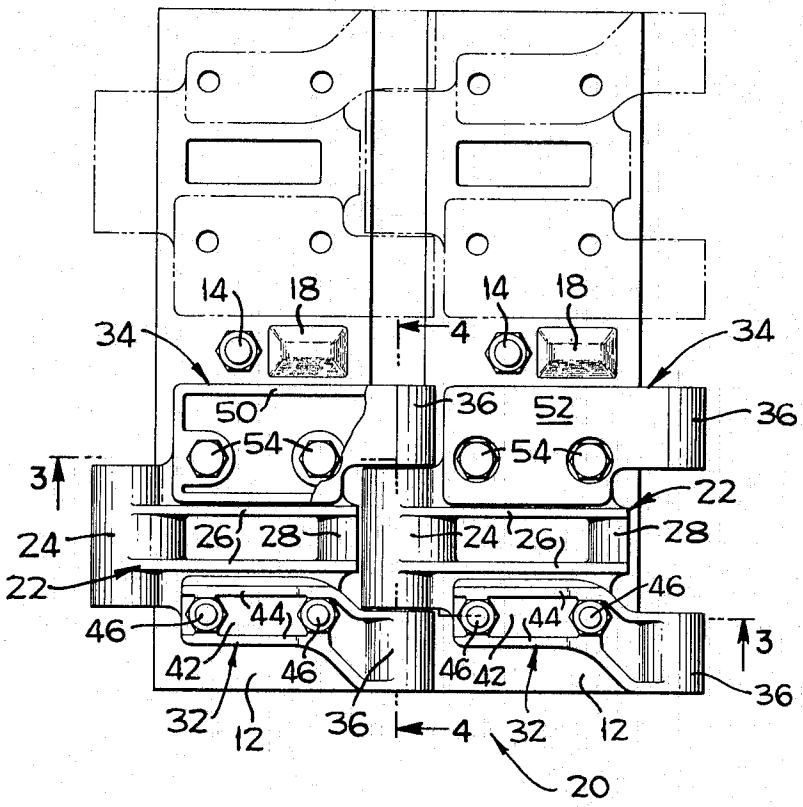
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Filed Oct. 6, 1965 5 Sheets-Sheet 2

FIG_2



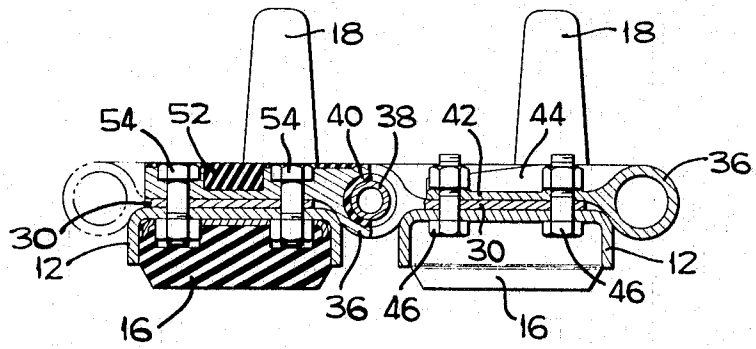


FIG_3

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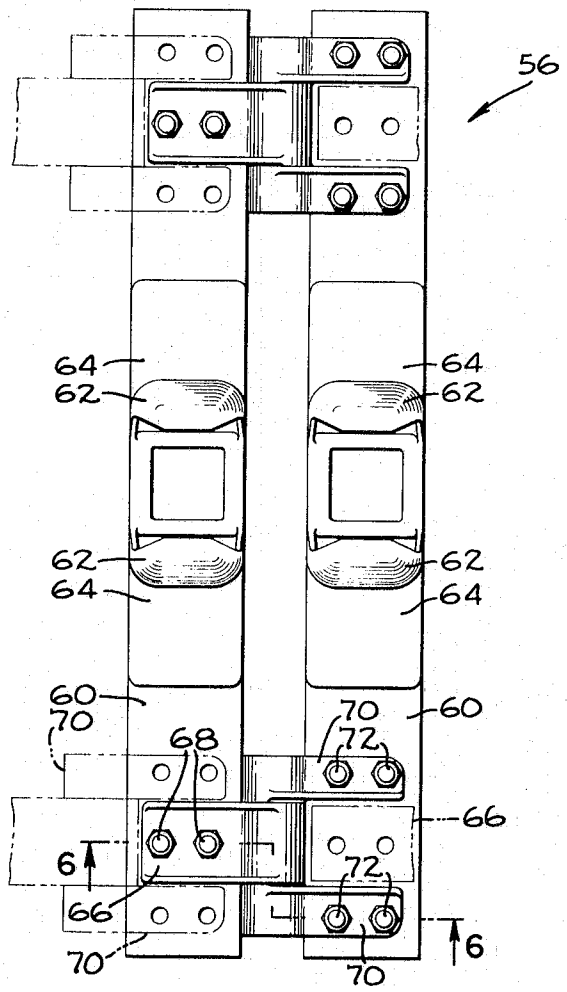
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Dec. 12, 1967 R. K. REYNOLDS ET AL 3,357,750

