APPARATUS FOR CONNECTION OF AN IMPLEMENT TO MACHINERY

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ABSTRACT

Apparatus for connecting an implement (5) to an arm assembly of machinery, the implement (5) having first and second pin support plates (4, 6) each having first opposed apertures (9, 10) and second opposed apertures (11, 13). The apparatus includes a first pin and bush assembly (2) having a pin (28) and two pairs of bushes (32, 34) and (36, 38) for engagement with the pin (28). The pin (28) extends through the first opposed apertures (9, 10) and through eccentric apertures in each pair of bushes (32, 34), (36, 38) with the pair of bushes (32, 34) abutting respective sides of the first pin support plate (4) and the other pair of bushes (36, 38) abutting respective sides of the second pin support plate (6). The first pin and bush assembly (2) is moveable to adjust the spatial separation between the pin (28) and a second pin (40) located between the second opposed apertures (11, 13) and the length of pin (28) between inner bushes (34, 36) is varied to accommodate the dimensions of a pin engagement portion of the arm assembly.
APPARATUS FOR CONNECTION OF AN IMPLEMENT TO MACHINERY

FIELD OF THE INVENTION

[0001] This invention relates to apparatus that enables connection of an implement to an arm assembly of machinery. More particularly the invention relates to apparatus that enables an arm assembly of an excavating machine to connect to an implement or tool, such as a bucket, ripper or rock grab.

BACKGROUND OF INVENTION

[0002] Excavating or earth moving machinery require different types of implements to be connected to a working arm assembly of the machine in order to undertake a particular task such as digging into earth and rock, moving earth and rock or for demolition purposes. Among the various manufacturers of such machinery and equipment, implements used to undertake these tasks vary greatly as do the connections to arm assemblies of the machines, one such connection is known as a quick hitch. A quick hitch is located between the end of the arm assembly of the machine and the implement and engages a set of pins located at the top of the implement in order to quickly pick up and attach the implement.

[0003] As excavators use a variety of implements, depending on the task required, suppliers of excavating equipment need to keep many different implements of the various manufacturers to fit to differing quick hitches of those manufacturers. Dimensions of components of the implements differ greatly between manufacturers, such as for example the location of the pins that engage with the quick hitch device. Thus suppliers have to stock a great number of implements to match a particular model of excavating machine. As an example, the bucket of one manufacturer will not necessarily be adapted to fit to the quick hitch or arm assembly connection of an excavating machine of another manufacturer, due to the dimensions of the pins of the bucket not being able to fit against the quick hitch device of the excavating machine manufacturer.

[0004] A known arrangement is disclosed in Australian Patent Application No. 2004201141 to Darryl Bates which recites a pair of ears that project from the top of a tool, such as a bucket, with the ears having opposed apertures, one set of apertures being circular and the other set of apertures being in the form of elongate slots. These apertures support first and second location pins that extend between the ears to account for different distances between the locating pins. A pair of elongate links fit to the respective ends of the pins in order to locate the second pin within the elongate slots, the links being attachable to the ears.

[0005] A particular problem with this arrangement is that many such links of differing dimensions must be stocked by a supplier to fit onto the two pins to vary the distance between the pins, in order to fit excavating equipment of different manufacturers.

[0006] Another potential problem is damage that can occur to the pins of the bucket when a hitch contacts each of the pins in order to engage the implement attached to the set of pins. The pins, due to the excessive force applied by the hitch, at the time of engagement with the pins, chips, deforms and bruises each pin, generally along the entire length of the pin which has a constant diameter. Over time, the continual damage to the pins makes them extremely difficult if not impossible to remove and replace the pins as the pins cannot be moved through the apertures on each pin support plate due to the excessive damage to the pins.

[0007] The present invention provides an alternative arrangement to the prior art to enable connection of a range of implements to a range of machinery.

