

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 35906-426WO01	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/US2020/028111	International filing date (day/month/year) 14.04.2020	Priority date (day/month/year) 15.04.2019	
International Patent Classification (IPC) or national classification and IPC INV. E02F9/28			
Applicant Hensley Industries, Inc.			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of <u>9</u> sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. ☒ (sent to the applicant and to the International Bureau) a total of <u>35</u> sheets, as follows: ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions). ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2). ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)). b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in the form of an Annex C/ST.25 text file, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3ter of Annex C of the Administrative Instructions).			
4. This report contains indications relating to the following items: ☒ Box No. I Basis of the report ☐ Box No. II Priority ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability ☐ Box No. IV Lack of unity of invention ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement ☐ Box No. VI Certain documents cited ☒ Box No. VII Certain defects in the international application ☒ Box No. VIII Certain observations on the international application			
Date of submission of the demand 15.02.2021		Date of completion of this report 17.06.2021	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465		Authorized officer Kühn, Thomas Telephone No. +49 89 2399-7883	



INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2020/028111

Box No. I Basis of the report

1. With regard to the **language**, this report is based on
- ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
 - ☐ international search (under Rules 12.3(a) and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4(a))
 - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a) and (b))
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-28 as originally filed

Claims, Numbers

1-38 filed with the demand for preliminary international examination

Drawings, Sheets

1/18-18/18 as originally filed

- ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
4. ☒ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
- ☐ the description, pages
 - ☒ the claims, Nos. 23,25
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
5. ☐ This report has been established:
- ☐ taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
 - ☐ without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2020/028111

6. ☒ With regard to top-up searches (Rules 66.1 *ter* and 70.2(f)):
- ☒ A top-up search was carried out by this Authority on 19.02.2021 (all discovered documents are listed in the Supplemental Box Relating to Top-up Search).
 - ☐ Additional relevant documents have been discovered during the top-up search.
 - ☐ No top-up search was carried out by this Authority because it would serve no useful purpose.
7. ☐ Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

* If item 4 applies, some or all of those sheets may be marked "superseded".

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>1-22, 29-34, 36-38</u>
	No: Claims	<u>23-25, 27, 28</u>
Inventive step (IS)	Yes: Claims	<u>1-22, 29-34, 36-38</u>
	No: Claims	<u>23-25, 27, 28</u>
Industrial applicability (IA)	Yes: Claims	<u>1-25, 27-34, 36-38</u>
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Relevant prior art

Reference is made to the following documents:

- D1 US 2014/013635 A1 (CUI KAN [US]) 16 January 2014 (2014-01-16)
- D2 WO 2013/033751 A1 (CQMS PTY LTD [AU]; GUIMARAES MIGUEL [AU] ET AL.) 14 March 2013 (2013-03-14)
- D3 KR 101 911 513 B1 (SUNGBO IND CO LTD [KR]) 24 October 2018 (2018-10-24)
- D4 US 2010/162594 A1 (BIERWITH ROBERT S [US]) 1 July 2010 (2010-07-01)

2 Amendments not taken into account

According to Article 19(2) PCT, the amendments shall not go beyond the disclosure in the international application as filed.

2.1 Independent claim 23

In claim 23 it has been further specified that the locking pin assembly further comprises "a rotatable lock portion which is coupled to the body portion". However, according to paragraphs [0053] and [0054], the locking pin assembly 106 includes, among other components, a body portion 110 and a shaft member, whereby the shaft member 112 is partially disposed within and extends from a locking cavity 125, which is an opening in the body portion 110 through the head 124. Shaft member 112 includes a tang 126 which protrudes radially from the shaft member 112 outside of the body portion 110. The tang 126 is the feature which provides mechanical interference with the wear member 104 to prevent the locking pin assembly 106 from being extracted from the bore 160 in the locked position. Consequently, the added feature is a generalization of the originally disclosed shaft member having a radially protruding tang which is rotatably received in a locking cavity of the body portion.

2.2 Independent claim 25

Claim 25 includes the further features of original claim 26 and the feature that "the installation ramp comprises an integrated helical portion and an integrated

flat portion".

According to paragraph [0085] "rotation of the shaft member 112 is translated into axial movement by the tang 126 sliding across the installation ramp 182, forcing the locking pin assembly 106 into a seated position within the bore 160. The last portion of travel of the tang 126 during rotation into the locked position may correspond to a portion of the installation ramp 182 which is flat, rather than ramped, and oriented transverse to the bore 160". Moreover, according to paragraph [0088], "for example, the transverse end portion of the installation ramp may effectively have a slope of zero".

There is no basis for a broader definition of an installation ramp comprising an integrated flat portion, since only an installation ramp is disclosed, which has an end portion having a slope of zero corresponding to the last portion of travel of the tang during rotation into the locked position.

- 2.3 Therefore, this opinion has been established as if such amendment had not been made (cf. Rule 70.2(c) PCT).

3 Independent claim 1

- 3.1 D1 is regarded as being the prior art closest to the subject-matter of claim 1, and discloses (see in particular paragraphs [0021]-[0041] and figs 1-6) a locking pin assembly 10 for securing a ground engaging member to a support structure, comprising:
- a body portion 20 arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;
 - a shaft member 40 comprising a distal end 46 and a proximal portion 36, the distal end having a first engagement feature 37b, and the distal end being disposed within the body portion (cf. figs. 4-7);
 - a tang 34 extending radially from the proximal portion of the shaft member outside the body portion,
 - the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure (cf. paragraphs [0023]-[0026]);
 - a biasing member 39 disposed within the body portion; and
 - a plunger 50 disposed between the biasing member and the distal end of the

shaft member, the plunger comprising a second engagement feature 57b configured to selectably engage the first engagement feature 47b of the shaft member, wherein the biasing member 39 urges the plunger toward the shaft member (cf. fig.6).

- 3.2 The subject-matter of claim 1 therefore differs from this known locking pin assembly in that
- the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions

- 3.3 The problem to be solved by the present invention may therefore be regarded as to provide an alternative engagement feature.

- 3.4 The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

The provision of an engagement feature which provides resistance during rotation in each of two opposing directions in conjunction with a locking pin assembly for securing a ground engaging member to a support structure is neither known nor rendered obvious by the available prior art.

According to D1, the saw-tooth teeth permit rotation in only one direction.

Moreover, a person skilled in the art would get no incentive from D1 to modify the saw-tooth design such that a resistance is provided during rotation of the shaft member relative to the plunger in each of two opposing directions.

4 Claims 2-21

Claims 2-21 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

5 Independent claims 22, 29, 33, 37

Independent claims 1, 22, 29, 33, 37 relate effectively to the same subject-matter. The reasoning as set out with respect to independent claim 1 applies likewise with respect to independent claims 22, 29, 33 and 37.

