US011298572B2

(12) **United States Patent**
Dillon et al.

(10) **Patent No.: US 11,298,572 B2**
(45) **Date of Patent: Apr. 12, 2022**

(54) **SAFETY SYSTEM WITH DIGITAL TRACKING AND REPORTING AND METHOD OF USE**

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(72) Inventors: **James David Dillon**, Liberty, TX (US); **Emily Anne Brown**, College Station, TX (US); **Anthony Kornegay**, College Station, TX (US); **Adam Laubach**, College Station, TX (US); **Trevor Lubianski**, College Station, TX (US); **Reynaldo Martinez**, College Station, TX (US); **Richard Hayden Meeks**, College Station, TX (US); **Jarrett Pawelek**, College Station, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/986,050**

(22) Filed: **May 22, 2018**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 62/583,295, filed on Nov. 8, 2017, provisional application No. 62/533,898, filed on Jul. 18, 2017.

(51) **Int. Cl.**
A62B 35/04 (2006.01)
A62B 35/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***A62B 35/0093*** (2013.01); ***A62B 35/0075*** (2013.01); ***G08B 21/02*** (2013.01); *A62B 35/0018* (2013.01); *A62B 35/04* (2013.01); *G01C 5/00* (2013.01); *G01D 5/12* (2013.01); *G01S 11/02* (2013.01)

(58) **Field of Classification Search**
CPC .. A62B 35/0093; A62B 35/0075; A62B 35/04
See application file for complete search history.

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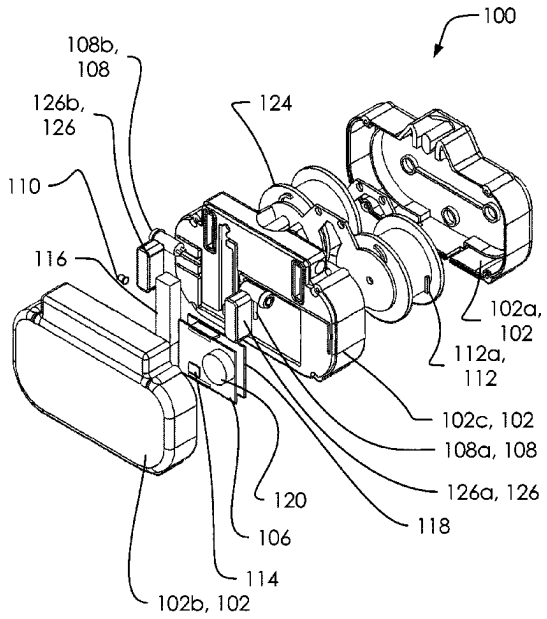
Primary Examiner — Alvin C Chin-Shue
(74) *Attorney, Agent, or Firm* — Shannon Warren

(57) **ABSTRACT**

A safety monitoring harness system for the protection of a climber comprising: said safety monitoring harness system comprising a base, a one or more tether assemblies, a retraction assembly, an alarm system, a strap length sensor assembly, and a power system. Said one or more tether assemblies comprising at least a first tether assembly and a second tether assembly. Said one or more tether assemblies each comprising a strap, and an anchoring hook. Said safety monitoring harness system is configured to selectively attach to said climber by: attaching a harness assembly to said climber, and securing said base to said harness assembly. A portion of said retraction assembly is enclosed within said base. Said retraction assembly are configured to selectively retract and release portions of said strap from within said base.

2 Claims, 33 Drawing Sheets



(51) **Int. Cl.**

G08B 21/02	(2006.01)
G01C 5/00	(2006.01)
G01D 5/12	(2006.01)
G01S 11/02	(2010.01)

(56) **References Cited**

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* cited by examiner

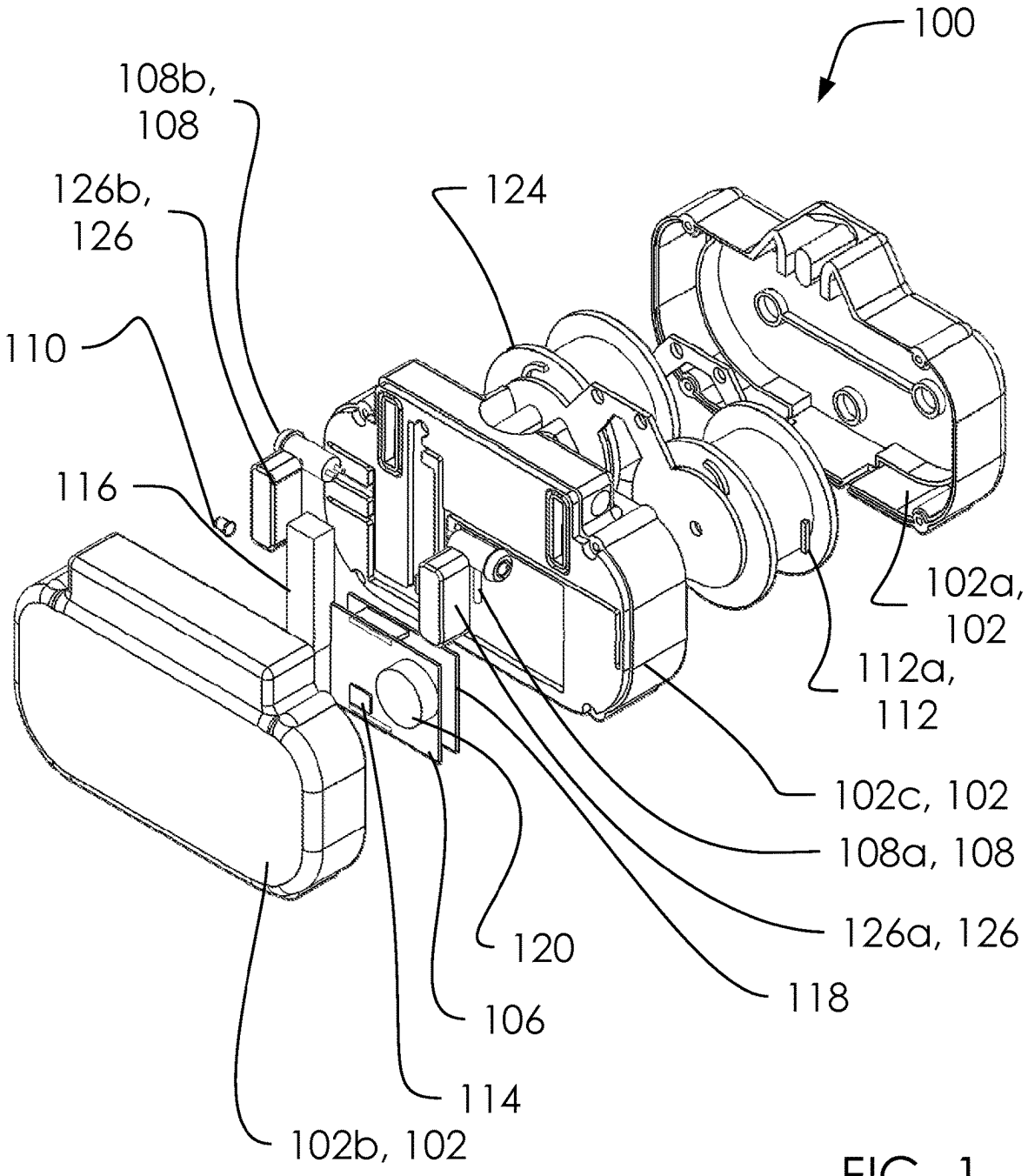

100
108b, 108
126b, 126
124
110
116
102a, 102
112a, 112
102c, 102
108a, 108
126a, 126
120
118
106
114
102b, 102