SUMMARY OF THE INVENTION

[0008] According to a first aspect of the invention, there is provided apparatus for connecting an implement to an arm assembly of machinery, the implement having a first pin support plate spaced apart from a second pin support plate, each pin support plate having a pair of apertures, the apertures being located to provide first opposed apertures and second opposed apertures facing across a space between the first and second pin support plates, the apparatus including:

[0009] a first pin and bush assembly including a pin and two pairs of bushes adapted to cooperate with the pin, the pin extendable through each pair of bushes and through the first opposed apertures of the first and second pin support plates;

[0010] wherein one pair of bushes engages the first pin support plate and the other pair of bushes engages the second pin support plate such that a pair of inner bushes is defined on the pin with respect to the first and second pin support plates;

[0011] each bush in said two pairs of bushes having an eccentric aperture for receiving the pin such that the pin and bush assembly is moveable to adjust the spatial separation between the pin and a second pin located between the second opposed apertures of the first and second pin support plates, and the length of the pin between the inner bushes is varied to accommodate the dimensions of a pin engagement portion of the arm assembly of machinery.

[0012] Preferably the apparatus further includes a second pin and bush assembly having the second pin and a pair of bushes adapted to cooperate with the second pin, the second pin extendable through the pair of bushes of the second pin and bush assembly and through the second opposed apertures of the first and second pin support plates.

[0013] Preferably one of the bushes in said pair of bushes of said second pin and bush assembly engages with the first pin support plate and the other bush in said pair of bushes of said second pin and bush assembly engages with the second pin support plate.

[0014] Preferably the second pin and bush assembly has two pairs of bushes adapted to cooperate with the second pin, wherein one pair of bushes engages the first pin support plate and the second pair of bushes engages the second pin support plate such that a pair of inner bushes is defined on the second pin and with respect to each of the first and second pin support plates, such that the length of the second pin between the inner bushes of the second pin and bush assembly is variable to accommodate the dimensions of a pin engagement portion of the arm assembly of machinery.

[0015] Each bush may have identical eccentric apertures. The pin may have at one end a mounting flange to enable the pin to be affixed to either the first pin support plate or to the second pin support plate. The second pin may have at one end a mounting flange to enable the second pin to be affixed to either the first pin support plate or to the second pin support plate. The mounting flange of the pin may be mountable to the respective pin support plate through one of the bushes of said first pin and bush assembly. The mounting flange of the second pin can be mountable to the respective pin support plate through one the bushes of said second pin and bush assembly.
A mounting disc can be provided on each of the first and second pin support plate either side of each aperture of the first opposed apertures and the second opposed apertures in the first and second pin support plates and wherein further a respective bush is mountable to a corresponding mounting disc.

Preferably one or more of the bushes has a flange, a portion of the flange positioned in use within a respective aperture of the first and second pin support plates.

The first pin and bush assembly may be rotatable to adjust the spatial separation of the pin and the second pin and is mountable to each of the pin support plates in any one of a number of predetermined rotational positions.

The second pin and bush assembly may be rotatable to adjust the spatial separation of the pin and second pin and is mountable to each of the pin support plates in any one of a number of predetermined rotational positions.

Either or both of the pin and the second pin may have a mid-section formed between a first end section and a second end section, the first and second end sections having the same diameter and larger than the diameter of the mid-section, such that only the mid-section is exposed to the pin engagement portion of the arm assembly.

Either or both of the pin and the second pin may be heat treated to increase the hardness of either or both the pin and second pin and thereby increase resistance to damage from engagement with the pin engagement portion of the pin assembly.

According to a second aspect of the invention there is provided an implement connectable to one of a plurality of machine arm assemblies using the apparatus of any one of the preceding claims coupled to the spaced apart first and second pin support plates of the implement.

