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(54) **REMOVABLE WHEEL ASSEMBLY AND METHOD**

(71) Applicant: **Honda Motor Co., Ltd.**, Tokyo (JP)

(72) Inventors: **Jeremy N. ROLON**, Redondo Beach, CA (US); **Robert Antonio RANGEL**, Huntington Beach, CA (US); **Robert F. CURIEL**, Corona, CA (US); **Geemay CHIA**, Pasadena, CA (US); **Dillon KANE**, Los Angeles, CA (US)

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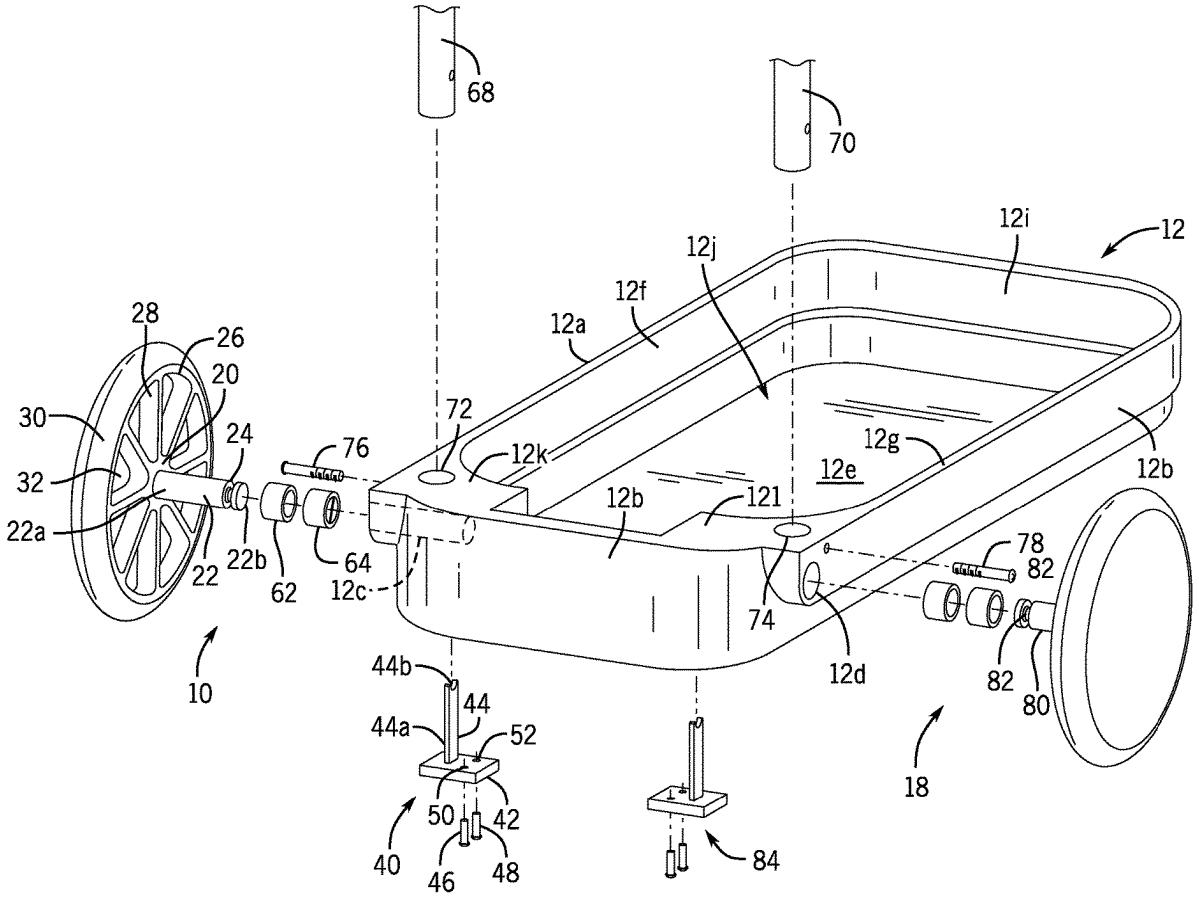
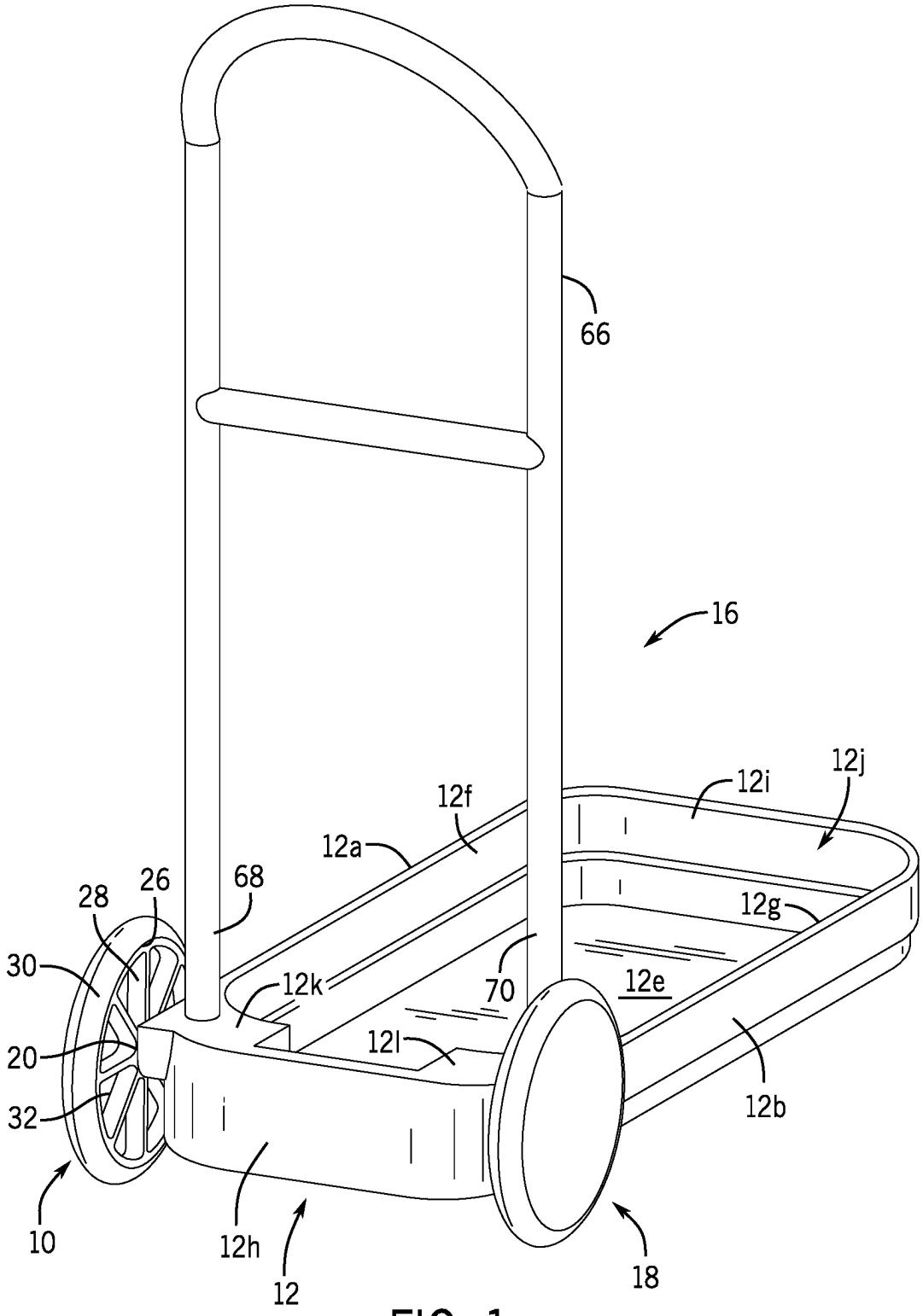
(57) **ABSTRACT**