FIG. 1

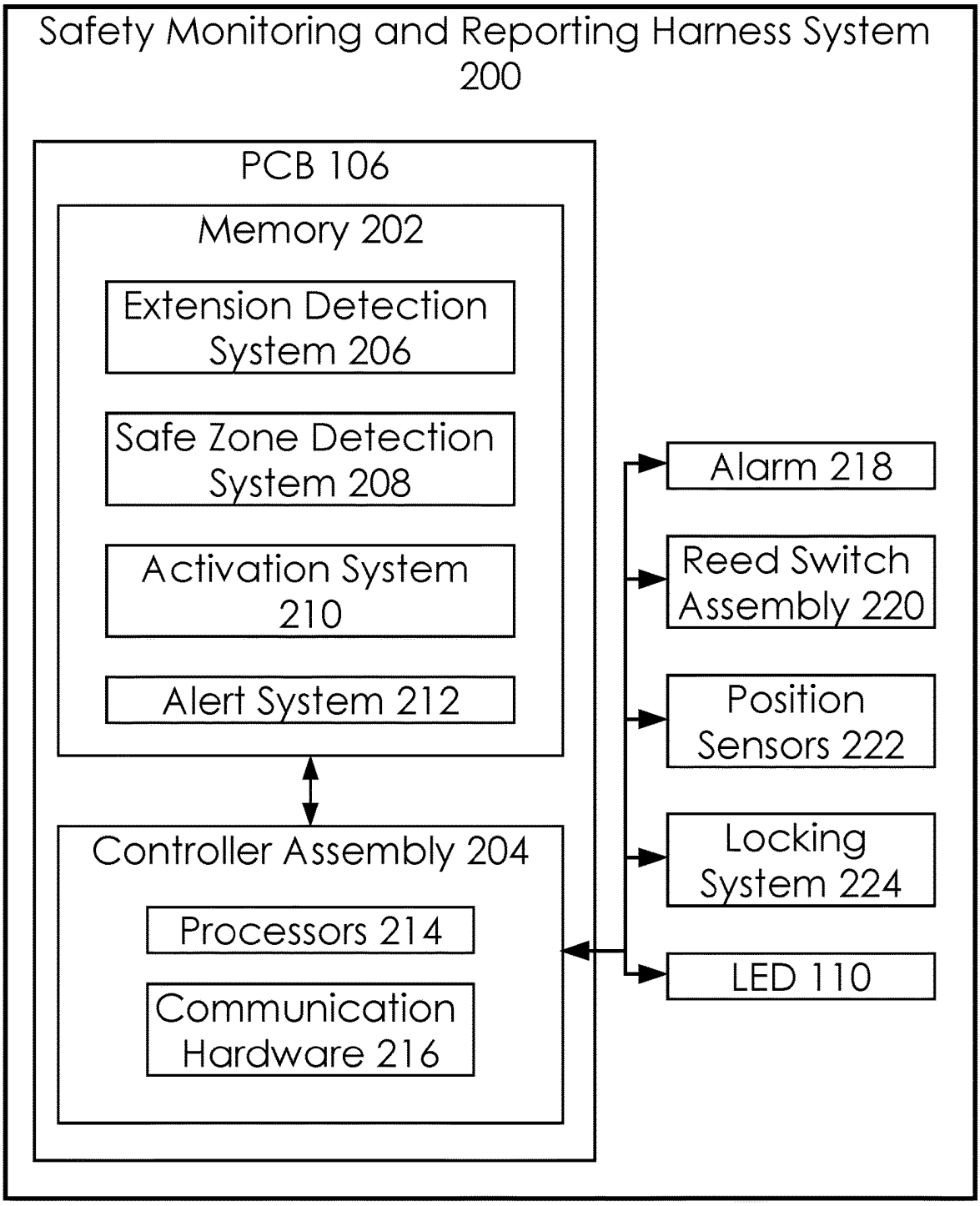

Safety Monitoring and Reporting Harness System 200
PCB 106
Memory 202
Extension Detection System 206
Safe Zone Detection System 208
Activation System 210
Alert System 212
Controller Assembly 204
Processors 214
Communication Hardware 216
Alarm 218
Reed Switch Assembly 220
Position Sensors 222
Locking System 224
LED 110