According to a third aspect of the invention there is provided a method of connecting an implement to an arm assembly of machinery, the implement having a first pin support plate spaced apart from a second pin support plate, each pin support plate having a pair of apertures defining first opposed apertures and second opposed apertures facing across a space between the first and second pin support plates, the method including the steps of:

- providing a first pin and bush assembly including a pin and two pairs of bushes adapted to cooperate with the pin;
- wherein one pair of the bushes engages the first pin support plate and the other pair of bushes engages the second pin support plate such that a pair of inner bushes is defined on the pin with respect to the first and second pin support plates;
- wherein further the length of the pin between the inner bushes is varied to accommodate the dimensions of a pin engagement portion of the arm assembly;
- positioning the pin through each pair of bushes and through the first opposed apertures of the first and second pin support plates;
- providing a second pin and positioning the second pin through the second opposed apertures of the pin support plates;
- providing eccentric apertures in each bush of the pairs of bushes;
- rotating the bushes with the eccentric apertures so as to adjust the spatial separation between the pin and the second pin;
- affixing the pin and second pin to the first and second pin support plates; and
- engaging the pin engagement portion of the arm assembly with the implement through the pin and second pin.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention will hereinafter be described, by way of example only, with reference to the drawings in which:

FIG. 1, is a perspective view from above of apparatus for connecting an implement to an arm assembly of machinery, showing one of two pin and bush assemblies detached from a portion of the implement;

FIG. 2, is a reverse perspective view of the apparatus of FIG. 1;

FIG. 3 is a perspective view of the apparatus of FIG. 1 fully assembled;

FIG. 4 is a perspective view from above of the assembled apparatus of FIG. 3; and

FIG. 5 is a perspective view showing the apparatus connected to the implement, being a bucket.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2 there is shown apparatus for connecting an implement, such as a bucket 5 (in FIG. 5), to machinery, and more particularly to a quick hitch device which is located at a distal end of an operating arm assembly of an excavating machine. The apparatus includes a first pin and bush assembly 2 and a second pin and bush assembly 3. The pin and bush assembly 2 includes first pin 28, outer bushes 32 and 38 and, optionally, inner bushes 34 and 36. The second pin and bush assembly 3 includes second pin 40, outer bushes 44 and 50 and, optionally, inner bushes 46 and 48. Bushes 32 and 38, as well as bushes 44 and 50, are primarily used to vary the spatial separation between pins 28 and 40. Bushes 34 and 36 of the first assembly 2 and bushes 46 and 48 of the second assembly 3 are primarily used as spacers to vary the distance along each of pins 28 and 40 that can engage with a quick hitch attached to the end of an arm assembly of the excavating machine. More inner bushes may be used, as required to vary the length of pins 28 or 40 exposed to the quick hitch. Each of the bushings has an eccentric aperture therethrough, the purpose of which will be discussed hereinafter.

Each of the assemblies 2 and 3 is adapted to fit between upright parallel pin support plates 4 and 6 which are located at a top face 8 of the implement or bucket 5 as is shown in FIG. 5. Each of the pin support plates 4 and 6 may be integrally formed with the bucket 5 or otherwise attached to the top face 8 of the bucket 5. Located at one end of the respective pin support plates 4 and 6 are apertures 9 and 10 directly opposed to one another across a space 7 between the pin support plates 4 and 6. Similarly, a further set of apertures 11, 13 is located at the opposite end of each of the pin support plates 4 and 6. Mounting discs 12 and 14 are located either side of support plate 4 such that each of the discs 12 and 14 have apertures that correspond with aperture 9. Similarly mounting discs 16 and 18 are located either side of plate 6 around aperture 10. At the opposite end of the pin support plate 4 the mounting discs 20 and 22 are located either side thereof around aperture 11 in plate 4 and similarly at a corresponding opposite end of plate 6 there is located either side thereof mounting discs 24 and 26 around aperture 13.
Each of pins 28 and 40 may be made up of an exposed central or mid-section 15 between first and second end sections 17 and 19, as shown in FIG. 1, each end section 17 and 19 having a diameter greater than mid-section 15. Mid-section 15 is exposed to engagement with a hitch of an arm assembly. Each of the end sections 17 and 19 are respectively covered by the bushes, mounting discs and pin support plates. Thus for example, end section 17 resides within aperture 9 and is substantially covered by each of bushes 32 and 34 as well as mounting discs 12 and 14 formed either side of the pin support plate 4. The second end section 19 of pin 28 is respectively covered by bushes 36 and 38, mounting discs 16 and 18 and a portion of the pin support plate 6. Each of the end sections 17 and 19 are not exposed to the engagement of a hitch and therefore are less likely to have damage occurring through that engagement. Only section 15 could, over time, potentially be chipped, deformed or bruised.