5.1 Claims 30, 34, 36, 38

These claims are dependent on claims 29, 33 and 37 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

6 Independent claim 23

Notwithstanding the clarity objection below, D3 discloses (see in particular figs. 8a,8b,11a,11b) a "locking pin assembly" for securing a ground engaging member to a support structure, comprising:

- a body portion including an outer surface having a proximal end and a distal end;
- a head disposed at the proximal end, the head having a perimeter, a portion of the perimeter having a non-circular shape 32 configured to be received within a correspondingly shaped proximal recess in a wall of the ground engaging member; and
- a tip disposed at the distal end 312; 312a a portion of the tip having a non-circular peripheral profile configured to be received within a correspondingly shaped distal recess in a portion of the ground engaging member opposite the proximal recess,
- wherein engagement of the head with the proximal recess and the tip with the distal recess prevents rotation of the body portion relative to the ground engaging member.

7 **Claim 24**

The features as comprised in claim 24 are known from D3, figs. 8a,8b,11a,11b: flat surface 3132.

8 **Independent claim 25**

D2 discloses (see in particular figs. 2A and 2B) a wear member 1100 for installation on an adapter 1200 carried on earth engaging equipment using a locking pin assembly, comprising:

- an external surface;
- an internal surface defining a cavity (cf. fig. 2A);
- a bore 1120, 1130 passing through the wear member from the external surface on a first wall to the external surface on a second wall opposite the first wall;
- an installation ramp 1124A disposed adjacent the bore and configured to engage a first surface of a tang 1316 of the locking pin assembly 1311 when the locking pin assembly is disposed within the bore as the tang is rotated in a first direction from an unlocked configuration to a locked configuration; and
- a removal ramp 1124B disposed adjacent the bore and configured to engage a second surface of the tang opposite the first surface of the tang 1316 as the tang is rotated in a second direction opposite the first direction from the locked configuration to the unlocked configuration.

9 **Claims 26-28**

The features as comprised in claims 26-28 are known from D2, figs. 2A and 2B.

10 **Independent claim 31**

- 10.1 D1 is regarded as being the prior art closest to the subject-matter of claim 31, and discloses (cf. paragraph [0024] and figs. 1-6) a method for locking a wear member to or removing a wear member from a nose carried on earth engaging equipment using a locking pin assembly, the method comprising
- first rotating, while the locking pin assembly is disposed within a bore passing through the wear member and the nose, a shaft member of the locking pin assembly relative to a body portion of the locking pin assembly in a first direction through a first range of motion in which a first surface of a tooth of the shaft member engages a corresponding first surface of a notch of a plunger disposed within the body portion, wherein the plunger is substantially rotationally fixed with respect to the body portion and rotation of the shaft member through the first range of motion axially displaces the plunger toward a biasing member from an initial position to a compressed position; and
 - second rotating the shaft member relative to the body portion in the first direction through a second range of motion in which a second surface of the tooth slides relative to a corresponding second surface of the notch, wherein during rotation of the shaft through the second range of motion the biasing member returns the plunger to the initial position.
- 10.2 The subject-matter of claim 31 therefore differs from this known method in that
- the first and second rotating moves a locking feature extending from the locking pin assembly from a first configuration to a second configuration, wherein when the locking feature is in one of the first and second configurations the locking feature interfaces with the wear member or nose to prevent withdrawal of the locking pin assembly from the wear member and
 - when the locking feature is in the other of the first and second configurations the locking pin assembly is removable from the wear member and is therefore new (Article 33(2) PCT).
- 10.3 The problem to be solved by the present invention may be regarded as facilitating the movement of the shaft member between locked and unlocked positions.
- 10.4 The solution to this problem proposed in claim 31 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:
- None of the available prior art discloses to use such a locking feature in order to realize a haptic feedback to a user when switching between locked and unlocked positions.

10.5 Claim 32

Claim 32 is dependent on claim 31 and as such also meets the requirements of the PCT with respect to novelty and inventive step.

11 Industrial applicability

The locking pin assembly according to claims 1-24, 29-30, 33,34,36-38, the wear member according to claims 25,27,28 and the method for locking a wear member to or removing a wear member from an adapter according to claims 31, 32 can be made and used in industry (Article 33(4) PCT).

Re Item VII

Certain defects in the international application

- 1 The claims are not numbered consecutively in Arabic numerals as required by Rule 6.1(b) PCT since claims 26 and 35 do not exist.
- 2 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
- 3 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in D1-D4 is not mentioned in the description, nor are these documents identified therein.

Re Item VIII

Certain observations on the international application

- 1 Although claims 1, 22, 23, 29, 33, 37 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 6 PCT.
- 2 Claim 23 relates to a "locking pin assembly". However, claim 23 merely defines one component of the locking pin assembly, i.e. a "body portion" of the locking pin assembly which renders claim 23 unclear (Art.6 PCT).
- 3 In claim 37 it is defined that the second tooth engages the first tooth to provide resistance during rotation in two opposing directions. However, it is unclear which parts are rotated relative to each other (Art.6 PCT).

**IN THE INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY
(IPEA/EP)**

Application of: Bilal	§	Docket No.: 35906.426WO01
	§	
Application No.: PCT/US2020/028111	§	
	§	
Int'l Filing Date: 14 April 2020	§	
	§	
For: POSITION-BIASED LOCKING	§	
PIN ASSEMBLY FOR A	§	
GROUND ENGAGING WEAR	§	
MEMBER	§	

**RESPONSE TO THE WRITTEN OPINION OF THE INTERNATIONAL SEARCH
AUTHORITY UNDER ARTICLE 34**

Via EPO
European Patent Office
P.B. 5818 Patentlaan
2 NL-2280 HV Rijswijk

In accordance with the PCT Rules, Applicant hereby responds to the Written Opinion of the International Search Authority and demands Chapter II examination under Article 34, in the above-referenced international application.

If any fees, including extension-of-time fees, are necessary, the extension of time is hereby requested, and the Commissioner is hereby authorized to charge any fees (or credit any overpayments) to Haynes and Boone, LLP's European Deposit Account No. **28300270**

Amendments to the Claims begin on page 2.

Remarks begin on page 12.

Clean Claims begin on page 16.

AMENDMENTS TO THE CLAIMS

Please replace the original claims with the claim set below:

1. (Original) A locking pin assembly for securing a ground engaging member to a support structure, comprising:
 - a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;
 - a shaft member comprising a distal end and a proximal portion, the distal end having a first engagement feature, and the distal end being disposed within the body portion;
 - a tang extending radially from the proximal portion of the shaft member outside the body portion, the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;
 - a biasing member disposed within the body portion; and
 - a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions.
2. (Original) The locking pin assembly of claim 1, wherein the first engagement feature and the second engagement feature are configured to rotate relative to one another when a rotational force applied to the shaft member exceeds a magnitude of the resistance to rotation exerted by the biasing member to rotate the shaft member from one of the first position and the second position to the other of the first position and the second position.