A removable wheel assembly and method includes a wheel hub and an axle shaft fixedly secured to the wheel hub at a proximal end and having a circumferential groove defined therein. The wheel assembly also includes a wheel rim radially spaced apart from and concentric with the wheel hub, and a locking device having an engagement end that is radially received within the circumferential groove of the axle shaft for inhibiting axial movement of the axle shaft and thereby inhibiting axial movement of the wheel hub.

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16
12j
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12a
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12g
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12k
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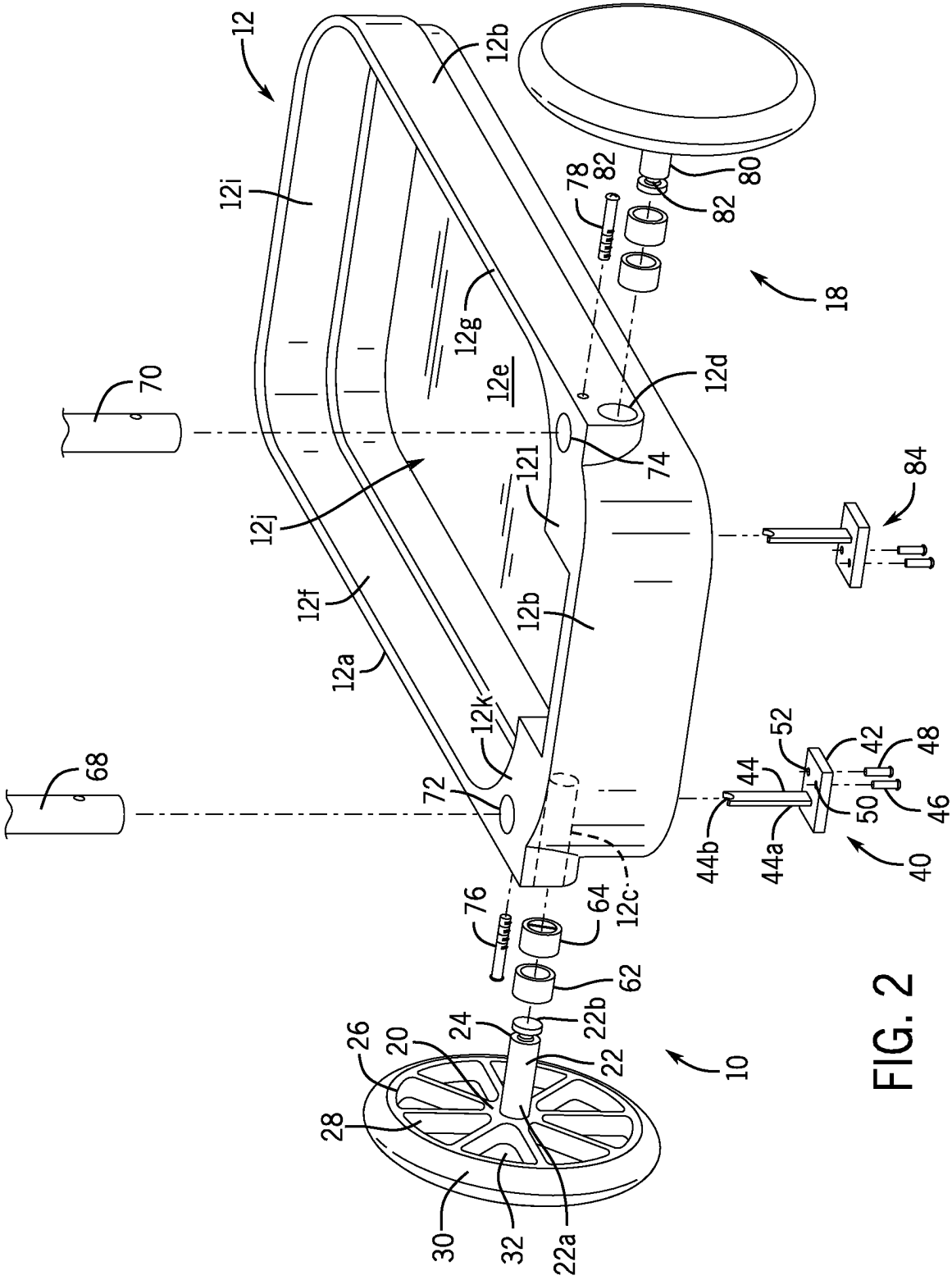
10
12h
12
18

FIG. 1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12b
12i
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121
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12a
12k
52
42
48
68
72
44
50
46
44b
44a
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76
64
12c
62
22b
24
26
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22
10
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30
32
22a