However, the whole pin 28 may be heat treated, or otherwise treated, so that it is hardened and strengthened, generally to a Rockwell hardness of 45 to 50 on the C scale. The various diameters of sections 15, 17 and 19 will change according to the particular application of the pin and the implement to which it is attached. As an example, a difference of 5 mm in diameter can exist whereby the mid-section 15 is 90 mm in diameter and each of the end sections 17 and 19 are 95 mm in diameter. By providing the additional hardness through the heat treatment to each of the pins 28 and 40, and by providing a smaller diameter exposed section 15 of each pin 28, 40, the end portions 17 and 19 are unlikely to be damaged through continual engagement with a hitch. Therefore it would be easier to remove each pin 28, 40, when needed, such as when a pin has to be replaced. Furthermore, it is much more difficult for bruising to occur to the end sections 17 and 19 due to the interfaces between mid-section 15 and each end section 17, 19 given the larger diameter of sections 17 and 19 compared with the diameter of mid-section 15. Bruising will generally not extend along such interfaces and will be limited to the mid-section 15.

It is to be noted that the length of the mid-section 15 can be varied, in order to account for the dimensions of the different types of hitches or pin engagement portions of arm assemblies, by using a combination of two or more inner bushes or by varying the width of a pair of inner bushes.

Bush 32 is adapted to engage with and connect to mounting disc 12 and bush 34 is adapted to engage with and connect to mounting disc 14. The description hereinafter in relation to the inter-engagement of bushes 32 and 34 with pin 28 and mounting discs 12, 14 of support plate 4 is similar to the inter-engagement of bushes 44 and 46 with pin 40 and the mounting discs 20 and 22 of plate 4. The inter-engagement description also applies to the symmetric arrangement of the inter-engagement of pin 28 with plate 6 and bushes 36 and 38 and also the inter-engagement of pin 40 with plate 6 and bushes 48 and 50.

Bush 32 has an eccentric aperture 33 that correspondingly extends through bush 34 (aperture 45) so that when pin 28 is inserted into each of the bushes 32 and 34, the pin 28 will be aligned through bushes 32 and 34. In bush 32 the aperture 33 extends through a cylindrical flange 35 extending from a base disc 37. The inner face of the base disc 37 abuts against mounting disc 12 while the flange 35 extends within the aperture 9. The bush 34 has a base disc 39 from which protrudes cylindrical or disc-like flanges 41 and 43 on either side of the disc 39. It is to be noted that the flanges 41, 43 are optional. Extending through each of the disc 39 and flanges 41 and 43 is eccentric aperture 45, which as mentioned previously, is of the same size and eccentricity as aperture 33. The flange 41 fits within aperture 9 while the disc 39 abuts against mounting disc 14.

Pin 28 is inserted through bush 32, the aperture 9 of pin support plate 4 and through bush 34 and also through bushes 36, 38 and aperture 10 of pin support plate 6. Once mounting flange 30 located at one end of pin 28 abuts against or is affixed to the outer face of bush 32, it is then possible to adjust the distance or spatial separation between pins 28 and 40. If required, the same process can be applied to pin 40, which is placed through the respective bushes 44, 46, 48 and 50 and corresponding apertures in support plates 4, 6 with corresponding flange 42, located at one end of pin 40, abutting against or affixed to the outer face of bush 44.

