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PATENT SPECIFICATION

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(54) HINGE PIN ASSEMBLY

(71) We, CATERPILLAR TRACTOR CO., a corporation organised and existing under the laws of the State of California, United States of America, of 100 N.E. Adams Street, Peoria, State of Illinois 61629, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to hinge pin assemblies for journalling one member on another, for example, for pivotally connecting an implement to an operating arm of a piece of constructional plant. It relates particularly to such assemblies having wedge members for receiving collets.

Such an assembly is shown in our British Specification No. 1,414,740.

Hinge pin assemblies, such as those illustrated in the above-mentioned Specification have proved quite satisfactory in operation. Nonetheless, improvement is desirable particularly in terms of obviating any need for separate elements to be used as "puller" assemblies for removing collets from wedge members and in terms of providing a construction wherein the collet may be properly seated upon wedge members with a minimum of friction during the assembly process.

It is the aim of this invention to provide a hinge pin assembly which satisfies these requirements.

To this end, according to this invention, a hinge pin assembly for pivotally connecting one member to another comprises a pin which is arranged to have its ends secured in openings in one of the members with the other member pivotally mounted on the part of the pin between its ends, an annular wedge member at each end of the pin, each wedge member tapering in an axial direction away from the centre of the pin, a radially expansible and contractable collet arranged to fit on each wedge member and a bolt, which is arranged to extend through an opening in the collet and has

a screw thread enabling it to be screwed into a screw-threaded bore in the end of the pin, the bolt having a second screw thread which is arranged to be screwed through the opening in the collet which is also screw-threaded, the screw thread of the opening in the collet being of a finer pitch than the screw thread of the bore in the end of the pin, whereby, as the bolt is screwed through the opening in the collet and into the bore in the pin, the collet is moved axially along the wedge member in a direction towards the centre of the pin and is expanded radially so that, in use, the end of the pin is secured in one of the openings in the one of the members, and as the bolt is unscrewed through the opening in the collet and from the bore in the pin, the collet is moved axially in an opposite direction so that it contracts radially.

As a consequence of this construction, during assembly, a differential screw action is presented allowing proper assemblage with a minimum of friction. At the same time, by loosening the bolt, a "puller" action of the bolt on the collet will occur to ensure removal of the collet from the wedge member without the need of separate puller tools.

In a preferred embodiment of the invention, the bolt has two portions of different diameters, the portion of larger diameter being adjacent the head of the bolt, the first screw thread of the bolt which is arranged to be screwed into the bore being on the portion of smaller diameter and the second screw thread of the bolt being on the portion of larger diameter.

Preferably, the assembly includes selectively operable spacer means arranged to be disposed between the head of the bolt and collet. In one embodiment, the spacer means comprises a removable shim, while in another embodiment, the collet is provided with an elongated recess surrounding the opening. The spacer means comprises an elongated shim pivotally impaled on the bolt and arranged to span the recess when pivoted on the bolt in one position and to

fit in the recess when pivoted into a second position.

An example of a hinge pin assembly in accordance with the invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a fragmentary, side elevation of a vehicle in which a hinge pin assembly of the type with which the invention is concerned is employed;

Figure 2 is a sectional view to a much larger scale taken along the line 2-2 of Figure 1 illustrating a prior art hinge pin assembly;

Figure 3 is a fragmentary sectional view to a still larger scale of one end of a hinge pin assembly in accordance with the invention, the assembly being shown in an initial position just prior to completion of installation;

Figure 4 is an end elevational view of the assembly shown in Figure 3;

Figure 5 is a view of a modified part of the assembly shown in Figures 3 and 4;

Figure 6 is a view similar to Figure 3 but illustrating the assembly at a later stage of installation; and,

Figure 7 is a view similar to Figures 3 and 6 but illustrating the assembly after completion of installation.

One typical use of a hinge pin construction in accordance with the invention is illustrated in connection with a front end loader in Figure 1 wherein a bucket 10 is mounted by hinge pins 12 on life arms 14 suitably mounted on a vehicle 16 and powered conventionally by hydraulic cylinders. The bucket 10 is pivotal about a horizontal axis defined by the hinge pins 12 on the life arms 14 through action of a pivot assembly, generally designated 18, pivoted to the bucket 10 at a location 20 remote from the hinge pin 12.

Figure 2 illustrates a conventional hinge pin assembly 12 and, specifically, that illustrated in the previously identified Specification No. 1,414,740 (Shankwitz et al). In particular, a pin 22 extends through a bore 24 in the arm 14 and has a radially inwardly, axially outwardly extending, annular tapered surface on each end defining an integral wedge member 26. While, as illustrated in Figure 2, the wedge members 26 are surface integrally formed on the pin, it is also conventional that they be separately formed elements secured on the ends of the pin.