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Filed Oct. 6, 1965 5 Sheets-Sheet 3

FIG_5



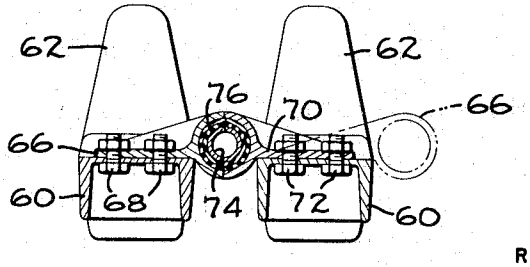


FIG_6

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Dec. 12, 1967 R. K. REYNOLDS ET AL 3,357,750

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Filed Oct. 6, 1965 5 Sheets-Sheet 4

FIG_7

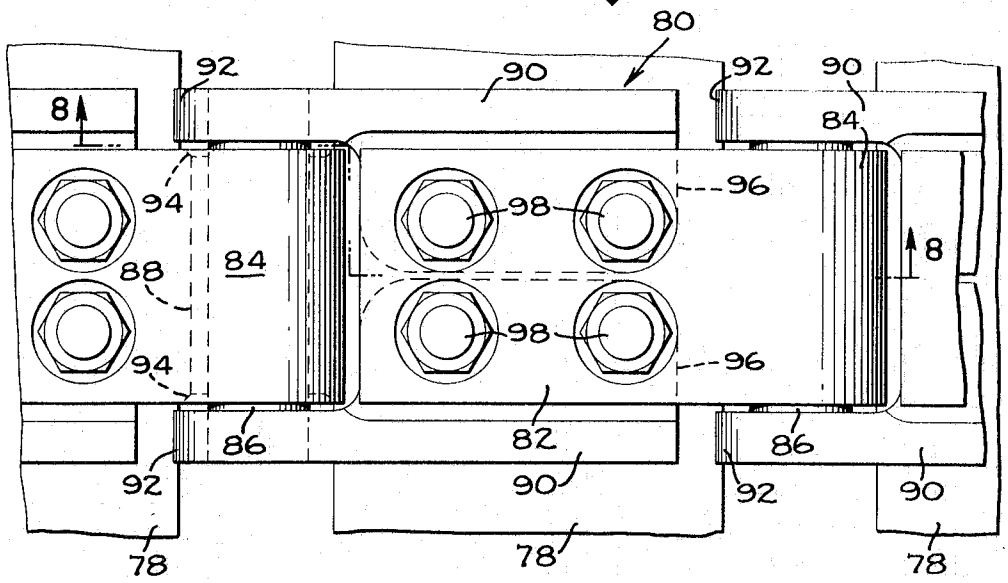


FIG_8

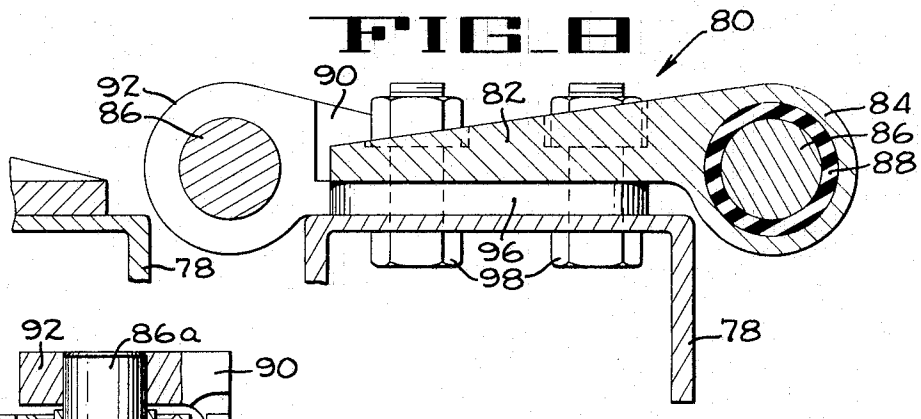
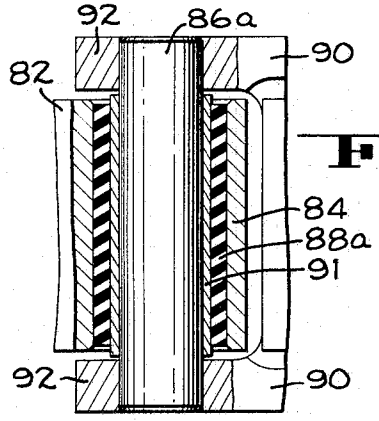