FIG. 2

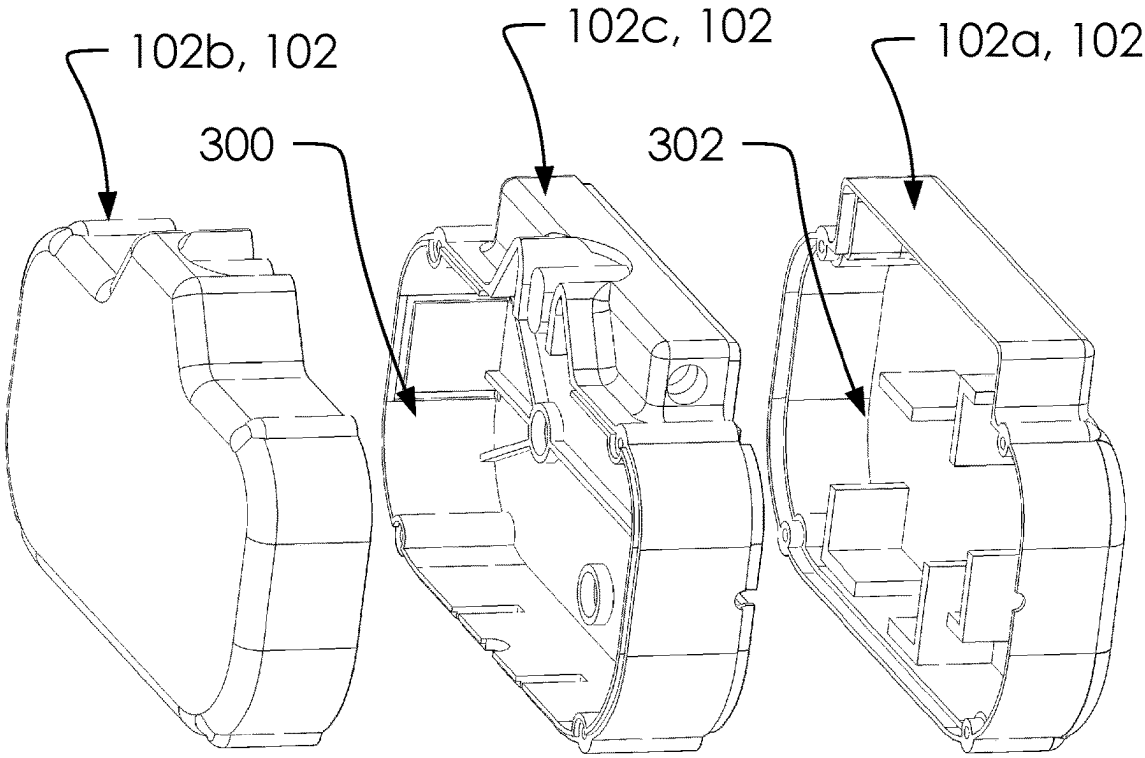


FIG. 3A

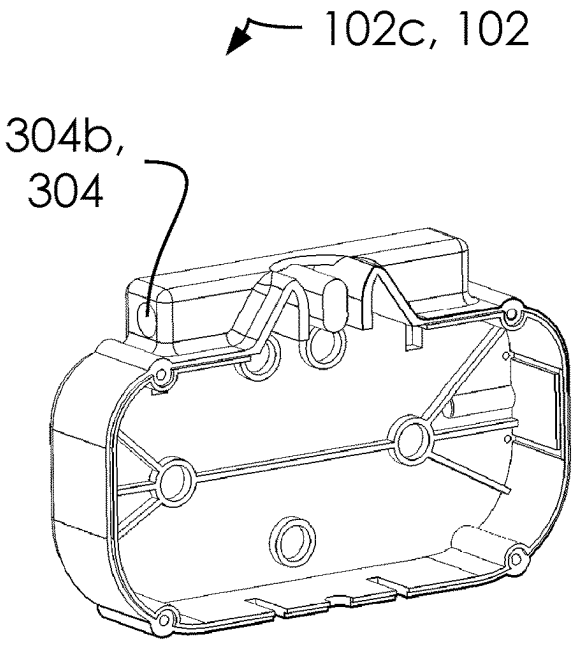


FIG. 3B

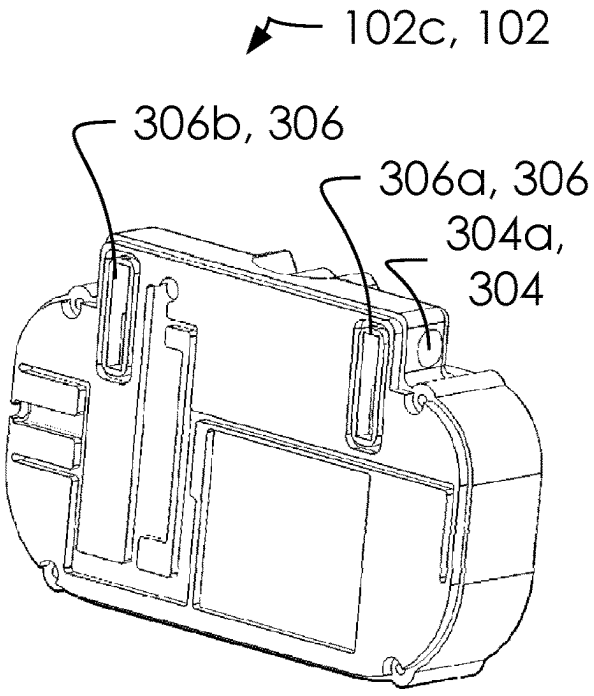


FIG. 3C

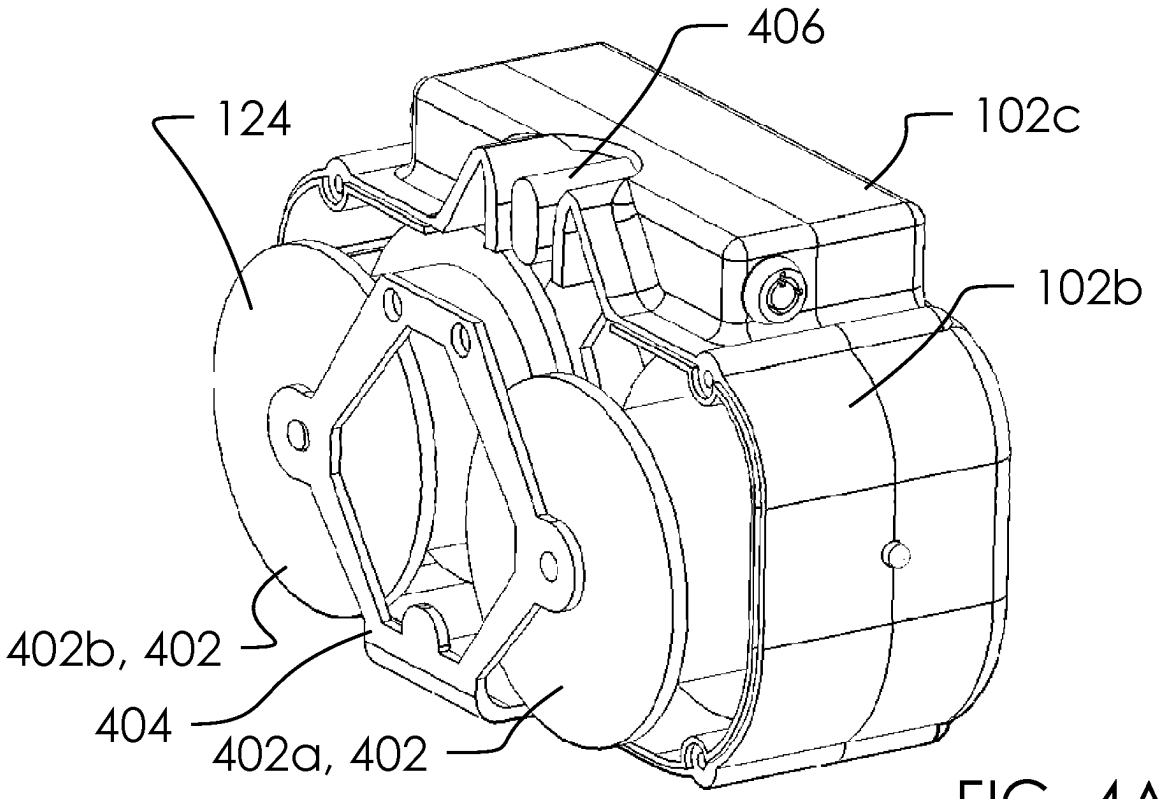
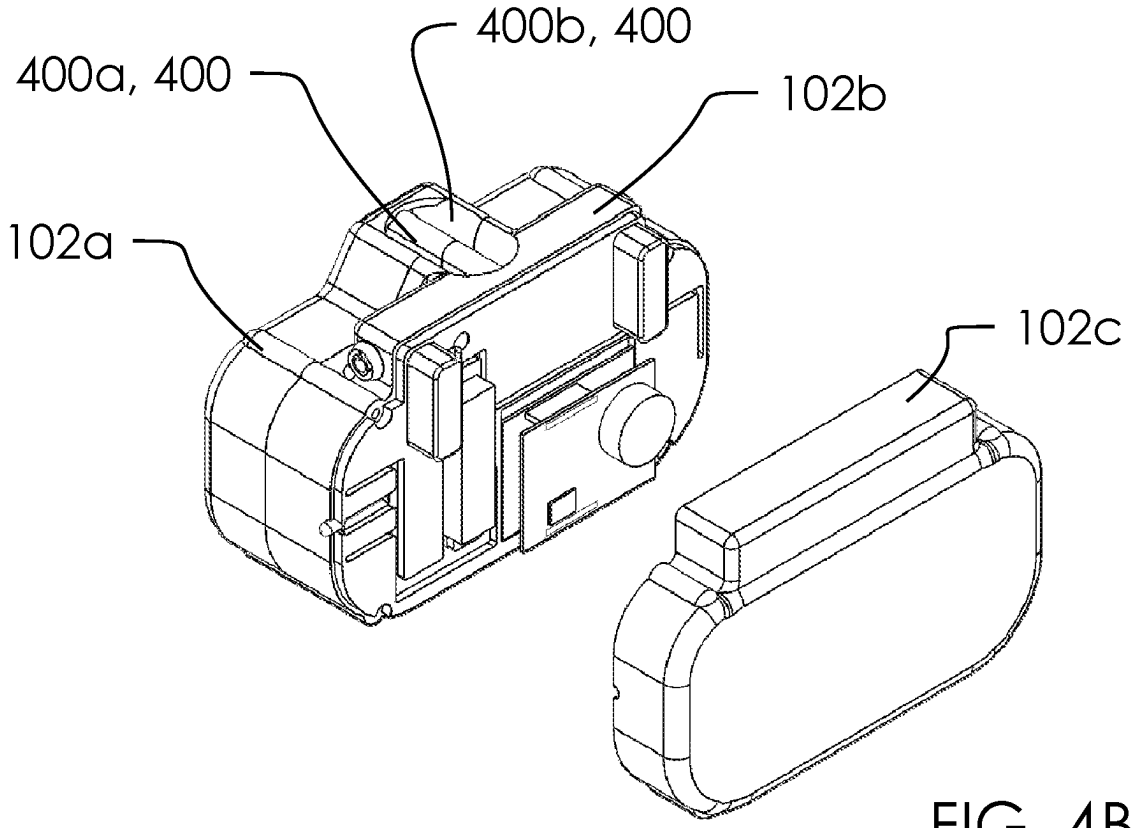