FIG. 2

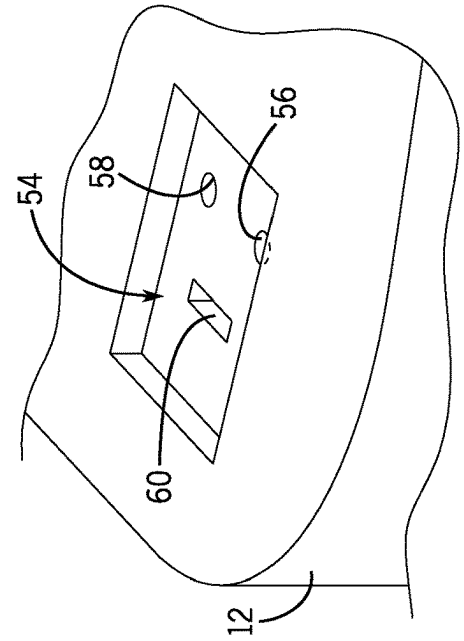
54
58
56
60
12

FIG. 4

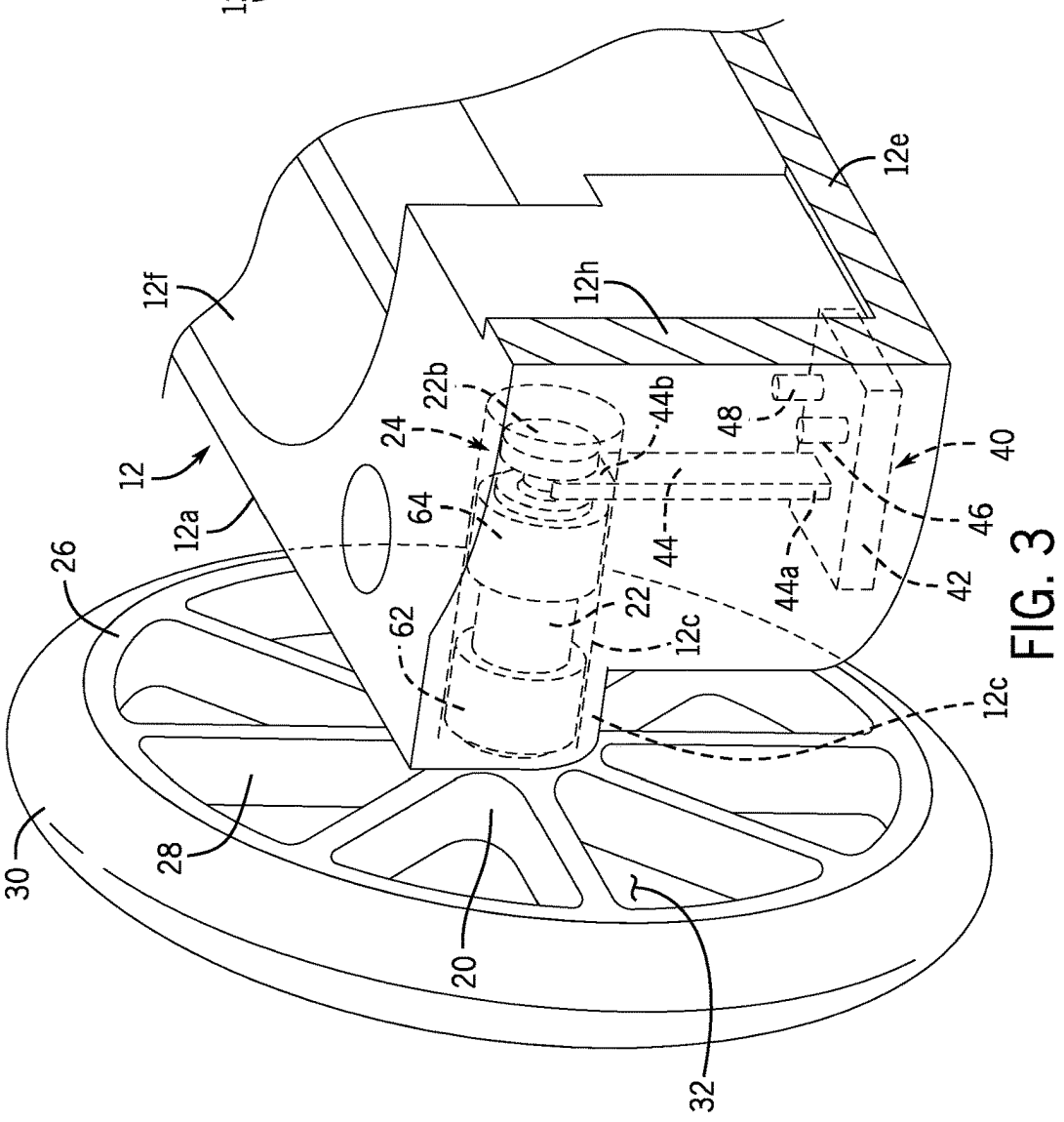
12e
12f
12h
22b
24
44b
48
40
12
12a
64
44
46
26
44a
42
62
22
12c
12c
28
30
20
32

FIG. 3

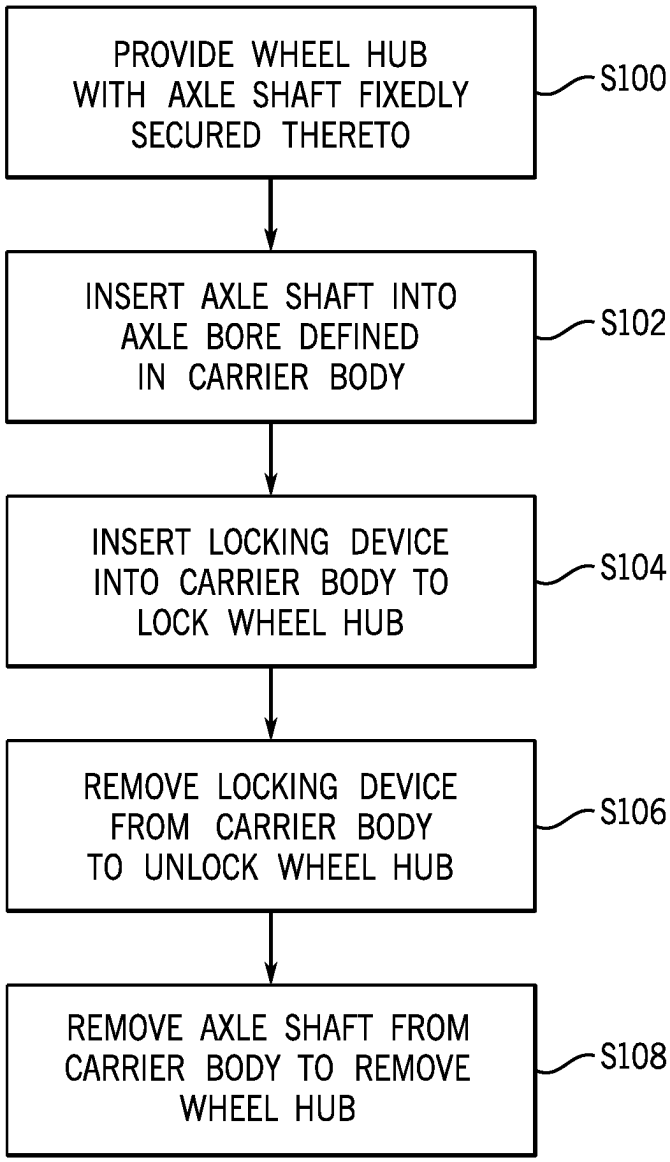
PROVIDE WHEEL HUB WITH AXLE SHAFT FIXEDLY SECURED THERETO
S100
INSERT AXLE SHAFT INTO AXLE BORE DEFINED IN CARRIER BODY
S102
INSERT LOCKING DEVICE INTO CARRIER BODY TO LOCK WHEEL HUB
S104
REMOVE LOCKING DEVICE FROM CARRIER BODY TO UNLOCK WHEEL HUB
S106
REMOVE AXLE SHAFT FROM CARRIER BODY TO REMOVE WHEEL HUB
S108