FIG_11



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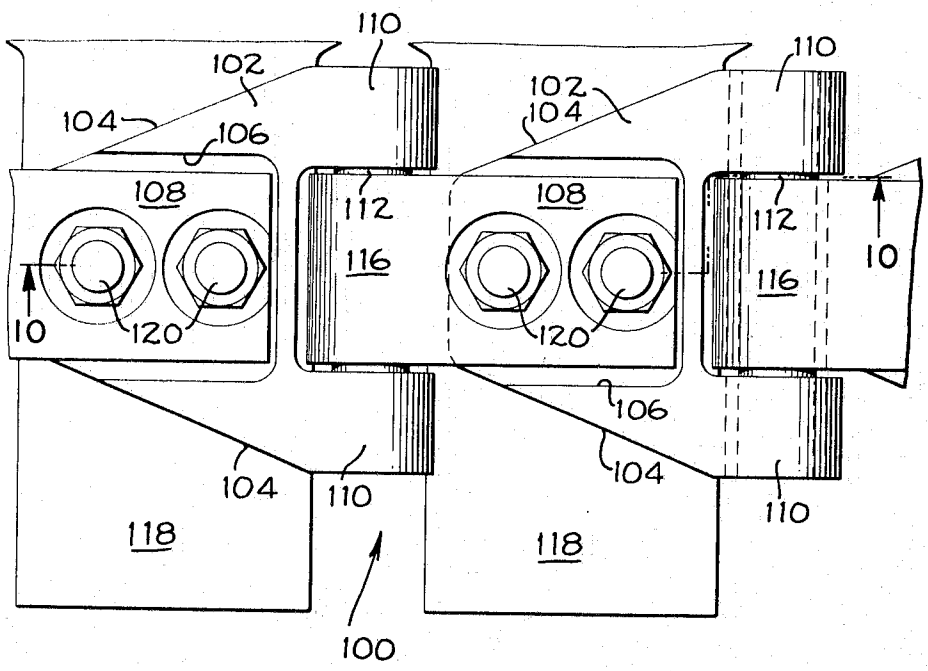
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FIG_9



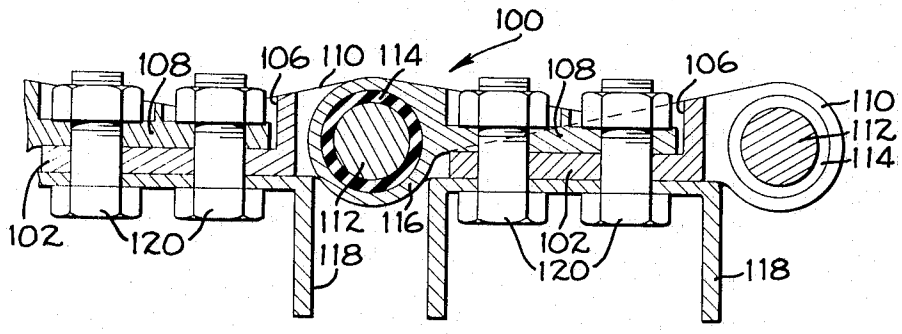


FIG_10

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3,357,750

HINGED TRACK

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Filed Oct. 6, 1965, Ser. No. 493,432
8 Claims. (Cl. 305—11)

ABSTRACT OF THE DISCLOSURE

Permanently assembled leaf hinge units are coupled together to form an endless crawler track chain. The same coupling means secure track shoes to the chain so that the intermediate one of any three adjacent hinge units can be removed and replaced, without destroying the continuity of the track, by disconnecting the confronting leaves of the two hingles spaced longitudinally of the track to release the intermediate hinge. By performing this operation twice for the hinges aligned transversely of the track, any track shoe link can also be replaced without destroying the continuity of the track. In one species of hinge, the drive sprocket engagement is with apertured leaves of the hinge.