3. (Original) The locking pin assembly of claim 2, wherein the first engagement feature, the second engagement feature, and the biasing member are configured so that the resistance to rotation exerted by the biasing member occurs during a first portion of rotational travel and does not occur during a second portion of rotational travel.

4. (Original) The locking pin assembly of claim 3, wherein one of the first and second engagement features comprises two adjacent notches separated by a resistance peak, and the other of the first and second engagement features comprises a tooth configured to selectably seat within each of the two notches.

5. (Original) The locking pin assembly of claim 4, wherein the resistance peak comprises a planar surface extending between a first angled surface and a second angled surface, the first and second angled surfaces defining opposing sides of the one of the first and second engagement features.

6. (Original) The locking pin assembly of claim 5, wherein the first and second angled surfaces are angled with respect to a direction of rotation of the shaft member in a range of about 60° to 80°.

7. (Original) The locking pin assembly of claim 4, wherein the resistance peak is disposed approximately midway between the two adjacent notches.

8. (Original) The locking pin assembly of claim 7, wherein the two adjacent notches are centered approximately 90 degrees apart.

9. (Original) The locking pin assembly of claim 8, wherein the other of the first and second engagement features comprises a third notch, and wherein the resistance peak is sized and shaped to fit within the third notch when the tooth is seated within one of the two adjacent notches.

10. (Original) The locking pin assembly of claim 8, wherein the first engagement feature, the

second engagement feature, and the biasing member are configured so that rotation of the shaft member between the two adjacent notches provides haptic feedback to a user confirming transition from the first position to the second position.

11. (Original) The locking pin assembly of claim 10, wherein the first engagement feature, the second engagement feature, and the biasing member are configured so that rotation of the shaft member between the two adjacent notches provides haptic feedback to a user confirming transition from the second position to the first position.

12. (Original) The locking pin assembly of claim 1, further comprising a rotation stopping element, and wherein the shaft member comprises a partially circumferential groove formed therein, and the rotation stopping element configured to mechanically interfere with opposing end portions of the groove to limit a range of rotation of the shaft member relative to the body portion.

13. (Original) The locking pin assembly of claim 12, wherein the groove extends helically such that engagement of the rotation stopping element with the groove translates rotation of the shaft member into axial displacement of the shaft member with respect to the body portion.

14. (Original) The locking pin assembly of claim 13, wherein the rotation stopping element interfering with the end portions limits rotation of the shaft member in a range of about 90 degrees relative to the body portion.

15. (Original) The locking pin assembly of claim 14, wherein the rotation stopping element comprises a dowel extending through a portion of the body portion.

16. (Original) The locking pin assembly of claim 1, further comprising:
a second rotation stopping element extending from the plunger and configured to prevent rotation of the plunger while permitting axial displacement of the plunger.

17. (Original) The locking pin assembly of claim 16, wherein the second rotation stopping

element comprises a second dowel fixed in relation to the body portion, and wherein the plunger comprises an elongated recess into which the second dowel extends.

18. (Original) The locking pin assembly of claim 16, wherein the second rotation stopping element comprises a protrusion extending from the plunger and fixed in relation thereto, wherein the protrusion extends into a longitudinal channel formed in an internal wall surface of the body portion.

19. (Original) The locking pin assembly of claim 1, wherein the shaft member and the plunger define a longitudinally extending reference axis, and a first cross-section of the body portion perpendicular to the reference axis adjacent a proximal end of the body portion comprises a first cross-sectional area, wherein a second cross-section of the body portion perpendicular to the reference axis adjacent a distal end of the body portion comprises a second cross-sectional area less than the first cross-sectional area, the body portion comprising an engagement surface along only one side that is parallel to the reference axis.

20. (Original) The locking pin assembly of claim 19, wherein the locking pin assembly is configured to be oriented within a bore extending through the ground engaging member and into the support structure such that at least a portion of the engagement surface engages a load bearing surface of the support structure defined by an internal wall of the bore.

21. (Original) The locking pin assembly of claim 20, wherein the load bearing surface is disposed on a side of the bore at which the locking pin assembly exerts a force in response to a force tending to remove the ground engaging member from the support structure.

22. (Original) A locking pin assembly for securing a ground engaging member to a support structure, comprising:

- a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

- a shaft member comprising a distal end and a proximal portion, the distal end having a first engagement feature, the distal end being disposed within the body portion, and wherein the

shaft member defines a longitudinally extending reference axis;

a locking feature extending radially from the locking pin assembly, the shaft member being rotatable relative to the body portion between a first position in which the locking feature is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the locking feature is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions;

wherein the body portion is shaped to be received within a bore extending through the ground engaging member and into the support structure such that when installed, the locking pin assembly is fixed in relation to the ground engaging member but movable relative to the support structure.

23. (Currently amended) A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a rotatable lock portion;

a body portion coupled to the rotatable lock portion and including an outer surface having a proximal end and a distal end;

a head disposed at the proximal end, the head having a perimeter, a portion of the perimeter having a non-circular shape configured to be received within a correspondingly shaped proximal recess in a wall of the ground engaging member; and

a tip disposed at the distal end, a portion of the tip having a non-circular peripheral profile configured to be received within a correspondingly shaped distal recess in a portion of the ground engaging member opposite the proximal recess, wherein engagement of the head with the

proximal recess and the tip with the distal recess prevents rotation of the body portion relative to the ground engaging member.

24. (Original) The locking pin assembly of claim 23, wherein the non-circular peripheral profile of the tip has at least one flat side.

25. (Currently amended) A wear member for installation on a nose ~~an adapter~~ carried on earth engaging equipment using a locking pin assembly, comprising:

an external surface;

an internal surface defining a cavity;

a bore passing through the wear member from the external surface on a first wall to the external surface on a second wall opposite the first wall;

an installation ramp disposed adjacent the bore and configured to engage a first surface of a tang of the locking pin assembly when the locking pin assembly is disposed within the bore as the tang is rotated in a first direction from an unlocked configuration to a locked configuration, the installation ramp comprising an integrated helical portion and an integrated flat portion; and

a removal ramp disposed adjacent the bore and configured to engage a second surface of the tang opposite the first surface of the tang as the tang is rotated in a second direction opposite the first direction from the locked configuration to the unlocked configuration, wherein the installation ramp and removal ramp are integrated into the first wall.

26. (Cancelled) ~~The wear member of claim 25, wherein the installation ramp and removal ramp are integrated into the first wall.~~

27. (Currently amended) The wear member of claim 25 ~~claim 26~~, wherein the installation ramp is configured such that engagement of the installation ramp with the first surface translates rotation of the tang in the first direction into axial displacement of the locking pin assembly to facilitate seating of the locking pin assembly in the wear member.