FIG. 5

REMOVABLE WHEEL ASSEMBLY AND METHOD

BACKGROUND

[0001] A variety of removable wheel systems are known. For example, an axle can be provided that extends across an entirety of a body (for example, a carrying platform) and has wheels axially secured to each end of the axle by cotter pins or some other retaining clip. One specific example of this configuration is found in hand trucks or dollies in which a flat or plate-like base member is provided and has an axle rotatably affixed thereto. The axle extends across an entirety of the base member with wheels secured at either end. An upright support structure is provided orthogonal to the base member for manipulating a load carried by the base member and optionally for providing a secondary support for the load. In another example, an axle shaft is provided with a circumferential groove at an end thereof and a corresponding locking pin is configured to insert into the groove to lock a wheel to the axle shaft. In particular, the locking pin is spring loaded and movably fixed to the removable wheel.

BRIEF DESCRIPTION

[0002] According to one aspect, a wheel assembly includes a wheel hub and an axle shaft fixedly secured to the wheel hub at a proximal end thereof and having a circumferential groove defined therein. The wheel assembly also includes a wheel rim radially spaced apart from and concentric with the wheel hub, and a locking device having an engagement end that is radially received within the circumferential groove of the axle shaft for inhibiting axial movement of the axle shaft and thereby inhibiting axial movement of the wheel hub.

[0003] According to another aspect, a removable wheel assembly for a carrier body includes a wheel hub having a wheel rim radially disposed thereabout and a short axle shaft fixedly secured to the wheel hub. The short axle shaft defines a circumferential groove that is spaced apart from the wheel hub. The removable wheel assembly further includes a locking device having an engagement end radially receivable in the circumferential groove of the short axle shaft for locking the short axle shaft within an axle bore of the carrier body.

[0004] According to a further aspect, a removable wheel method includes provision of a wheel hub with an axle shaft fixedly secured to the wheel hub at a proximal end thereof. The axle shaft has a circumferential groove defined therein. The wheel hub supports a wheel rim in radially spaced relation relative to the wheel hub and the axle. The method further includes insertion of the axle shaft into an axle bore defined in a carrier body and insertion of a locking device into the carrier body such that an engagement end of the locking device is radially received in the circumferential groove of the axle shaft to inhibit axial movement of the axial shaft thereby preventing removal of the wheel hub from the carrier body.

BRIEF DESCRIPTION OF DRAWINGS

[0005] FIG. **1** is a perspective view of a carrier assembly having a pair of removable wheel assemblies thereon in accord with an exemplary embodiment;

[0006] FIG. **2** is an exploded perspective view of the carrier assembly of FIG. **1**.

[0007] FIG. **3** is a partial enlarged view of one of the removable wheel assemblies of claim **1** shown secured to a carrier body of the carrier assembly of FIG. **1**.

[0008] FIG. **4** is a partial englarged perspective view of an underside of the carrier body shown with a locking device removed therefrom.

[0009] FIG. **5** is a block diagram illustrating a removable wheel method in accord with an exemplary embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0010] It should, of course, be understood that the description and drawings herein are merely illustrative and that various modifications and changes can be made in the structures disclosed without departing from the present disclosure. Spatially relative terms may be used to describe an element and/or features relationship to another element(s) and/or feature(s) as, for example, illustrated in the figures. Moreover, any term of degree used herein, such as "substantially" and "approximately" means a reasonable amount of deviation of the modified word is contemplated such that the end result is not significantly changed.

[0011] Referring now to the drawings, wherein like numerals refer to like parts throughout the several views, FIGS. **1-3** illustrates a removable wheel assembly **10** for a carrier body **12** according to one embodiment of the present disclosure. In the illustrated embodiment, the carrier body **12** can be the base of a carrier assembly **16**. In one embodiment, the carrier assembly **16** is a hand truck or dolly of the type used to carry loads on the carrier body **12**. However, it is to be appreciated by those skilled in the art that the carrier body **12** could be any carrier body associated with a variety of assemblies, including for example a dolly, a cart, etc., and need not be configured as a hand truck as shown in the illustrated embodiment.

[0012] Also, the removable wheel assembly **10** is one of two removable wheel assemblies **10**, **18** in the illustrated embodiment in that the wheel assembly **10** is provided on a first side **12***a* of the carrier body **12** and the wheel assembly **18** is provided on a second side **12***b* of the carrier body **12** that is opposite the first side **12***a*. As shown, the wheel assemblies **10**, **18** can be identical to one another and so only wheel assembly **10** will be described in further detail herein, though it is to be appreciated that all details discussed in reference to wheel assembly **10** are applicable to the wheel assembly **18**.