406
124
102c
102b
402b, 402
404
402a, 402

FIG. 4A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102b
102a
102c

FIG. 4B

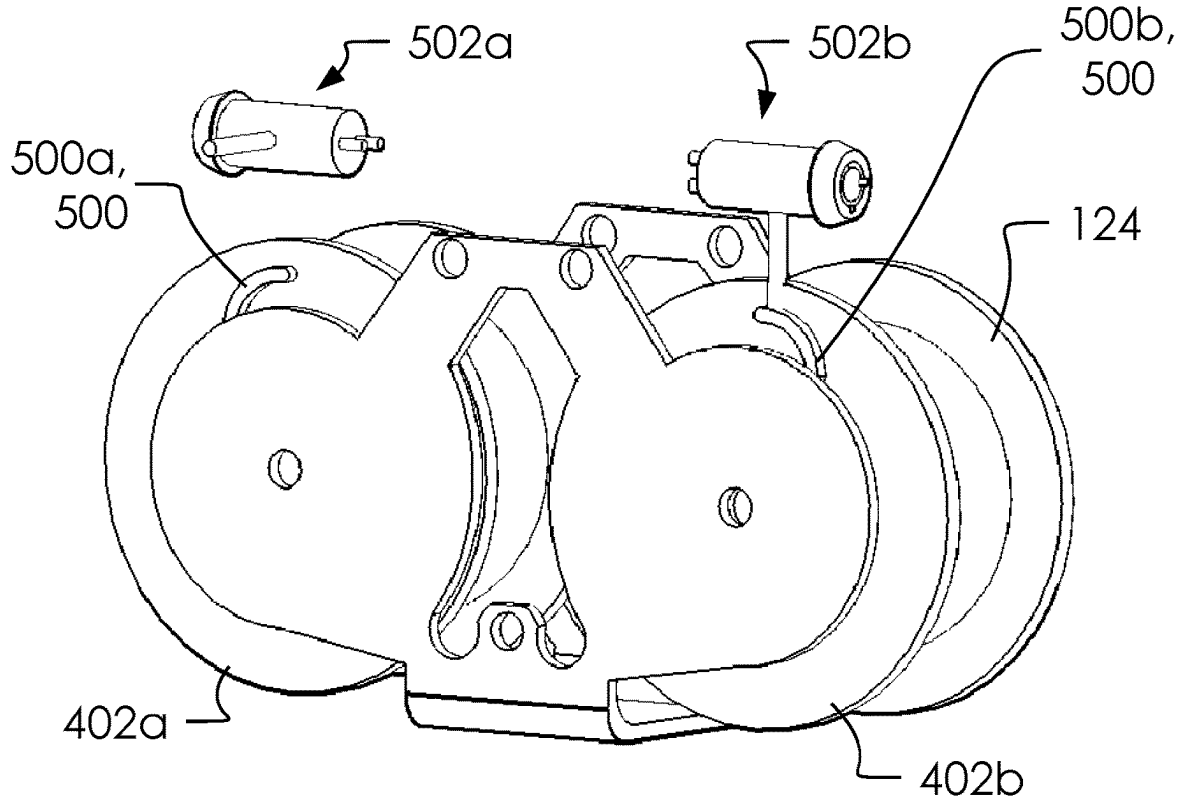
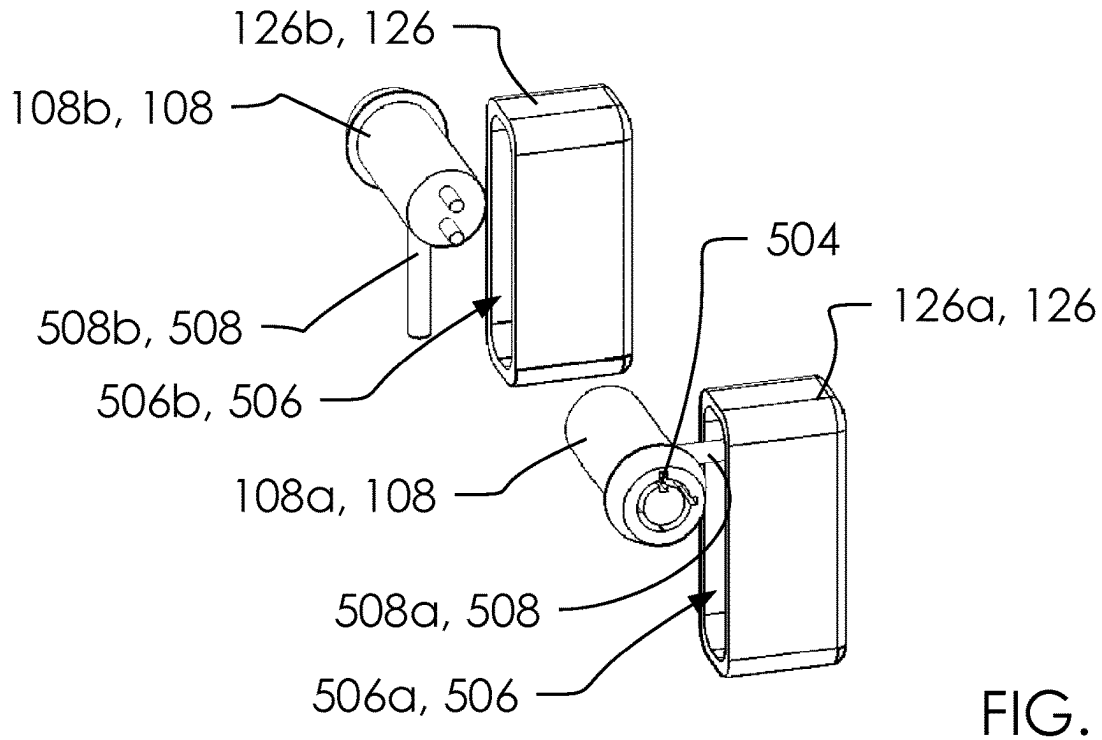