28. (Original) The wear member of claim 27, wherein the removal ramp is configured such that engagement of the removal ramp with the second surface translates rotation of the tang in

the second direction into axial displacement of the locking pin assembly to facilitate removal of the locking pin assembly from the wear member.

29. (Original) A locking pin assembly for securing a ground engaging member to a support structure, comprising:

- a body portion arranged to selectively project into an opening in the support structure;
- a shaft member comprising a distal end and a proximal portion, the distal end having a first engagement feature, the distal end being disposed within the body portion, wherein the shaft member is rotatable relative to the body portion between a locked position to secure the ground engaging member to the support structure and an unlocked position to permit removal of the ground engaging member from the support structure;

- a biasing member disposed within the body portion; and

- a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions.

30. (Original) The locking pin assembly of claim 29, wherein the first engagement feature, the second engagement feature, and the biasing member are configured so that the resistance to rotation exerted by the biasing member occurs during a first portion of rotational travel and does not occur during a second portion of rotational travel, and wherein one of the first and second engagement features comprises two adjacent notches separated by a resistance peak, and the other of the first and second engagement features comprises a tooth configured to selectably seat within each of the two notches.

31. (Currently amended) A method for locking a wear member to or removing a wear member from ~~a nose on an adapter~~ carried on earth engaging equipment using a locking pin assembly, the method comprising:

- first rotating, while the locking pin assembly is disposed within a bore passing through

the wear member and the ~~nose adapter~~, a shaft member of the locking pin assembly relative to a body portion of the locking pin assembly in a first direction through a first range of motion in which a first surface of a tooth of the shaft member engages a corresponding first surface of a notch of a plunger disposed within the body portion, wherein the plunger is substantially rotationally fixed with respect to the body portion and rotation of the shaft member through the first range of motion axially displaces the plunger toward a biasing member from an initial position to a compressed position; and

second rotating the shaft member relative to the body portion in the first direction through a second range of motion in which a second surface of the tooth slides relative to a corresponding second surface of the notch, wherein during rotation of the shaft through the second range of motion the biasing member returns the plunger to the initial position; and

wherein the first and second rotating moves a locking feature extending from the locking pin assembly from a first configuration to a second configuration, wherein when the locking feature is in one of the first and second configurations the locking feature interfaces with the wear member or ~~nose an adapter~~ to prevent withdrawal of the locking pin assembly from the wear member and when the locking feature is in the other of the first and second configurations the locking pin assembly is removable from the wear member.

32. (Original) The method of claim 31,

wherein the first range of motion comprises a range between 0 and 180 degrees; and
wherein the second range of motion comprises a range between 0 and 180 degrees.

33. (Currently amended) A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

a shaft member having a first axis and comprising a distal end and a proximal portion, the distal end having a first plurality of equidistantly spaced teeth, the first plurality of equidistantly spaced teeth being spaced radially about the first axis in a range between about 30 degrees and 120 degrees apart, the distal end being disposed within the body portion;

a tang extending radially from the proximal portion of the shaft member outside the body

portion, the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger having a second axis and comprising a second plurality of equidistantly spaced teeth, the second plurality of equidistantly spaced teeth being spaced radially about the second axis in a range between about 30 degrees and 120 degrees apart and shaped to selectively engage the first plurality of equidistantly spaced teeth of the shaft member to provide resistance to rotation in two opposing directions, wherein the first plurality of equidistantly spaced teeth and the second plurality of equidistantly spaced teeth are configured to rotate relative to one another when a rotational force applied to the shaft member exceeds a magnitude of the resistance to rotation exerted by the biasing member to rotate the shaft member from one of the first position and the second position to the other of the first position and the second position.

34. (Original) The locking pin assembly of claim 33, wherein the first and the second pluralities of equidistantly spaced teeth are shaped to provide about equal resistance to rotation in two directions.

35. (Cancelled) ~~The locking pin assembly of claim 33, wherein the first plurality of equidistantly spaced teeth and the second plurality of equidistantly spaced teeth are configured to rotate relative to one another when a rotational force applied to the shaft member exceeds a magnitude of the resistance to rotation exerted by the biasing member to rotate the shaft member from one of the first position and the second position to the other of the first position and the second position.~~

36. (Currently amended) The locking pin assembly of claim 33 ~~claim 35~~, wherein the first plurality of equidistantly spaced teeth, the second plurality of equidistantly spaced teeth, and the

biasing member are configured so that the resistance to rotation exerted by the biasing member occurs during a first portion of rotational travel and does not occur during a second portion of rotational travel.

37. (Currently amended) A locking pin assembly for securing a ground engaging member to a support structure, comprising:

- a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

- a shaft member having a first axis and comprising a distal end and a proximal portion, the distal end having a first tooth extending in an axial direction and offset from the first axis, the distal end being disposed within the body portion;

- a tang extending radially from the proximal portion of the shaft member outside the body portion, the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;

- a biasing member disposed within the body portion; and

- a plunger disposed between the biasing member and the distal end of the shaft member, the plunger having a second axis and comprising a second tooth extending in a proximal direction and offset from the second axis, the second tooth engaging the first tooth to provide resistance during [[to]] rotation in two opposing directions.

38. (Original) The locking pin assembly of claim 37, wherein one of the shaft member and the plunger comprises a notch adjacent the respective first tooth or second tooth, each of the first tooth and the second tooth sized to form a radial arc in a range between about 30 degrees and 120 degrees about the first axis and the second axis respectively.

REMARKS

Status of the Application

Prior to entry of this paper, claims 1-38 were pending, of which claims 1, 22, 23, 25, 29, 31, 33, and 37 are independent. This paper proposes amendments to claims 23, 25, 27, 31, 33, 36, and 37, and cancels claims 26 and 35 without prejudice or disclaimer of the subject matter therein. Some of the amendments are made to simply add clarity or more specificity to the claims.

In the Written Opinion dated July 16, 2020, the Examiner characterized claims 3-11, 13-15, 17, 30-32, 34-36, and 38 as having both novelty and inventive step, and the Written Opinion characterized claims 1, 2, 12, 16, 18-29, 33, and 37 as lacking novelty or inventive step under PCT Article 33(3). This characterization is respectfully traversed for the reasons set out below.

Search Report References

The Search Report identifies the following references.

- D1: U.S. 2014/013635 to Cui
- D2: WO 2013/033751 owned by CQMS Pty Ltd
- D3: KR 101 911 513 owned by Sngbo Ind Co Ltd.
- D4: U.S. 2010/162594 to Bierwith

Independent Claim 1

The Office asserts that independent claim 1 lacks novelty in view of D1. Claim 1 is directed to a locking pin assembly as claimed, including the claim recitation of “a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions.” (Underlining added.)