[0013] More particularly, the wheel assembly **10** includes a wheel hub **20** and an axle shaft **22** fixedly secured to the wheel hub **20** at a proximal end **22***a* thereof. In particular, the axle shaft **22** can be welded to the wheel hub **20**. Alternatively, the axle shaft **22** can be co-molded with the wheel hub **20** or otherwise integrally formed with the wheel hub **20** so as to comprise a unitary component. The axle shaft **22** of the illustrated embodiment is a short axle shaft **22** that has a circumferential groove **24** defined therein that is spaced apart from the wheel hub **20**. In particular, in the illustrated embodiment, the circumferential groove **24** is defined in the axle shaft **22** at or adjacent a distal end **22***b* of the axle shaft **22** (i.e., the distal end **22***b* is distal relative to the wheel hub **20**). The wheel assembly **10** also includes a wheel rim **26** radially spaced apart from and concentric with the wheel hub **20**. More specifically, the wheel hub **20** has the wheel rim **26** radially disposed thereabout. Spokes **28** can extend radially between the wheel hub **20** and the wheel rim **26**, and

a tire **30** can be annularly disposed on the wheel rim **26**. In the illustrated embodiment, a cover member is disposed axially on one side of the spokes **28**, thought this is not required.

[0014] The wheel assembly **10** further includes a locking device **40** for selectively locking both the wheel hub **20** and the axle shaft **22**, which is fixedly secured to the wheel hub **20**, to the carrier body **12**. In particular, the locking device **40** includes a base portion or locking plate **42** and a shaft portion or extension arm **44**. The shaft portion **44** has a proximal end **44***a* fixed to the base portion **42** and an engagement end **44***b* disposed distally relative to the base portion **42**. The engagement end **44***b* can be radially received within the circumferential groove **24** of the axle shaft **22** for inhibiting axial movement of the axle shaft **22** and thereby inhibiting axial movement of the wheel hub **20** relative to the carrier body **12**. In other words, the locking device **40** has the engagement end **34***b* that is radially receivable in the circumferential groove **24** of the axle shaft **22** for locking the axle shaft **22** within a first axle bore **12***c* of the carrier body **12**. In the illustrated embodiment, the engagement end **44***b* can be complementarily formed in a semi-circular shape so as to substantially match and correspond with the portion of the axle shaft **22** defining the circumferential groove **24**.

[0015] The wheel assembly **10** can also include threaded members **46**, **48** received in corresponding throughholes **50**, **52** defined in the base portion **42** to secure the base portion **42** to an associated body (e.g., the carrier body **12** in the illustrated embodiment) and thereby axially secure the axle shaft **22** to the carrier body **12**. More particularly, in the illustrated embodiment, the throughholes **50**, **52** are spaced apart from the shaft portion **44**. With additional reference to FIG. **4**, the carrier body **12** can include a recessed portion **54** in which the base portion **42** can be accommodated so as to present a flush or near flush appearance. The carrier body **12** can also include threaded bores **56**, **58** into which the threaded members **46**, **48** are threadedly received to removably secure the locking device **40** to the carrier body **12**.

[0016] In a locked state, the shaft portion **44** extends through a locking slot **60** defined in the carrier body **12** and connected to the first axle bore **12***c* to extend into the circumferential groove **24** of the axle shaft **22** to lock the axle shaft **22** in the carrier body **12**. In an unlocked state, the shaft portion **44** is removed from the locking slot **60** to allow for removable of the axle shaft **22** from the carrier body **12**. Also in the locked state, the base portion **42** is lockable to the carrier body **12** to lock the shaft portion **44** in the locking slot **60** and to lock the engagement end **34***b* in the circumferential groove **24** to hereby lock the axle shaft **22** in the carrier body **12**.

[0017] The wheel assembly **10** can additionally include at least one annular bearing, and in the illustrated embodiment includes a pair of annular bearings **62**, **64** that are annularly disposed on the axle shaft **22**. In particular, in the illustrated embodiment, the at least one annular bearing can include first annual bearing **62** axially spaced form the wheel hub **20** and a second annular bearing **64** axially spaced apart from the wheel hub **20** and from the first annular bearing **62**. The annular bearings **62**, **64** can facilitate rotation of the axle shaft **22** and thereby the wheel hub **20** relative to the carrier body **12**.

[0018] As discussed above, the carrier body **12** defines the axle bore **12***c* in the first side **12***a* into which the axle shaft **22** is receivable. The annular bearings **62**, **64** are annularly disposed on the axle shaft **22** and radially disposed between the axle shaft **22** and a portion of the carrier body **12** defining the axle bore **12***c*. As shown, the first axle bore **12***c* can extend only partially into the carrier body **12**. That is, the first axle bore **12***c* can have an axial dimension that is less than a width dimension between the first and second sides **12***a*, **12***b* of the carrier body **12**. In particular, the first axle bore **12***c* can have an axial dimension that is short relative to the width dimension of the carrier body **12** and corresponds to the axial length of the axle shaft **22** allowing the axle shaft **22** to be a short axle shaft **22**. A second axial bore **12***d* can be provided in the second side **12***b* for accommodating the second wheel assembly **18** and can be a mirror image of the first axial bore **12***c*.

[0019] In one example, the axial length of the axle shaft **22** and the first axle bore **12***c* can be less than half the width dimension of the carrier body. In a more particular example, the axial length of the axle shaft **22** and the first axle bore **12***c* can be less than one third the width of the carrier body **12**. This is advantageous in that the carrier body **12** be sized and shaped to accommodate the shorter axial dimension of the axial bore **12***c* thereby providing increased carrying capacity within the carrier body **12**.