This invention relates to improvements in crawler treads and more particularly to built-up crawler treads.

In the interest of economy, reliability and ease of maintenance earlier track designs were constructed of one or more flexible chains having track shoes rigidly fastened by rivets, bolts, or keys to the links of the chain. This design is usually referred to as the built-up type. Its simplicity recommended this design for wide spread military and non-military uses but experience with such designs brought to fore a weakness rendering this design limited in its application. The problem encountered was the loss of the track shoes due to shearing of the fasteners. A representative example of this construction is shown in United States Patent 1,536,604 dated May 5, 1925.

The built-up or chain-type track has been displaced by the link type track since this construction is considerably stronger. In the link type track each of the ground engaging plates are formed with lugs through which extend pivot pins to form a continuous flexible belt. The main problem encountered with this type of track concerns the wearing and retention of the pivot pins and the fact that field replacements of worn track shoes are rather difficult and require tools especially adapted for this purpose.

In an effort to reduce the wear of the pivot connections caused by the infiltration of dirt, lubricated crawler tracks have been proposed but due to the expense and difficulty in replacing worn parts, this design does not lend itself to be practical for certain military and non-military uses. A widely used method of reducing wear has been the incorporation of rubber bushed pin connections. The bore of the lugs and the diameter of the pin are sized to define an annular space within which the rubber bushings are located. The unrestrained diameter of these rubber bushings are substantially greater than the diameter of the lugs so that upon assembly the rubber bushing is extruded and held under compression completely filling the annular space. Under these conditions the relative pivotal movement between adjacent links of the track subject the rubber bushing to shearing forces.

When a rubber bushed track is assembled, adjacent links are oriented to define a predetermined angle which will maximize the torsional fatigue life of the rubber bushings. This predetermined angle is normally midway between the limits of angular oscillation between adjacent track shoes during vehicle operation.

When it is required to replace a track shoe in a rubber bushed crawler tread, special tools are required to remove the rubber bushed pins and it is necessary to orient the replacement shoe at a definite angle prior to insertion of the pivot pin and the rubber bushing. It often happens, especially in field replacement, that the required orientation is not performed properly thereby possibly subjecting the rubber bushing to twice the value of shear it is designed to withstand. This causes rapid failure of the bushing.

The present invention discloses a rubber bushed hinged connection which avoids the expense, reduces the time, and avoids the possibility of incorrectly assembling the rubber bushing. This invention also obviates the need of special tools for repairing the track.

Accordingly, it is one object of this invention to interconnect the shoes of the crawler track so that individual treads or hinges may be separately replaced without removing the hinge pin between the adjacent shoes.

Another object of this invention is to provide a crawler tread that can be assembled and disassembled by ordinary readily available tools.

Another object of this invention is to provide a crawler track which may be disassembled at any pitch without disassembling the hinge unit itself.

Another object of this invention is to provide a built-up crawler track wherein the strength of the chain is not affected by the strength of the ground engaging shoe.

These and other objects and advantages of the present invention will be apparent in the following description and the accompanying drawings in which:

FIGURE 1 is a perspective of the hinge connection constructed according to the invention.

FIGURE 2 is a top plan of FIGURE 1.

FIGURE 3 is a transverse section taken substantially along the offset cutting plane **3—3** of FIGURE 2.

FIGURE 4 is an axial section of the hinge unit taken substantially along the line **4—4** of FIGURE 2.

FIGURE 5 is a plan view of a modified form of a hinge unit incorporating the invention.

FIGURE 6 is a transverse section taken along the offset cutting plane **6—6** of FIGURE 5.

FIGURE 7 is a plan of another modified form of hinge unit constructed according to this invention.

FIGURE 8 is a section taken along the offset cutting plane **8—8** of FIGURE 7.

FIGURE 9 is a plan view of still another modification of the hinge unit constructed according to this invention.

FIGURE 10 is a section taken substantially along the offset cutting plane **10—10** of FIGURE 9.

FIGURE 11 is a section of a modified form of the hinge connection which may be utilized in the modification of FIGURE 7.