However, D1 fails to teach at least a locking pin assembly with the subject matter underlined above. More particularly, the Office relies upon D1’s teaching of mating teeth 57b and teeth 47b to permit rotation of a rotator section 32b relative to locking member 56. However, this is not a teaching of the claimed subject matter because the mating teeth 57b and 47b of D1 do not meet the claim 1 recitation of “engage...to provide resistance during rotation

of the shaft member relative to the plunger in each of two opposing directions.” In fact, D1 operates very differently by explicitly teaching that components must “disengage” to permit rotation. *See* D1, para. 0032 relating to FIG. 6 and para. 0024 & 0029 relating to FIGS. 3-5. Disengaging to permit rotation is different than the claim 1 recitation of “engag[ing]...to provide resistance during rotation of the shaft member relative to the plunger.”

Even if (contrary to what is explicitly taught by D1 in Para. 0032) the saw-tooth teeth 47b and 57b in FIG. 6 of D1 were to permit rotation while engaged, it could still only do so in one direction. The saw tooth shape of the teeth in D1 would completely prevent rotation in two directions when engaged. This is different than the invention in claim 1 which recites engagements features that “engage...to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions.” (Underlining added.) Accordingly, D1 does not teach the invention recited in claim 1, and claim 1 should have both novelty and inventive step.

Independent claims 22 and 29

Each of independent claims 22 and 29 recites, among other features, “the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions.” Accordingly, claims 22 and 29 should properly meet the criteria for novelty and inventive step for the same reasons as claim 1 discussed above.

Independent claim 37

Independent claim 37 is amended herein and now recites, among other features, “a plunger7 disposed between the biasing member and the distal end of the shaft member, the plunger having a second axis and comprising a second tooth extending in a proximal direction and offset from the second axis, the second tooth engaging the first tooth to provide resistance during rotation in two opposing directions.” (Underlining added.) Accordingly, claim 37 should properly meet the criteria for novelty and inventive step for the same reasons as claim 1 discussed above.

Independent claim 23

The Office indicates that claim 23 lacks novelty and inventive step in view of reference D3, and particularly FIGS. 8a, 8b, 11a, and 11b of D3. Further, the Office indicates that claim 23 lacks clarity because the claim recites a single component. Accordingly, this paper amends claim 23 to recite a lock feature that is coupled to the body portion. D3 includes no such teaching and therefore claim 23 should have both novelty and inventive step over D3.

Independent claim 25

The Office indicates that claim 25 lacks novelty and inventive step in view of reference D2. This paper amends claim 25 to recite the subject matter of claim 26 and additional features. Accordingly, claim 25 is now directed to a wear member including, among other features:

an installation ramp disposed adjacent the bore and configured to engage a first surface of a tang of the locking pin assembly when the locking pin assembly is disposed within the bore as the tang is rotated in a first direction from an unlocked configuration to a locked configuration, the installation ramp comprising an integrated helical portion and an integrated flat portion; and

a removal ramp disposed adjacent the bore and configured to engage a second surface of the tang opposite the first surface of the tang as the tang is rotated in a second direction opposite the first direction from the locked configuration to the unlocked configuration, wherein the installation ramp and removal ramp are integrated into the first wall.

None of the references teach such claimed features, and therefore, claim 25 should have both novelty and inventive step.

Dependent Claims

Each of the dependent claims depend from and add additional features to one of the corresponding independent claims. Therefore, for at least the reasons above, the dependent claims should also be allowable over the applied references.

Conclusion

In view of the foregoing it is respectfully requested that the Examiner consider the foregoing remarks and conduct a detailed examination of the International application which is the subject of the Demand under Article 31 of the PCT, including the issuance of an International Preliminary Report on Patentability with respect to the pending claims, and providing the Applicant with an opportunity and ample time to respond to any negative opinions contained therein.

Respectfully submitted,

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CLEAN CLAIMS

1. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

a shaft member comprising a distal end and a proximal portion, the distal end having a first engagement feature, and the distal end being disposed within the body portion;

a tang extending radially from the proximal portion of the shaft member outside the body portion, the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions.

2. The locking pin assembly of claim 1, wherein the first engagement feature and the second engagement feature are configured to rotate relative to one another when a rotational force applied to the shaft member exceeds a magnitude of the resistance to rotation exerted by the biasing member to rotate the shaft member from one of the first position and the second position to the other of the first position and the second position.

3. The locking pin assembly of claim 2, wherein the first engagement feature, the second

engagement feature, and the biasing member are configured so that the resistance to rotation exerted by the biasing member occurs during a first portion of rotational travel and does not occur during a second portion of rotational travel.

4. The locking pin assembly of claim 3, wherein one of the first and second engagement features comprises two adjacent notches separated by a resistance peak, and the other of the first and second engagement features comprises a tooth configured to selectably seat within each of the two notches.

5. The locking pin assembly of claim 4, wherein the resistance peak comprises a planar surface extending between a first angled surface and a second angled surface, the first and second angled surfaces defining opposing sides of the one of the first and second engagement features.

6. The locking pin assembly of claim 5, wherein the first and second angled surfaces are angled with respect to a direction of rotation of the shaft member in a range of about 60° to 80°.

7. The locking pin assembly of claim 4, wherein the resistance peak is disposed approximately midway between the two adjacent notches.

8. The locking pin assembly of claim 7, wherein the two adjacent notches are centered approximately 90 degrees apart.

9. The locking pin assembly of claim 8, wherein the other of the first and second engagement features comprises a third notch, and wherein the resistance peak is sized and shaped to fit within the third notch when the tooth is seated within one of the two adjacent notches.

10. The locking pin assembly of claim 8, wherein the first engagement feature, the second engagement feature, and the biasing member are configured so that rotation of the shaft member between the two adjacent notches provides haptic feedback to a user confirming transition from

the first position to the second position.

11. The locking pin assembly of claim 10, wherein the first engagement feature, the second engagement feature, and the biasing member are configured so that rotation of the shaft member between the two adjacent notches provides haptic feedback to a user confirming transition from the second position to the first position.

12. The locking pin assembly of claim 1, further comprising a rotation stopping element, and wherein the shaft member comprises a partially circumferential groove formed therein, and the rotation stopping element configured to mechanically interfere with opposing end portions of the groove to limit a range of rotation of the shaft member relative to the body portion.

13. The locking pin assembly of claim 12, wherein the groove extends helically such that engagement of the rotation stopping element with the groove translates rotation of the shaft member into axial displacement of the shaft member with respect to the body portion.

14. The locking pin assembly of claim 13, wherein the rotation stopping element interfering with the end portions limits rotation of the shaft member in a range of about 90 degrees relative to the body portion.

15. The locking pin assembly of claim 14, wherein the rotation stopping element comprises a dowel extending through a portion of the body portion.

16. The locking pin assembly of claim 1, further comprising:
a second rotation stopping element extending from the plunger and configured to prevent rotation of the plunger while permitting axial displacement of the plunger.