[0020] More particularly, in the illustrated embodiment, the carrier body **12** can include a base portion or wall **12***e* having sidewalls **12***f*, **12***g*, **12***h* and **12***i* extending orthogonally upward therefrom. In particular, the sidewall **12***f* can extend upward to form the first side **12***a* and the sidewall **12***g* can extend upward opposite the sidewall **12***f* to form the second side **12***b*. The sidewalls **12***h* and **12***i* can extend between and connect to the sidewalls **12***f* and **12***g*. The sidewalls **12***f*, **12***g*, **12***h*, **12***i* together can form a cargo or receptable area **12***j* in which associated items can be loaded, carried by the carrier body **12** and later unloaded. The recessed portion **54** is particularly disposed on an underside of the base portion or wall **12***e* as best shown in FIG. **4**.

[0021] Where the sidewall **12***h* meets with the sidewalls **12***f* and **12***g*, respectively, corner portions **12***k*, **12***l* can be provided with increased dimensions and size for accommodating the axial bores **12***c*, **12***d*. These corner portions **12***k*, **12***l* can extend partially into the cargo area **12***j* thereby reducing an overall volume available in the cargo area **12***j*. Accordingly, having these corner portions **12***k*, **12***l* reduced in size (i.e., they do not extend across the carrier body **12**) is advantageous in that more volume can be provided in the cargo area **12***j*. Thus, the shorter axial dimension of the axle shaft **22** and thereby the shorter required axial dimension for the axle bore **12***c* advantageously increases the cargo volume available by the carrier body **12**.

[0022] In the illustrated embodiment, an upright handle member **66** can extend upward from the carrier body **12** for manual manipulation of the carrier body **12**. IN particular, the upright handle member **66** can include legs **68**, **70** receivable in handle bores **72**, **74** defined in or near the corner portions **12***k*, **12***l* of the carrier body and secured to the carrier body **12** via fasteners **76**, **78**, such as threaded fasteners or bolts. Of course, other handle members could be used instead of handle member **66** and/or other connects between the handle member **66** and the legs **68**, **70** could be provided. By the illustrated arrangement, the carrier body **12** can be manipulated together with the wheel assemblies **10**, **18** to provide a hand truck assembly. Of course, it is to be appreciated that the carrier body **12** need not be configured

as shown in the illustrated embodiment and/or the upright handle member **66** need not be provided or, as already mentioned, could be alternatively provided.

[0023] As mentioned, the wheel hub **20** and the axle shaft **22** correspond to the first wheel assembly **10** and are thus a first wheel hub **20** and a first axle shaft **22**. The second wheel assembly **18** can likewise include a second wheel hub (not shown) and a second axle shaft **80** fixedly secured to the second wheel hub at a proximal end thereof and having a second axle circumferential groove **82** defined therein. A second locking device **84** can be provided for selectively locking the second wheel assembly **18** to the carrier body **12**. When both wheel assemblies **10**, **18** are locked to the carrier body **12**, as shown in FIG. **1**, the first and second axle shafts **22**, **60** can be coaxial and axially spaced apart from one another.

[0024] Both wheel assemblies **10**, **18** are easily removable from the carrier body **12** by removing the threaded members (e.g., threaded members **46**, **48**) and then removing the locking devices (e.g., locking device **40**). Once the locking devices are removed, the axles **22**, **80** can be removed from their respective bores **12***c*, **12***d*. Optionally, the wheel assemblies **10**, **18** can be interchangeable with different types of wheels depending on the intended use. For example, larger wheels could be installed, such as for sand and/or softer surfaces; smaller, harder wheels can be used for smooth surfaces, pneumatic wheels could be used; hard rubber wheels could be used, scooter tires could be used, etc. Optionally, the wheel assemblies **10**, **18** can be removed and the carrier body **12** used without any wheels.

[0025] A removable wheel method will now be described with reference to FIG. **4**. In particular, the method will be described with respect to the wheel assembly **10** described herein but this is not required and the method could be used with other wheel assemblies. In the method, at S**100**, wheel hub **20** with axle shaft **22** fixedly secured to the wheel hub **20** at the proximal end **22***a* thereof is provided. As discussed hereinabove, the axle shaft **22** has the circumferential groove **24** defined herein and the wheel hub **20** supports the wheel rim **26** in radially spaced relation relative to the wheel hub **20** and the axle **22**. At S**102**, the axle shaft **22** is inserted into the axle bore **12***c* defined in the carrier body **12**. At S**104**, the locking device **40** is inserted into the carrier body **12** such that the engagement end **44***b* of the locking device **40** is radially received in the circumferential groove **24** of the axle shaft **22** to inhibit axial movement of the axial shaft **22** thereby preventing removable of the wheel hub **20** from the carrier body **12**.