Referring now to FIGURE 1 there is shown a portion of the crawler track constructed according to this invention and it is generally indicated by the numeral **10**. Each pitch of the track comprises an inverted generally U-shaped rigid plate **12** to which is secured, by a bolt **14**, a ground engaging rubber block **16**. At the transverse center of each plate an upwardly extending generally pyramidal guide horn **18** is provided which serves to maintain the track in a predetermined orbital plane. On each plate **12**, and on opposite sides of the guide horn **18**, hinge assemblies **20**, preferably of the type referred to as a 1–2 linkage, are rigidly and detachably mounted to the upper surface of each rigid plate **12**. Since the illustrated hinge assemblies are symmetrical, only that hinge assembly appearing on the right hand side of FIGURE 1 will be described in detail.

The illustrated hinge assemblies **20** are preferably cast parts and are detachably rigidly connected to the plates **12**. Referring to FIGURE 1 it will be seen that each hinge assembly comprises three members which are per-

manently pinned together preferably by a rubber bushed pin prior to their attachment to the plates **12**. As shown in FIGURE 1, each hinge assembly comprises a central elongate leaf **22** having a bored male lug **24** for receiving a rubber bushed connecting pin. The central portion of the leaf overlying the plate **12** is provided with a pair of laterally spaced upwardly extending parallel ribs **26** interconnected at respective ends by an integral wall **28**. These ribs and the wall form a generally rectangular opening for receiving the teeth of the driving sprocket to thereby effect orbital movement of the crawler chain. Each central leaf also includes lateral extension **30** forming platforms upon which are mounted the remaining portions of each hinge assembly as will be presently described. The hinge assembly also includes leaf members **32** and **34** formed with lug portions **36** which are spaced apart a sufficient distance to receive therebetween the male lug **24** of the central leaf **22**. A tubular pin **38** and rubber bushings **40** are inserted through the lugs thereby pivotally interconnecting the hinge members **22, 32** and **34**. The pivotal connection is shown best in FIGURE 4.

The leaves **32** which are located closest to the lateral edges of the plate **12** have a lower wall portion **42** overlying the lateral extensions **30** of the central leaf **22** and upwardly extending strengthening ribs **44**. A pair of bolts **46** extending through holes formed in the rigid plate **12**, through the lateral extensions **30**, and the lower wall **42** rigidly attached to the leaf **32** of one hinge assembly to the leaf **22** of an adjacent hinge assembly.

In addition to providing interconnection of adjacent hinge assemblies, the leaf members **34** are formed with a cavity surrounded by a narrow wall **50**. A rubber block **52** of suitable shape is fixed within a cavity by any conventional method such as bonding. The rubber block is formed with a flat upper surface which is engaged by the bogie wheels of the vehicle. This surface is generally known as the wheel path or guiding surface. Each of the leaf members **34** overlies the inner lateral extension **30** of the central leaf **22** and are attached to the plate **12** by conventional nut and bolt assemblies **54**.

In accordance with one important aspect of this invention, the respective leaves of each hinge assembly are pivotally interconnected by the pin **38** and a rubber bushing **40** prior to their attachment to the plates **12**. During the assembly, the leaf members **32** and **34** are held in a common plane and the leaf member **22** is located in a plane which defines an angle with the plane containing the leaf members **32** and **34**. The angle between such planes is an engineering design consideration depending upon the amount of shear that the rubber bushing **40** is designed to withstand. When the leaf members are disposed at an angle relative to each other, the pin **38** and the rubber bushing **40** are inserted into the lugs **36** and **24** and they assume the position shown in FIGURE 4. Prior to being assembled the rubber bushings **40** have a free diameter which is substantially greater than the diameter of the lugs **36** and **40**. Upon assembly they are extruded, subjecting the bushings to a rather large compressive force.

According to the above described construction it should be readily apparent that by providing preassembled hinge assemblies which are detachably connected to the longitudinally adjacent track shoes, replacement of any desired hinge assembly or any track shoe is easily performed since all that is necessary is to remove the various bolts connecting the hinge assemblies to the track shoes.

FIGURES 5 and 6 show a modified version of the hinge assembly incorporating the principles of this invention and it is generally indicated by the numeral **56**. The hinge assemblies are arranged to be independently connected to adjacent track shoes so that each individual hinge may be attached and removed without disturbing the fasteners of an adjacent hinge.