17. The locking pin assembly of claim 16, wherein the second rotation stopping element comprises a second dowel fixed in relation to the body portion, and wherein the plunger comprises an elongated recess into which the second dowel extends.

18. The locking pin assembly of claim 16, wherein the second rotation stopping element comprises a protrusion extending from the plunger and fixed in relation thereto, wherein the protrusion extends into a longitudinal channel formed in an internal wall surface of the body portion.

19. The locking pin assembly of claim 1, wherein the shaft member and the plunger define a longitudinally extending reference axis, and a first cross-section of the body portion perpendicular to the reference axis adjacent a proximal end of the body portion comprises a first cross-sectional area, wherein a second cross-section of the body portion perpendicular to the reference axis adjacent a distal end of the body portion comprises a second cross-sectional area less than the first cross-sectional area, the body portion comprising an engagement surface along only one side that is parallel to the reference axis.

20. The locking pin assembly of claim 19, wherein the locking pin assembly is configured to be oriented within a bore extending through the ground engaging member and into the support structure such that at least a portion of the engagement surface engages a load bearing surface of the support structure defined by an internal wall of the bore.

21. The locking pin assembly of claim 20, wherein the load bearing surface is disposed on a side of the bore at which the locking pin assembly exerts a force in response to a force tending to remove the ground engaging member from the support structure.

22. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

- a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

- a shaft member comprising a distal end and a proximal portion, the distal end having a first engagement feature, the distal end being disposed within the body portion, and wherein the shaft member defines a longitudinally extending reference axis;

- a locking feature extending radially from the locking pin assembly, the shaft member being rotatable relative to the body portion between a first position in which the locking feature

is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the locking feature is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions;

wherein the body portion is shaped to be received within a bore extending through the ground engaging member and into the support structure such that when installed, the locking pin assembly is fixed in relation to the ground engaging member but movable relative to the support structure.

23. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a rotatable lock portion;

a body portion coupled to the rotatable lock portion and including an outer surface having a proximal end and a distal end;

a head disposed at the proximal end, the head having a perimeter, a portion of the perimeter having a non-circular shape configured to be received within a correspondingly shaped proximal recess in a wall of the ground engaging member; and

a tip disposed at the distal end, a portion of the tip having a non-circular peripheral profile configured to be received within a correspondingly shaped distal recess in a portion of the ground engaging member opposite the proximal recess, wherein engagement of the head with the proximal recess and the tip with the distal recess prevents rotation of the body portion relative to the ground engaging member.

24. The locking pin assembly of claim 23, wherein the non-circular peripheral profile of the tip has at least one flat side.

25. A wear member for installation on a nose carried on earth engaging equipment using a locking pin assembly, comprising:

an external surface;

an internal surface defining a cavity;

a bore passing through the wear member from the external surface on a first wall to the external surface on a second wall opposite the first wall;

an installation ramp disposed adjacent the bore and configured to engage a first surface of a tang of the locking pin assembly when the locking pin assembly is disposed within the bore as the tang is rotated in a first direction from an unlocked configuration to a locked configuration, the installation ramp comprising an integrated helical portion and an integrated flat portion; and

a removal ramp disposed adjacent the bore and configured to engage a second surface of the tang opposite the first surface of the tang as the tang is rotated in a second direction opposite the first direction from the locked configuration to the unlocked configuration, wherein the installation ramp and removal ramp are integrated into the first wall.

26. (Cancelled)

27. The wear member of claim 25, wherein the installation ramp is configured such that engagement of the installation ramp with the first surface translates rotation of the tang in the first direction into axial displacement of the locking pin assembly to facilitate seating of the locking pin assembly in the wear member.

28. The wear member of claim 27, wherein the removal ramp is configured such that engagement of the removal ramp with the second surface translates rotation of the tang in the second direction into axial displacement of the locking pin assembly to facilitate removal of the locking pin assembly from the wear member.

29. A locking pin assembly for securing a ground engaging member to a support structure,

comprising:

- a body portion arranged to selectively project into an opening in the support structure;
- a shaft member comprising a distal end and a proximal portion, the distal end having a first engagement feature, the distal end being disposed within the body portion, wherein the shaft member is rotatable relative to the body portion between a locked position to secure the ground engaging member to the support structure and an unlocked position to permit removal of the ground engaging member from the support structure;
- a biasing member disposed within the body portion; and
- a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions.

30. The locking pin assembly of claim 29, wherein the first engagement feature, the second engagement feature, and the biasing member are configured so that the resistance to rotation exerted by the biasing member occurs during a first portion of rotational travel and does not occur during a second portion of rotational travel, and wherein one of the first and second engagement features comprises two adjacent notches separated by a resistance peak, and the other of the first and second engagement features comprises a tooth configured to selectably seat within each of the two notches.

31. A method for locking a wear member to or removing a wear member from a nose carried on earth engaging equipment using a locking pin assembly, the method comprising:

- first rotating, while the locking pin assembly is disposed within a bore passing through the wear member and the nose, a shaft member of the locking pin assembly relative to a body portion of the locking pin assembly in a first direction through a first range of motion in which a first surface of a tooth of the shaft member engages a corresponding first surface of a notch of a plunger disposed within the body portion, wherein the plunger is substantially rotationally fixed with respect to the body portion and rotation of the shaft member through the first range of

motion axially displaces the plunger toward a biasing member from an initial position to a compressed position; and

second rotating the shaft member relative to the body portion in the first direction through a second range of motion in which a second surface of the tooth slides relative to a corresponding second surface of the notch, wherein during rotation of the shaft through the second range of motion the biasing member returns the plunger to the initial position; and

wherein the first and second rotating moves a locking feature extending from the locking pin assembly from a first configuration to a second configuration, wherein when the locking feature is in one of the first and second configurations the locking feature interfaces with the wear member or nose to prevent withdrawal of the locking pin assembly from the wear member and when the locking feature is in the other of the first and second configurations the locking pin assembly is removable from the wear member.

32. The method of claim 31,
wherein the first range of motion comprises a range between 0 and 180 degrees; and
wherein the second range of motion comprises a range between 0 and 180 degrees.

33. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

a shaft member having a first axis and comprising a distal end and a proximal portion, the distal end having a first plurality of equidistantly spaced teeth, the first plurality of equidistantly spaced teeth being spaced radially about the first axis in a range between about 30 degrees and 120 degrees apart, the distal end being disposed within the body portion;

a tang extending radially from the proximal portion of the shaft member outside the body portion, the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground

engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger having a second axis and comprising a second plurality of equidistantly spaced teeth, the second plurality of equidistantly spaced teeth being spaced radially about the second axis in a range between about 30 degrees and 120 degrees apart and shaped to selectively engage the first plurality of equidistantly spaced teeth of the shaft member to provide resistance to rotation in two opposing directions, wherein the first plurality of equidistantly spaced teeth and the second plurality of equidistantly spaced teeth are configured to rotate relative to one another when a rotational force applied to the shaft member exceeds a magnitude of the resistance to rotation exerted by the biasing member to rotate the shaft member from one of the first position and the second position to the other of the first position and the second position.