Collets 30 are receivable on each of the wedge members 26 and may be advanced thereon by the tightening of bolts 32 received in threaded bores 34 in respective ends of the pins 22.

Advancing of the collets 30 axially inwardly causes fingers 36 thereof to be wedged outwardly into firm, frictional engagement with the interior opening 38 in rearwardly extending ears 40 on the back of the bucket 10. As will be appreciated, proper assembly of the collet 32 to the wedge members 26 involves a great deal of

friction as the collets 30 are advanced on the wedge members 26. In addition, it will be appreciated that removal of the collets 30 will be exceedingly difficult without some sort of puller tool or device. Shankwitz et al, identified previously, illustrates one such means, the details of which are herein incorporated by reference.

Turning now to Figures 3-7, a hinge construction made according to the invention is illustrated. Where components similar or identical to those of the prior art construction are employed, they will be given the same reference numeral.

In the embodiment illustrated in Figures 3-7, the pin 22 is not provided with integral wedge members 26, but rather, separate annular wedge members 42. The members 42 fit closely on the ends of the pin 22 and do not need to move thereon. Each end of the pin 22, however, is provided with one of the threaded bores 34. The collet 30 includes fingers 36 which may be wedged into firm frictional engagement with an opening 38 in the ears 40.

In lieu of the bolt 32, a bolt 50 is employed in the present invention. The bolt 50 includes a head 52 and an adjacent washer 54. The shank of the bolt includes a large diameter portion 56 and a remote lesser diameter portion 58. The lesser diameter portion 58 is threaded so as to be threadably received within the bore 34, while the large diameter portion 56 is threadably received in a bore 60 extending through the center of the collet 30. Moreover, the threads on the portion 58 are coarse, while the threads on the portion 56 are fine. That is, the threads on the portion 56 have a finer pitch than those on the portion 58.

The axially outer end of the collet 30 is also provided with an elongated recess 62 in the form of a rectangle. As seen in Figure 4, a spacing means in the form of an elongated shim 64 is provided and is pivotally disposed about the bolt 50 and sized to be receivable in the recess 62. As illustrated in Figures 3 and 4, the shim 64 is pivoted to bring the recess 62 to limit inward movement of the head 52 relative to the collet 30 whereas Figures 6 and 7 illustrate the pivoting of the shim 64 approximately 90° from the position shown in Figure 4 to be disposed within the recess 62 to allow the head 52 to be advanced toward the collet 30.

If desired, the shim 64 can be dispensed with and a wholly removable shim 66 having an open ended slot 68 for receipt about the bolt can be employed (see Figure 5).

Installation and removal and the advantages of this construction during such procedures will now be described.

Initially, the components are oriented as illustrated in Figure 3 with the spacer 64 or the spacer 66 disposed to limit movement of the head 52 toward the collet 30. The lesser diameter portion 58 is introduced into bore 34 and the bolt rotated. At this time, the fingers 130

36 of the collet 30 will not encounter any appreciable resistance to entry into the bore 38 and the collet 30 will rotate with the bolt 50, with minimal resistance.

5 At some point in time, the inner surface of the fingers 36 will engage the tapered surface of the wedge members 42, while the outer surfaces of the fingers 36 will frictionally engage the aperture 38. The bolt 50 may continue to be
10 tightened to any designed predetermined torque with the consequence that the parts will be seated. This configuration is generally that illustrated in Figure 6 except that the spacer 64 would be in the position illustrated in Figure 3 rather than as shown in Figure 6.

15 The bolt may then be backed off sufficiently so as to allow the spacer 64 to be rotated to be disposed within the recess 62 or, if the spacer 66 is employed, to be removed entirely. The
20 bolt 50 may then further be tightened until the position of the components illustrated in Figure 7 is achieved. Because of the difference in pitch, the bolt 50 will advance to the right, as viewed in the Figure, at a more rapid rate than
25 the collet 30 so as to allow the collet 30 to be seated properly but with a minimum of friction due to such axial movement. Thus, installation is substantially simplified.

30 For removal, the reverse of the foregoing procedure will be employed, although it is unnecessary to utilize the spacer at any point in the process. It will be recognized that as the bolt 50 is backed out of the bore 34, the collet 30 will be backed off of the wedge member 42
35 and the wedging surface 26 thereof at a lesser rate allowing disassembly, again, with a minimum of effort.