This embodiment comprises rigid laterally extending channel members **60** having centrally located upwardly

extending guide horns **62**. On either side of each guide horn, suitable rubber pads **64** are provided which are rollingly engaged by bogie wheels. The hinge assembly includes a central leaf **66** secured to one of the channel members **60** by the bolts **68** and leaves **70** are secured by bolts **72** to an adjacent one of the channel members **60**. A tubular pin **74** and a rubber bushing **76** extending through the lug portions of each leaf pivotally interconnect these leaves together and they assume the relationship shown in FIGURE 5. The leaves **70** are spaced a sufficient distance apart to receive therebetween the leaves **66** of an adjacent hinge assembly.

By virtue of this constructon any one of the hinge assemblies may be easily removed or attached to adjacent track elements by simply removing the bolts **68** and **72** while the fasteners holding the adjacent hinges to the track shoes are not disturbed. The hinge assemblies of this embodiment are also assembled priot to their being attached to the track shoes in order to assure proper stressing of the rubber bushing.

Yet another embodiment of this invention is shown in FIGURES 7 and 8. Although this embodiment discloses a hinge assembly which can be attached to the track shoes in its assembled relationship, it has the added advantage of providing for pivot pin seals, if desired. This embodiment includes a suitable channel shaped track shoe **78**, adjacent pairs of which are interconnected in spaced relationship by hinge assemblies **80**. Each hinge assembly comprises a central, generally rectangular leaf portion **82** having a tubular lug **84** formed on one end thereof. A preferably solid pin **86** and a rubber bushing **88** are assembled within a lug portion **84** and the pin is of sufficient length to extend beyond the lateral sides of the leaf **82**. Leaf portions **90** are formed with bored lugs **92** and are press-fitted on the outwardly laterally extending portions of the pin **86**.

In the event a track of the lubricated type is desired, the rubber bushing **88** may be eliminated and the bore of the lug **84** would then be appropriately sized to allow free rotation of the pin **86** relative to the leaf members.

Before leaf portions in **90** are press-fitted on the pin **86**, a suitable seal **94** whether it be of elastomeric material, Teflon or rubber-backed rotary metal seals is fitted in suitable recesses formed in the tubular lug **84**. Each leaf member **90** is formed with inwardly extending ears **96** which underlie the leaf portion **82** of a longitudinally adjacent hinge assembly. Bolt and nut assemblies **98** extending through suitable bores formed in the track shoes **78**, the ears **96**, and the leaf portion **82** rigidly interconnect the hinge assemblies to the track shoes.

The significant feature of the embodiment shown in FIGURES 7 and 8 pertains to the fact that this type of hinge assembly is well adapted for a rubber bushed track or a lubricated track and in either case replacement of the shoes or the hinge assemblies is easily accomplished by merely removing the appropriate nut and bolt assemblies.

FIGURE 11 shows a modified form of a hinge pin connection which can be used with a two leaf hinge of the type shown in FIGURES 7 and 8, the main difference being that the leaf members **90** are made as one leaf. The hinge connection illustrated in FIGURE 11 comprises a metal bushing **91** and a rubber bushing **88***a* which is secured by bonding, or any other suitable method, to the exterior surface of the metal bushing. These bushings are forcibly fitted in the bore of the lug **84**. The leaf **90** is positioned so that the bore of the lugs **92** are in alignment with the bushing **91** and the pin **86***a* is then press-fitted through the lugs **92** and the bushing **91** pivotally rigidly attaching the leaf members together.

The relative pivotal movement between the leaves **90** and **82** stresses the rubber bushing **91** as in the prior modifications. In this modification, however, assembly of the cooperating leaf members avoids the possibility of misalignment of the bolt holes thus avoiding operator

error and avoiding the necessity of providing special assembly fixtures for positioning the leaf portion **90** of FIGURES 7 and 8. The pin connection of FIGURE 11, however is not practically adapted to provide lubricated pin joints.

The embodiment of the invention shown in FIGURES 9 and 10 illustrates a very compact structure of a hinge assembly which merely includes two parts interconnected by a rubber bushed pin. This hinge assembly generally indicated by the numeral **100** includes one leaf portion **102** formed preferably with tapering side walls **104** and a central recess **106** in which is located the leaf member **108** of an adjacent hinge assembly. Axially spaced lug portions **110** are provided for receiving a pivot pin **112** and a rubber bushing **114**. The leaf member **108** is also formed with a lug portion **116** being of sufficient width to be received between the lug portions **110**. The lug **116** is also bored to receive the pivot pin **112** and the rubber bushing **114**. As shown in FIGURE 10 the leaf portion **108** overlies the leaf portion **102** and they are fastened to a track shoe **118** by a pair of nut and bolt assemblies **120**. It will be obvious that this embodiment also incorporates those structural features which will permit replacement of any hinge unit at any point in the crawler track and yet insure that the torsional loads applied to the rubber bushing will not exceed the design limits.