34. The locking pin assembly of claim 33, wherein the first and the second pluralities of equidistantly spaced teeth are shaped to provide about equal resistance to rotation in two directions.

35. (Cancelled)

36. The locking pin assembly of claim 33, wherein the first plurality of equidistantly spaced teeth, the second plurality of equidistantly spaced teeth, and the biasing member are configured so that the resistance to rotation exerted by the biasing member occurs during a first portion of rotational travel and does not occur during a second portion of rotational travel.

37. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

a shaft member having a first axis and comprising a distal end and a proximal portion, the distal end having a first tooth extending in an axial direction and offset from the first axis, the distal end being disposed within the body portion;

a tang extending radially from the proximal portion of the shaft member outside the body portion, the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger having a second axis and comprising a second tooth extending in a proximal direction and offset from the second axis, the second tooth engaging the first tooth to provide resistance during rotation in two opposing directions.

38. The locking pin assembly of claim 37, wherein one of the shaft member and the plunger comprises a notch adjacent the respective first tooth or second tooth, each of the first tooth and the second tooth sized to form a radial arc in a range between about 30 degrees and 120 degrees about the first axis and the second axis respectively.

CLEAN CLAIMS

1. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

a shaft member comprising a distal end and a proximal portion, the distal end having a first engagement feature, and the distal end being disposed within the body portion;

a tang extending radially from the proximal portion of the shaft member outside the body portion, the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions.

2. The locking pin assembly of claim 1, wherein the first engagement feature and the second engagement feature are configured to rotate relative to one another when a rotational force applied to the shaft member exceeds a magnitude of the resistance to rotation exerted by the biasing member to rotate the shaft member from one of the first position and the second position to the other of the first position and the second position.

3. The locking pin assembly of claim 2, wherein the first engagement feature, the second

AMENDED SHEET

engagement feature, and the biasing member are configured so that the resistance to rotation exerted by the biasing member occurs during a first portion of rotational travel and does not occur during a second portion of rotational travel.

4. The locking pin assembly of claim 3, wherein one of the first and second engagement features comprises two adjacent notches separated by a resistance peak, and the other of the first and second engagement features comprises a tooth configured to selectably seat within each of the two notches.

5. The locking pin assembly of claim 4, wherein the resistance peak comprises a planar surface extending between a first angled surface and a second angled surface, the first and second angled surfaces defining opposing sides of the one of the first and second engagement features.

6. The locking pin assembly of claim 5, wherein the first and second angled surfaces are angled with respect to a direction of rotation of the shaft member in a range of about 60° to 80°.

7. The locking pin assembly of claim 4, wherein the resistance peak is disposed approximately midway between the two adjacent notches.

8. The locking pin assembly of claim 7, wherein the two adjacent notches are centered approximately 90 degrees apart.

9. The locking pin assembly of claim 8, wherein the other of the first and second engagement features comprises a third notch, and wherein the resistance peak is sized and shaped to fit within the third notch when the tooth is seated within one of the two adjacent notches.

10. The locking pin assembly of claim 8, wherein the first engagement feature, the second engagement feature, and the biasing member are configured so that rotation of the shaft member between the two adjacent notches provides haptic feedback to a user confirming transition from

the first position to the second position.

11. The locking pin assembly of claim 10, wherein the first engagement feature, the second engagement feature, and the biasing member are configured so that rotation of the shaft member between the two adjacent notches provides haptic feedback to a user confirming transition from the second position to the first position.

12. The locking pin assembly of claim 1, further comprising a rotation stopping element, and wherein the shaft member comprises a partially circumferential groove formed therein, and the rotation stopping element configured to mechanically interfere with opposing end portions of the groove to limit a range of rotation of the shaft member relative to the body portion.

13. The locking pin assembly of claim 12, wherein the groove extends helically such that engagement of the rotation stopping element with the groove translates rotation of the shaft member into axial displacement of the shaft member with respect to the body portion.

14. The locking pin assembly of claim 13, wherein the rotation stopping element interfering with the end portions limits rotation of the shaft member in a range of about 90 degrees relative to the body portion.

15. The locking pin assembly of claim 14, wherein the rotation stopping element comprises a dowel extending through a portion of the body portion.

16. The locking pin assembly of claim 1, further comprising:
a second rotation stopping element extending from the plunger and configured to prevent rotation of the plunger while permitting axial displacement of the plunger.

17. The locking pin assembly of claim 16, wherein the second rotation stopping element comprises a second dowel fixed in relation to the body portion, and wherein the plunger comprises an elongated recess into which the second dowel extends.

18. The locking pin assembly of claim 16, wherein the second rotation stopping element comprises a protrusion extending from the plunger and fixed in relation thereto, wherein the protrusion extends into a longitudinal channel formed in an internal wall surface of the body portion.

19. The locking pin assembly of claim 1, wherein the shaft member and the plunger define a longitudinally extending reference axis, and a first cross-section of the body portion perpendicular to the reference axis adjacent a proximal end of the body portion comprises a first cross-sectional area, wherein a second cross-section of the body portion perpendicular to the reference axis adjacent a distal end of the body portion comprises a second cross-sectional area less than the first cross-sectional area, the body portion comprising an engagement surface along only one side that is parallel to the reference axis.

20. The locking pin assembly of claim 19, wherein the locking pin assembly is configured to be oriented within a bore extending through the ground engaging member and into the support structure such that at least a portion of the engagement surface engages a load bearing surface of the support structure defined by an internal wall of the bore.

21. The locking pin assembly of claim 20, wherein the load bearing surface is disposed on a side of the bore at which the locking pin assembly exerts a force in response to a force tending to remove the ground engaging member from the support structure.

22. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

- a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

- a shaft member comprising a distal end and a proximal portion, the distal end having a first engagement feature, the distal end being disposed within the body portion, and wherein the shaft member defines a longitudinally extending reference axis;

- a locking feature extending radially from the locking pin assembly, the shaft member being rotatable relative to the body portion between a first position in which the locking feature

is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the locking feature is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions;

wherein the body portion is shaped to be received within a bore extending through the ground engaging member and into the support structure such that when installed, the locking pin assembly is fixed in relation to the ground engaging member but movable relative to the support structure.

23. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a rotatable lock portion;

a body portion coupled to the rotatable lock portion and including an outer surface having a proximal end and a distal end;

a head disposed at the proximal end, the head having a perimeter, a portion of the perimeter having a non-circular shape configured to be received within a correspondingly shaped proximal recess in a wall of the ground engaging member; and

a tip disposed at the distal end, a portion of the tip having a non-circular peripheral profile configured to be received within a correspondingly shaped distal recess in a portion of the ground engaging member opposite the proximal recess, wherein engagement of the head with the proximal recess and the tip with the distal recess prevents rotation of the body portion relative to the ground engaging member.