502a
502b
500b, 500
500a, 500
124
402a
402b

FIG. 5A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504
126a, 126
508b, 508
506b, 506
108a, 108
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506a, 506

FIG. 5B

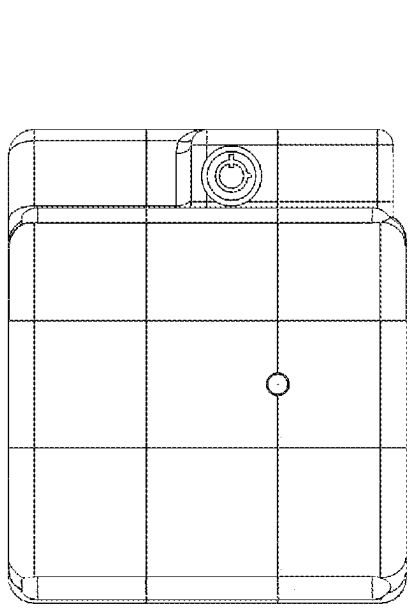


FIG. 6A

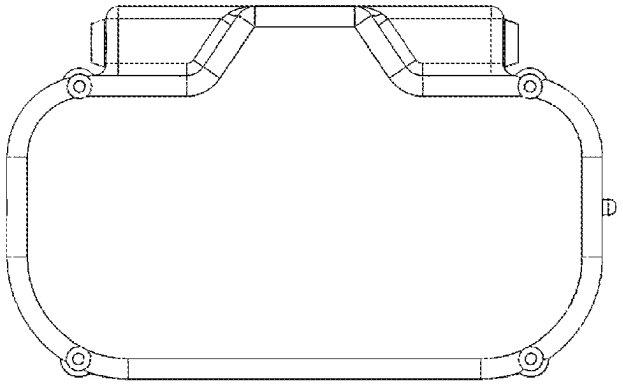


FIG. 6B

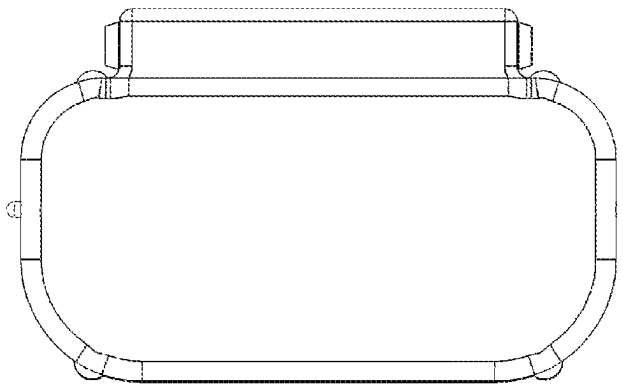


FIG. 6C

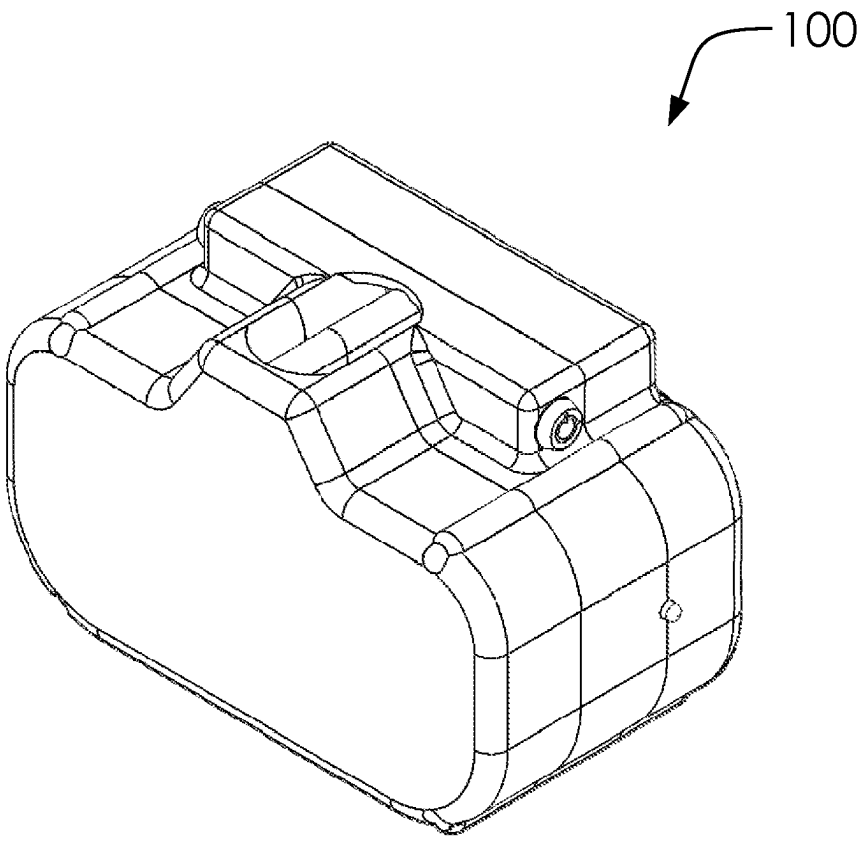


FIG. 7