Although several embodiments incorporating the principles of this invention have been shown and described, it will be understood that the apparatus is capable of variations without departing from the principles of the invention, and that the scope of the invention should be limited only by the scope and proper interpretation of the claims appended hereto.

Having thus described our invention, what we claim as new and desire to protect by Letters Patent is:

1. A hinge connection for pivotally interconnecting adjacent shoes of a crawler track so that the individual shoes or the hinges may be separately replaced without removing the hinge pin, said hinge comprising spaced apart generally parallel hinge leaves removably rigidly securable to one track shoe and having respective overhanging pin-receiving portions, a single hinge leaf located between said spaced apart leaves and removably rigidly securable to longitudinally adjacent track shoe, said single leaf having a portion overhanging its associated shoe and also having a pin-receiving portion, and a pivot pin including a rubber bushing permanently seated in the overhanging portion of said leaves, said spaced apart leaves being spaced a sufficient distance apart to receive therebetween the single hinge leaf associated with another longitudinally adjacent hinge connection.

2. A hinge connection for a crawler track comprising, a pair of spaced apart leaves having respective portions formed to receive a pivot pin, another leaf located between said pair of leaves and also having a portion formed to receive a pivot pin, a pivot pin extending through said portions pivotally connecting all of said leaves, said another leaf including a central upstanding projection having an opening therein engageable by the teeth of a driving sprocket and lateral extensions located on opposite sides and at the base of said projection, means detachably securing the pivotally connected leaves to adjacent ground engaging shoes of the crawler track, said leaves being associated so that one pair of spaced apart leaves of one hinge connection overlie the lateral extensions of the adjacent hinge connection.

3. A crawler chain segment comprising a plurality of ground engaging track shoes, a permanently preassembled leaf hinge structure for pivotally interconnecting each pair of said shoes, said hinge including at least two leaves having aligned apertured lugs, a pivot pin extending through said lugs, one of said leaves being aligned with one of said pair of track shoes and provided with a laterally directed extension in contact with a first adjacent hinge structure leaf overlying the same track shoe, attachment means for securing the thus contacting hinge portions together and to the track shoe aligned therewith, the other of said leaves of said first mentioned hinge overlying the other track shoe of said pair of track shoes and contacting the laterally directed extension of a second adjacent hinge, and attachment means for securing said other of said leaves and said extension of said second adjacent hinge to said other track shoe.

4. A crawler chain assembly comprising a plurality of ground engaging track shoes, a plurality of preassembled leaf hinges for individually pivotally interconnecting each adjacent pair of said track shoes, each hinge including at least two leaves coupled by a pivot pin, each leaf of each said hinge being superimposed on a leaf of an adjacent hinge, common attachment means securing one of the leaves of a hinge to one of said track shoes and to one leaf of a first adjacent hinge, and common attachment means securing the other leaf of said first mentioned hinge to the next adjacent track shoe and to a leaf of a second adjacent hinge.

5. The invention of claim **4** wherein each of said hinges has a leaf thereof formed to engage the teeth of a driving sprocket.

6. The invention of claim **4** wherein selected hinge leaves of said hinges include pads which cooperatively define a guiding surface for a crawler chain guide wheel.

7. The invention of claim **4** wherein said leaves of each preassembled hinge are spaced along the axis of said pivot pin, and wherein one leaf is provided with a laterally directed extension to which the leaf of an adjacent hinge is connected by said common attachment means.

8. The invention of claim **4** wherein each of said plurality of preassembled leaf hinges comprises a central leaf and two separate side leaves having lug portions mounted with a press fit on said pivot pins, said side leaves being laterally spaced apart and located one on each side of said central leaf, removable means securing said central leaf to one of said track shoes, common removable means securing said side leaves to the next adjacent one of said track shoes, and annular face seals circumscribing said pivot pin, each seal being arranged to prevent the intrusion of foreign matter between the lug portions of said central leaf and said side leaves.

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