24. The locking pin assembly of claim 23, wherein the non-circular peripheral profile of the tip has at least one flat side.
25. A wear member for installation on a nose carried on earth engaging equipment using a locking pin assembly, comprising:
- an external surface;
 - an internal surface defining a cavity;
 - a bore passing through the wear member from the external surface on a first wall to the external surface on a second wall opposite the first wall;
 - an installation ramp disposed adjacent the bore and configured to engage a first surface of a tang of the locking pin assembly when the locking pin assembly is disposed within the bore as the tang is rotated in a first direction from an unlocked configuration to a locked configuration, the installation ramp comprising an integrated helical portion and an integrated flat portion; and
 - a removal ramp disposed adjacent the bore and configured to engage a second surface of the tang opposite the first surface of the tang as the tang is rotated in a second direction opposite the first direction from the locked configuration to the unlocked configuration, wherein the installation ramp and removal ramp are integrated into the first wall.
26. (Cancelled)
27. The wear member of claim 25, wherein the installation ramp is configured such that engagement of the installation ramp with the first surface translates rotation of the tang in the first direction into axial displacement of the locking pin assembly to facilitate seating of the locking pin assembly in the wear member.
28. The wear member of claim 27, wherein the removal ramp is configured such that engagement of the removal ramp with the second surface translates rotation of the tang in the second direction into axial displacement of the locking pin assembly to facilitate removal of the locking pin assembly from the wear member.
29. A locking pin assembly for securing a ground engaging member to a support structure,

comprising:

a body portion arranged to selectively project into an opening in the support structure;

a shaft member comprising a distal end and a proximal portion, the distal end having a first engagement feature, the distal end being disposed within the body portion, wherein the shaft member is rotatable relative to the body portion between a locked position to secure the ground engaging member to the support structure and an unlocked position to permit removal of the ground engaging member from the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger comprising a second engagement feature configured to selectably engage the first engagement feature of the shaft member, wherein the biasing member urges the plunger toward the shaft member and the second engagement feature is configured to engage the first engagement feature to provide resistance during rotation of the shaft member relative to the plunger in each of two opposing directions.

30. The locking pin assembly of claim 29, wherein the first engagement feature, the second engagement feature, and the biasing member are configured so that the resistance to rotation exerted by the biasing member occurs during a first portion of rotational travel and does not occur during a second portion of rotational travel, and wherein one of the first and second engagement features comprises two adjacent notches separated by a resistance peak, and the other of the first and second engagement features comprises a tooth configured to selectably seat within each of the two notches.

31. A method for locking a wear member to or removing a wear member from a nose carried on earth engaging equipment using a locking pin assembly, the method comprising:

first rotating, while the locking pin assembly is disposed within a bore passing through the wear member and the nose, a shaft member of the locking pin assembly relative to a body portion of the locking pin assembly in a first direction through a first range of motion in which a first surface of a tooth of the shaft member engages a corresponding first surface of a notch of a plunger disposed within the body portion, wherein the plunger is substantially rotationally fixed with respect to the body portion and rotation of the shaft member through the first range of

motion axially displaces the plunger toward a biasing member from an initial position to a compressed position; and

second rotating the shaft member relative to the body portion in the first direction through a second range of motion in which a second surface of the tooth slides relative to a corresponding second surface of the notch, wherein during rotation of the shaft through the second range of motion the biasing member returns the plunger to the initial position; and

wherein the first and second rotating moves a locking feature extending from the locking pin assembly from a first configuration to a second configuration, wherein when the locking feature is in one of the first and second configurations the locking feature interfaces with the wear member or nose to prevent withdrawal of the locking pin assembly from the wear member and when the locking feature is in the other of the first and second configurations the locking pin assembly is removable from the wear member.

32. The method of claim 31,
wherein the first range of motion comprises a range between 0 and 180 degrees; and
wherein the second range of motion comprises a range between 0 and 180 degrees.

33. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

a shaft member having a first axis and comprising a distal end and a proximal portion, the distal end having a first plurality of equidistantly spaced teeth, the first plurality of equidistantly spaced teeth being spaced radially about the first axis in a range between about 30 degrees and 120 degrees apart, the distal end being disposed within the body portion;

a tang extending radially from the proximal portion of the shaft member outside the body portion, the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground

engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger having a second axis and comprising a second plurality of equidistantly spaced teeth, the second plurality of equidistantly spaced teeth being spaced radially about the second axis in a range between about 30 degrees and 120 degrees apart and shaped to selectively engage the first plurality of equidistantly spaced teeth of the shaft member to provide resistance to rotation in two opposing directions, wherein the first plurality of equidistantly spaced teeth and the second plurality of equidistantly spaced teeth are configured to rotate relative to one another when a rotational force applied to the shaft member exceeds a magnitude of the resistance to rotation exerted by the biasing member to rotate the shaft member from one of the first position and the second position to the other of the first position and the second position.

34. The locking pin assembly of claim 33, wherein the first and the second pluralities of equidistantly spaced teeth are shaped to provide about equal resistance to rotation in two directions.

35. (Cancelled)

36. The locking pin assembly of claim 33, wherein the first plurality of equidistantly spaced teeth, the second plurality of equidistantly spaced teeth, and the biasing member are configured so that the resistance to rotation exerted by the biasing member occurs during a first portion of rotational travel and does not occur during a second portion of rotational travel.

37. A locking pin assembly for securing a ground engaging member to a support structure, comprising:

a body portion arranged to non-rotatably, selectively project into an opening in the support structure, the body portion having an opening formed therein;

a shaft member having a first axis and comprising a distal end and a proximal portion, the distal end having a first tooth extending in an axial direction and offset from the first axis, the distal end being disposed within the body portion;

a tang extending radially from the proximal portion of the shaft member outside the body portion, the shaft member being rotatable relative to the body portion between a first position in which the tang is positionable to mechanically inhibit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure and a second position in which the tang is positionable to permit removal of the locking pin assembly from the ground engaging member when positioned to secure the ground engaging member to the support structure;

a biasing member disposed within the body portion; and

a plunger disposed between the biasing member and the distal end of the shaft member, the plunger having a second axis and comprising a second tooth extending in a proximal direction and offset from the second axis, the second tooth engaging the first tooth to provide resistance during rotation in two opposing directions.

38. The locking pin assembly of claim 37, wherein one of the shaft member and the plunger comprises a notch adjacent the respective first tooth or second tooth, each of the first tooth and the second tooth sized to form a radial arc in a range between about 30 degrees and 120 degrees about the first axis and the second axis respectively.