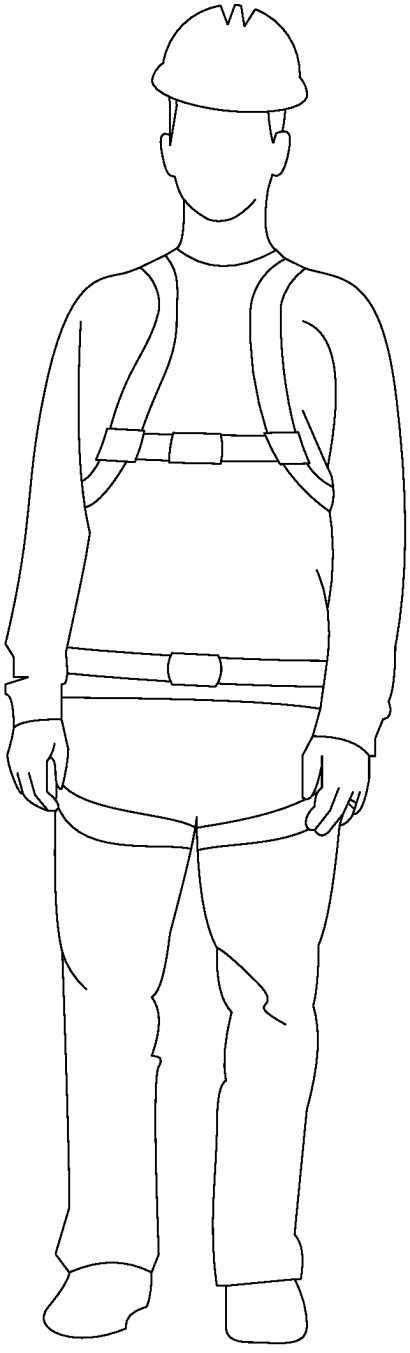


FIG. 8A

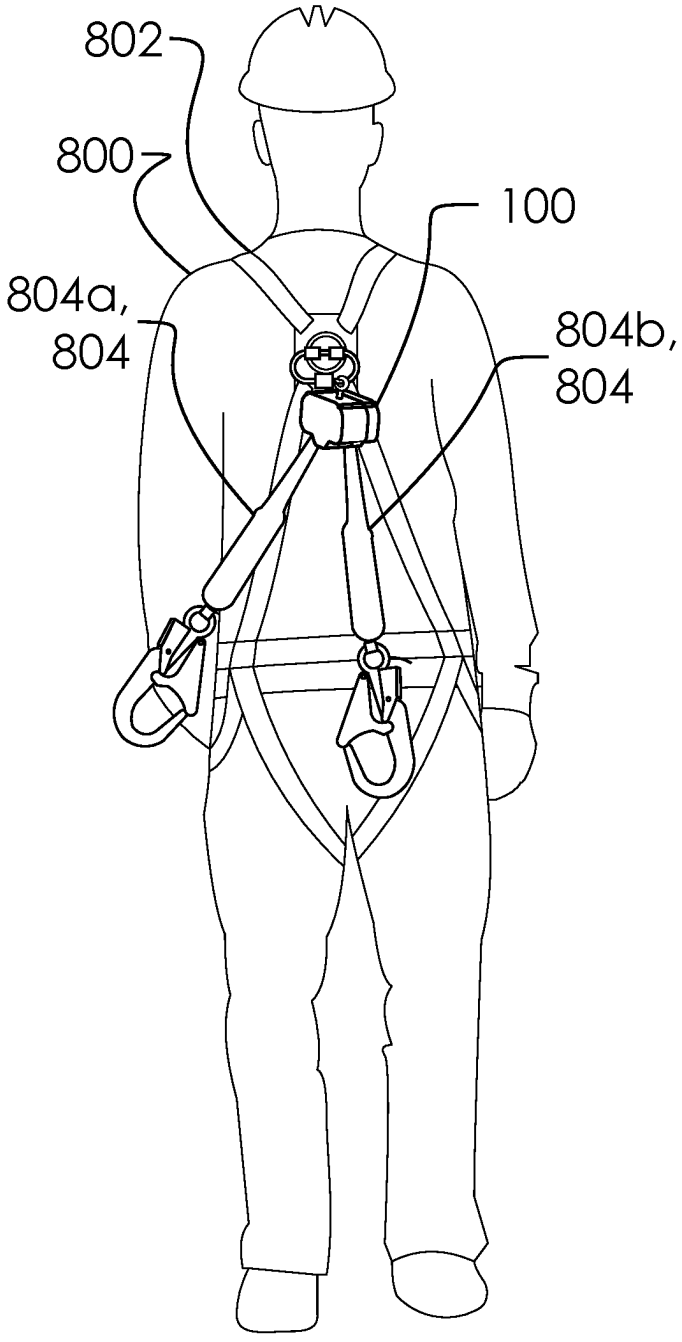


FIG. 8B

PRIOR ART

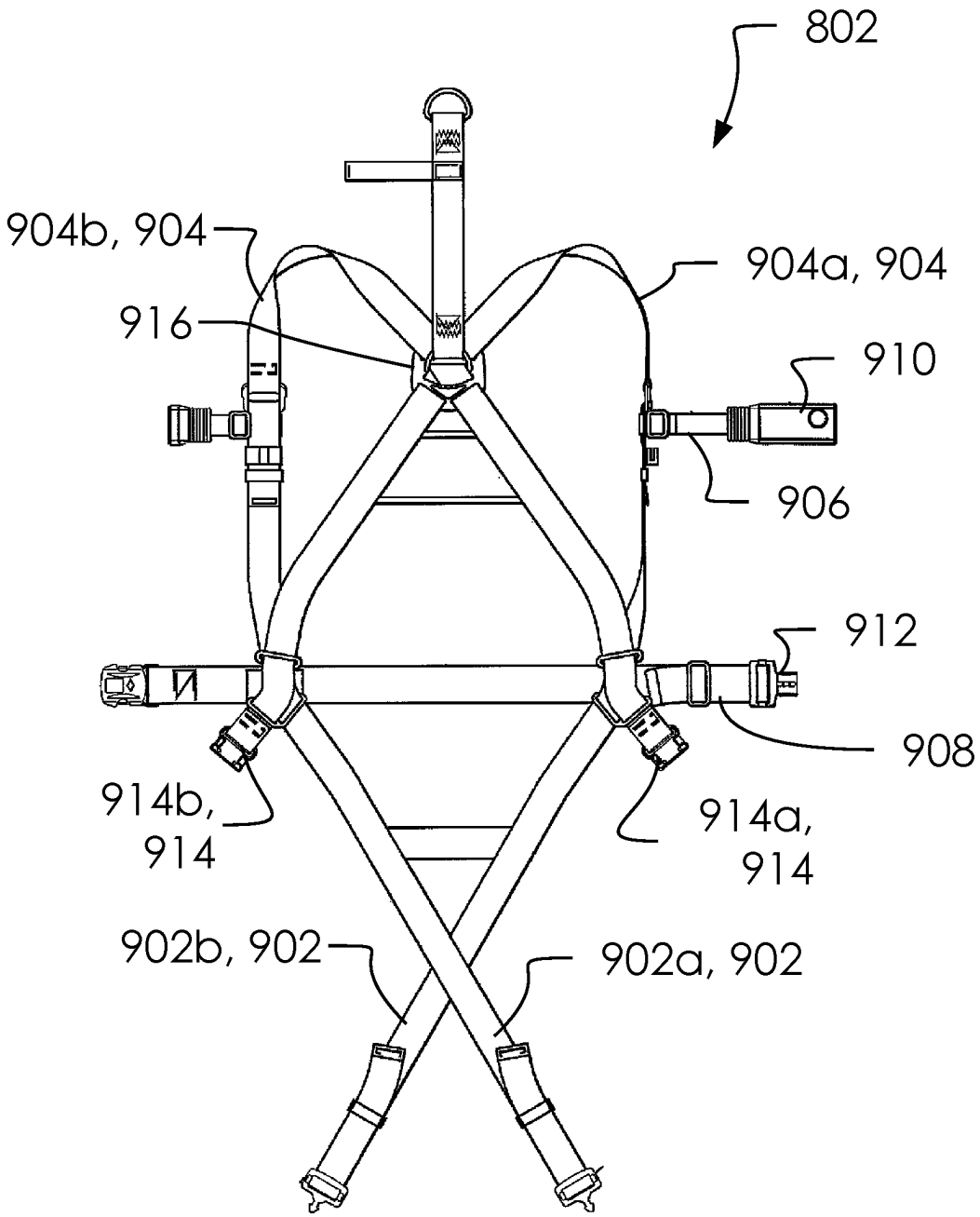


FIG. 9

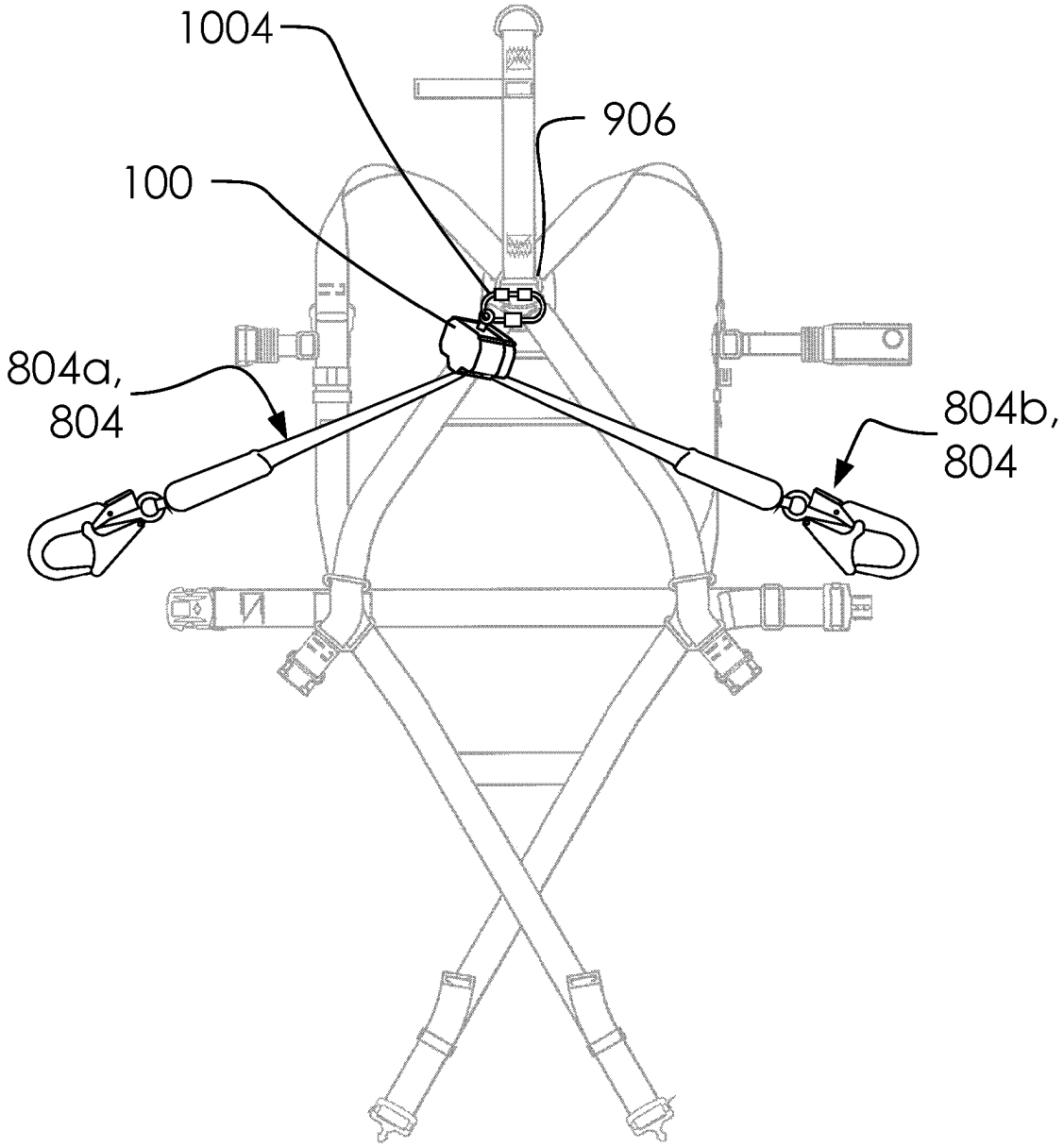


FIG. 10