WHAT WE CLAIM IS:-

40 1. A hinge pin assembly for pivotally connecting one member to another, the assembly comprising a pin, which is arranged to have its ends secured in openings in one of the members with the other member pivotally mounted on the part of the pin between its ends, an annular
45 wedge member at each end of the pin, each wedge member tapering in an axial direction away from the centre of the pin, a radially expansible and contractable collet arranged to fit on each wedge member and a bolt, which is
50 arranged to extend through an opening in the collet and has a screw thread enabling it to be

screwed into a screw-threaded bore in the end of the pin, the bolt having a second screw thread which is arranged to be screwed through the opening of the collet which is also screw-threaded, the screw thread of the opening in the collet being of a finer pitch than the screw thread of the bore in the end of the pin, whereby, as the bolt is screwed through the opening in the collet and into the bore in the pin, the collet is moved axially along the wedge member in a direction towards the centre of the pin and is expanded radially so that, in use, the end of the pin is secured in one of the openings in the one of the members, and as the bolt is unscrewed through the opening in the collet and from the bore in the pin, the collet is moved axially in an opposite direction so that it contracts radially.

2. An assembly according to claim 1, in which each bolt has two portions of different diameters, the portion of larger diameter being adjacent the head of the bolt, the first screw thread of the bolt which is arranged to be screwed into the bore being on the portion of smaller diameter and the second screw thread of the bolt being on the portion of larger diameter.

3. An assembly according to claim 1 or claim 2, further comprising selectively operable spacer means arranged to be disposed between said collet and the head of said bolt.

4. An assembly according to claim 3, in which the spacer means is a removable shim.

5. An assembly according to claim 3, in which the collet is provided with an elongated recess surrounding the opening and the spacer means comprises an elongated shim pivotally impaled on the bolt and arranged to span the recess when pivoted on the bolt in one position and to fit in the recess when pivoted into a second position.

6. An assembly according to claim 1, substantially as described with reference to Figures 3, 4, 6 and 7, or Figures 3, 4, 6 and 7 modified as described with reference to Figure 5, of the accompanying drawings.

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36 of the collet 30 will not encounter any appreciable resistance to entry into the bore 38 and the collet 30 will rotate with the bolt 50, with minimal resistance.

5 At some point in time, the inner surface of the fingers 36 will engage the tapered surface of the wedge members 42, while the outer surfaces of the fingers 36 will frictionally engage the aperture 38. The bolt 50 may continue to be tightened to any designed predetermined torque with the consequence that the parts will be seated. This configuration is generally that illustrated in Figure 6 except that the spacer 64 would be in the position illustrated in Figure 3 rather than as shown in Figure 6.

10 The bolt may then be backed off sufficiently so as to allow the spacer 64 to be rotated to be disposed within the recess 62 or, if the spacer 66 is employed, to be removed entirely. The bolt 50 may then further be tightened until the position of the components illustrated in Figure 7 is achieved. Because of the difference in pitch, the bolt 50 will advance to the right, as viewed in the Figure, at a more rapid rate than the collet 30 so as to allow the collet 30 to be seated properly but with a minimum of friction due to such axial movement. Thus, installation is substantially simplified.

20 For removal, the reverse of the foregoing procedure will be employed, although it is unnecessary to utilize the spacer at any point in the process. It will be recognized that as the bolt 50 is backed out of the bore 34, the collet 30 will be backed off of the wedge member 42 and the wedging surface 26 thereof at a lesser rate allowing disassembly, again, with a minimum of effort.

WHAT WE CLAIM IS:-

40 1. A hinge pin assembly for pivotally connecting one member to another, the assembly comprising a pin, which is arranged to have its ends secured in openings in one of the members with the other member pivotally mounted on the part of the pin between its ends, an annular wedge member at each end of the pin, each wedge member tapering in an axial direction away from the centre of the pin, a radially expandable and contractable collet arranged to fit on each wedge member and a bolt, which is arranged to extend through an opening in the collet and has a screw thread enabling it to be

screwed into a screw-threaded bore in the end of the pin, the bolt having a second screw thread which is arranged to be screwed through the opening of the collet which is also screw-threaded, the screw thread of the opening in the collet being of a finer pitch than the screw thread of the bore in the end of the pin, whereby, as the bolt is screwed through the opening in the collet and into the bore in the pin, the collet is moved axially along the wedge member in a direction towards the centre of the pin and is expanded radially so that, in use, the end of the pin is secured in one of the openings in the one of the members, and as the bolt is unscrewed through the opening in the collet and from the bore in the pin, the collet is moved axially in an opposite direction so that it contracts radially.

2. An assembly according to claim 1, in which each bolt has two portions of different diameters, the portion of larger diameter being adjacent the head of the bolt, the first screw thread of the bolt which is arranged to be screwed into the bore being on the portion of smaller diameter and the second screw thread of the bolt being on the portion of larger diameter.

3. An assembly according to claim 1 or claim 2, further comprising selectively operable spacer means arranged to be disposed between said collet and the head of said bolt.

4. An assembly according to claim 3, in which the spacer means is a removable shim.

5. An assembly according to claim 3, in which the collet is provided with an elongated recess surrounding the opening and the spacer means comprises an elongated shim pivotally impaled on the bolt and arranged to span the recess when pivoted on the bolt in one position and to fit in the recess when pivoted into a second position.

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