[0026] When desired to remove the wheel assembly **10**, the method can continue at S**106** wherein the locking device **40** is removed from the carrier body **12** to remove the engagement end **34***b* from the circumferential groove **24** to unlock the wheel hub **20** from the carrier body **12**. Then, at S**108**, the axle shaft **22** can be removed from the axle bore **12***c* defined in the carrier body **12** to remove the wheel hub **20** and the wheel rim **26** from the carrier body **12**. If desired, a different wheel assembly (e.g., one with differently sized and/or configured tires) can be installed on the carrier body **12**.

[0027] It will be appreciated that various of the above-disclosed and other features and functions, or alternatives or varieties thereof, may be desirably combined into many other different systems or applications. Also that various presently unforeseen or unanticipated alternatives, modifications, variations, or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

1. A wheel assembly, comprising:

a wheel hub;

an axle shaft fixedly secured to the wheel hub at a proximal end thereof and having a circumferential groove defined therein;

a wheel rim radially spaced apart from and concentric with the wheel hub; and

a locking device having an engagement end that is radially received within the circumferential groove of the axle shaft for inhibiting axial movement of the axle shaft and thereby inhibiting axial movement of the wheel hub.

2. The wheel assembly of claim **1** wherein the circumferential groove is defined in the axle shaft adjacent a distal end of the axle shaft.

3. The wheel assembly of claim **1** wherein the locking device includes a base portion and a shaft portion, the shaft portion having a proximal end fixed to the base portion and having the engagement end disposed distally relative to the base portion.

4. The wheel assembly of claim **3** further including threaded members received in throughholes defined in the base portion to secure the base portion to an associated body and thereby axially secure the axle shaft to the associated body.

5. The wheel assembly of claim **1** further including at least one annular bearing annularly disposed on the axle shaft.

6. The wheel assembly of claim **5** wherein the at least one annular bearing includes a first annular bearing axially spaced from the wheel hub and a second annular bearing axially spaced from the wheel hub and from the first annular bearing.

7. The wheel assembly of claim **1** further including a carrier body defining an axle bore in a sidewall thereof into which the axle shaft is receivable.

8. The wheel assembly of claim **7** further including at least one annular bearing annularly disposed on the axle shaft and radially disposed between the axle shaft and a portion of the carrier body defining the axle bore.

9. The wheel assembly of claim **7** wherein the axle shaft is a short axle shaft extending only partially into the axle bore of the carrier body.

10. The wheel assembly of claim **7** further including an upright handle member extending upward from the carrier body for manual manipulation of the carrier body.

11. The wheel assembly of claim **1** wherein the wheel hub and the axle shaft are, respectively, a first wheel hub and a first axle shaft, wherein the wheel assembly further includes a second wheel hub and a second axle shaft fixedly secured to the second wheel hub at a proximal end thereof and having a second axle circumferential groove defined therein, wherein the first and second axle shafts are coaxial and axially spaced apart from one another.

12. The wheel assembly of claim **1** wherein the axle shaft is welded to the wheel hub.

13. The wheel assembly of claim **1** further including spokes extending radially between the wheel hub and the wheel rim, and a tire annularly disposed on the wheel rim.

14. A removable wheel assembly for a carrier body, comprising:

a wheel hub having a wheel rim radially disposed thereabout;

a short axle shaft fixedly secured to the wheel hub, the short axle shaft defining a circumferential groove that is spaced apart from the wheel hub; and

a locking device having an engagement end radially receivable in the circumferential groove of the short axle shaft for locking the short axle shaft within an axle bore of the carrier body.

15. The removable wheel assembly of claim **14** wherein the axle bore extends only partially into the carrier body.

16. The removable wheel assembly of claim **15** wherein the locking device includes an extension arm having the engagement end disposed at one end thereof, wherein, in a locked state, the extension arm extends through a locking slot defined in the carrier body and connected to the axle bore to extend into the circumferential groove of the short axle shaft to lock the short axle shaft in the carrier body, and, in an unlocked state, the extension arm is removed from the locking slot to allow removal of the short axle shaft from the carrier body.

17. The removable wheel assembly of claim **16** wherein the locking device further includes a locking plate disposed at another end that is opposite said one end, the locking plate lockable to the carrier body to lock the extension arm in the locking slot and to lock the engagement end in the circumferential groove to thereby lock the short axle shaft in the carrier body.

18. The removable wheel assembly of claim **17** wherein the locking plate includes at least two throughholes that receive threaded fasteners to lock the locking plate to the carrier body.

19. A removable wheel method, comprising:

providing a wheel hub with an axle shaft fixedly secured to the wheel hub at a proximal end thereof, the axle shaft having a circumferential groove defined therein, the wheel hub supporting a wheel rim in radially spaced relation relative to the wheel hub and the axle;

inserting the axle shaft into an axle bore defined in a carrier body; and

inserting a locking device into the carrier body such that an engagement end of the locking device is radially received in the circumferential groove of the axle shaft to inhibit axial movement of the axle shaft thereby preventing removal of the wheel hub from the carrier body.

20. The removable wheel method of claim **19**, further including:

removing the locking device from the carrier body to remove the engagement end from the circumferential groove to unlock the wheel hub from the carrier body; and

removing the axle shaft from the bore defined in the carrier body to remove the wheel hub and wheel rim from the carrier body.

* * * * *