The pin 28 and bushes 32 and 34 can be rotated to one of four positions in order to provide a particular predetermined distance between the pins 28 and 40. If required, more than four positions can be made available. The four positions are set by a series of apertures 47 correspondingly located in each of bushes 32, 34, 36 and 38 and also in mounting discs 12, 14, 16 and 18. Once the required position of the pin 28 is set, fasteners are used to fasten each of the bushes to each of the respective mounting discs of the pin support plates 4 and 6 and pin 28 is fastened to bush 32 by suitable fasteners through respective apertures 49 and 51. Similarly once the required position of pin 40 is determined from a number of possible positions, then flange 42 is affixed to bush 44 through aperture 53 in flange 42 and also a corresponding aperture (not shown) in bush 44.

Due to the eccentricity of the apertures in the respective bushes, a large range of relative positions between the pins 28 and 40 is possible, not just with respect to a lateral separation distance but in relative height between the two pins 28 and 40 to suit the dimensions of hook elements located on a quick hitch assembly of particular excavating machinery.

Shown in FIGS. 3 and 4 are the assembled versions of the apparatus as affixed to the pin support plates 4 and 6 that are attached to the top face 8 of bucket 5 as shown in FIG. 5. The minimum separation distance between pins 28 and 40 is shown in FIG. 3 where the heads of respective mounting flanges 30 and 42 are facing one another. The maximum separation distance between pins 28 and 40 is shown in FIG. 4 where the heads of respective flanges 30 and 42 are diametrically opposed in relation to pins 28 and 40. In between these two settings, the spatial separation of pins 28 and 40, that is laterally and in height (longitudinally), can be varied.

In order to account for the lateral spacing between support plates 4 and 6 to vary the exposed portions of pins 28 and 40 that can be engaged by a pin engagement portion, such as a quick hitch, of an arm assembly of machinery, the bushes 34, 36, 46 and 48 can act as spacers and be packed around the respective pins 28 and 40 so they abut against the respective mounting discs 14, 16, 22 and 24. Alternatively, the width of the base disc 39 and other respective base discs of bushes 36, 46 and 48 may be widened so as to narrow the distance of the exposed part of each of the pins 28 and 40 in order to accommodate the components of the quick hitch device.

1. Apparatus for connecting an implement to an arm assembly of machinery, the implement having a first pin support plate spaced apart from a second pin support plate, each pin support plate having a pair of apertures, the apertures being
located to provide first opposed apertures and second opposed apertures facing across a space between the first and second pin support plates, the apparatus comprising:

a first pin and bush assembly including a pin and two pairs of bushes adapted to cooperate with the pin, the pin extendable through each pair of bushes and through the first opposed apertures of the first and second pin support plates;

wherein one pair of bushes engages the first pin support plate and the other pair of bushes engages the second pin support plate such that a pair of inner bushes is defined on the pin with respect to the first and second pin support plates; and

each bush in said two pairs of bushes having an eccentric aperture for receiving the pin such that the pin and bush assembly is moveable to adjust the spatial separation between the pin and second pin located between the second opposed apertures of the first and second pin support plates, and the length of the pin between the inner bushes is varied to accommodate the dimensions of a pin engagement portion of the arm assembly of machinery.

2. Apparatus according to claim 1 further including a second pin and bush assembly having the second pin and a pair of bushes adapted to cooperate with the second pin, the second pin extendable through the pair of bushes of the second pin and bush assembly and through the second opposed apertures of the first and second pin support plates.

3. Apparatus according to claim 2 wherein one of the bushes in said pair of bushes of said second pin and bush assembly engages with the first pin support plate and the other bush in said pair of bushes of said second pin and bush assembly engages with the second pin support plate.

4. Apparatus according to claim 3 wherein the second pin and bush assembly has two pairs of bushes adapted to cooperate with the second pin, wherein one pair of bushes engages the first pin support plate and the second pair of bushes engages the second pin support plate such that a pair of inner bushes is defined on the second pin and with respect to each of the first and second pin support plates, such that the length of the second pin between the inner bushes of the second pin and bush assembly is variable to accommodate the dimensions of a pin engagement portion of the arm assembly of machinery.

5. Apparatus according to claim 2 wherein each bush has identical eccentric apertures.

6. Apparatus according to claim 2 wherein the pin has at one end a mounting flange to enable the pin to be affixed to either the first pin support plate or to the second pin support plate.

7. Apparatus according to claim 2 wherein the second pin has at one end a mounting flange to enable the second pin to be affixed to either the first pin support plate or to the second pin support plate.

8. Apparatus according to claim 6 wherein the mounting flange of the pin is mountable to the respective pin support plate through one of the bushes of said first pin and bush assembly.

9. Apparatus according to claim 7 wherein the mounting flange of the second pin is mountable to the respective pin support plate through one of the bushes of said second pin and bush assembly.

10. Apparatus according to claim 2, wherein a mounting disc is provided on each of the first and second pin support plate either side of each aperture of the first opposed apertures and the second opposed apertures in the first and second pin support plates and wherein further a respective bush is mountable to a corresponding mounting disc.

11. Apparatus according to claim 1 wherein one or more of the bushes has a flange, a portion of the flange positioned in use within a respective aperture of the first and second pin support plates.

12. Apparatus according to claim 1, wherein the first pin and bush assembly is rotatable to adjust the spatial separation of the pin and the second pin and is mountable to each of the pin support plates in any one of a number of predetermined rotational positions.

13. Apparatus according to claim 2, wherein the second pin and bush assembly is rotatable to adjust the spatial separation of the pin and second pin and is mountable to each of the pin support plates in any one of a number of predetermined rotational positions.

14. Apparatus according to claim 1 wherein either or both of the pin and the second pin have a mid-section formed between a first end section and a second end section, the first and second end sections having the same diameter and larger than the diameter of the mid-section, such that only the mid-section is exposed to the pin engagement portion of the arm assembly.

15. Apparatus according to claim 1 wherein either or both of the pin and the second pin are heat treated to increase the hardness of either or both the pin and second pin and thereby increase resistance to damage from engagement with the pin engagement portion of the arm assembly.

16. An implement connectable to one of a plurality of machine arm assemblies using the apparatus of claim 1 coupled to the spaced apart first and second pin support plates of the implement.

17. A method of connecting an implements to an arm assembly of machinery, the method having a first pin support plate spaced apart from a second pin support plate, each pin support plate having a pair of apertures defining first opposed apertures and second opposed apertures facing across a space between the first and second pin support plates, the method comprising:

providing a first pin and bush assembly including a pin and two pairs of bushes adapted to cooperate with the pin, wherein one pair of the bushes engages the first pin support plate and the other pair of bushes engages the second pin support plate such that a pair of inner bushes is defined on the pin with respect to the first and second pin support plates;

wherein further the length of the pin between the inner bushes is varied to accommodate the dimensions of a pin engagement portion of the arm assembly,

positioning the pin through each pair of bushes and through the first opposed apertures of the first and second pin support plates;

providing a second pin and positioning the second pin through the second opposed apertures of the pin support plates;

providing eccentric apertures in each bush of the pairs of bushes;

rotating the bushes with the eccentric apertures so as to adjust the spatial separation between the pin and the second pin;

affixing the pin and second pin to the first and second pin support plates; and

engaging the pin engagement portion of the arm assembly with the implement through the pin and second pin.
18. A method according to claim 17 further including the step of providing a second pin and bush assembly having the second pin and a pair of bushes adapted to cooperate with the second pin, the second pin extendable through the pair of bushes of the second pin and bush assembly and through the second opposed apertures of the first and second pin support plates.

19. A method according to claim 18 including the steps of engaging one of the bushes in said pair of bushes of said second pin and bush assembly with the first pin support plate and engaging the other bush in said pair of bushes of said second pin and bush assembly with the second pin support plate.

20. A method according to claim 19 including the step of providing the second pin and bush assembly with two pairs of bushes adapted to cooperate with the second pin, such that one pair of bushes engages the first pin support plate and the second pair of bushes engages the second pin support plate wherein a pair of inner bushes is defined on the second pin with respect to each of the first and second pin support plates, and the length of the second pin between the inner bushes of the second pin and bush assembly is variable to accommodate the dimensions of a pin engagement portion of the arm assembly of machinery.