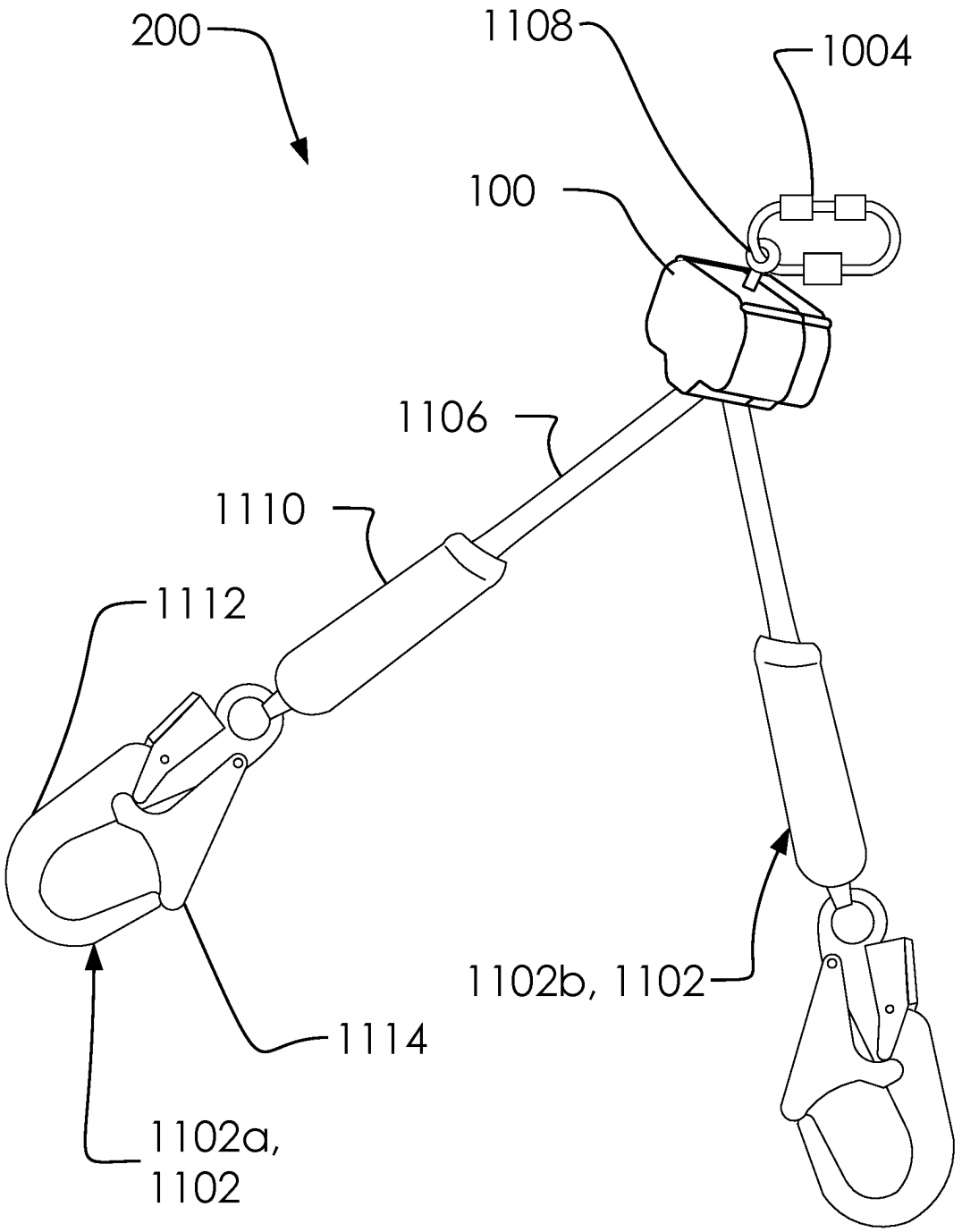


FIG. 11

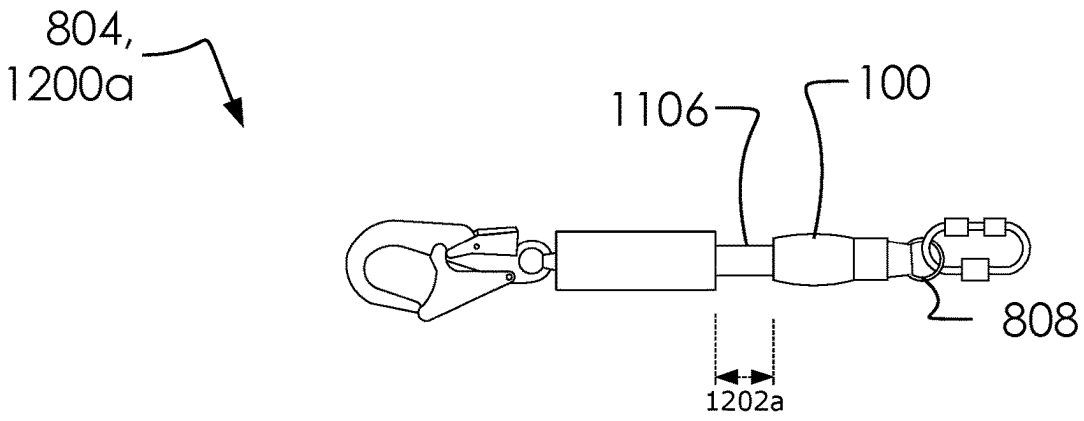


FIG. 12A

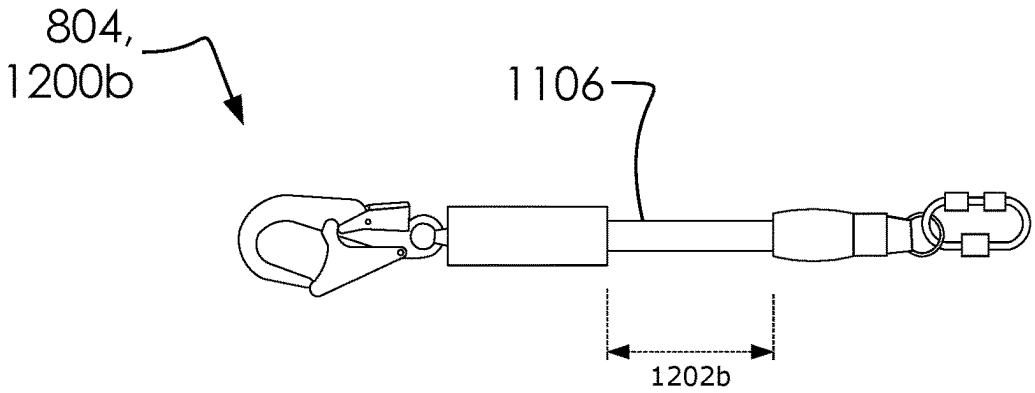


FIG. 12B

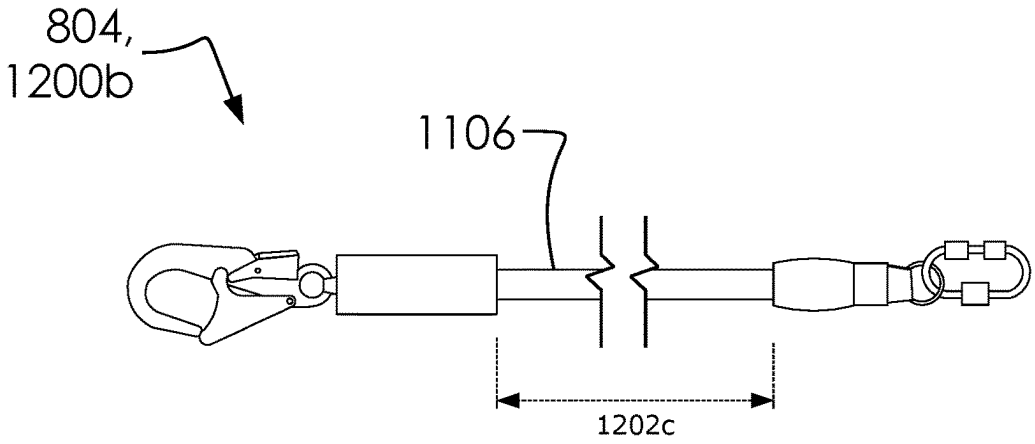


FIG. 12C

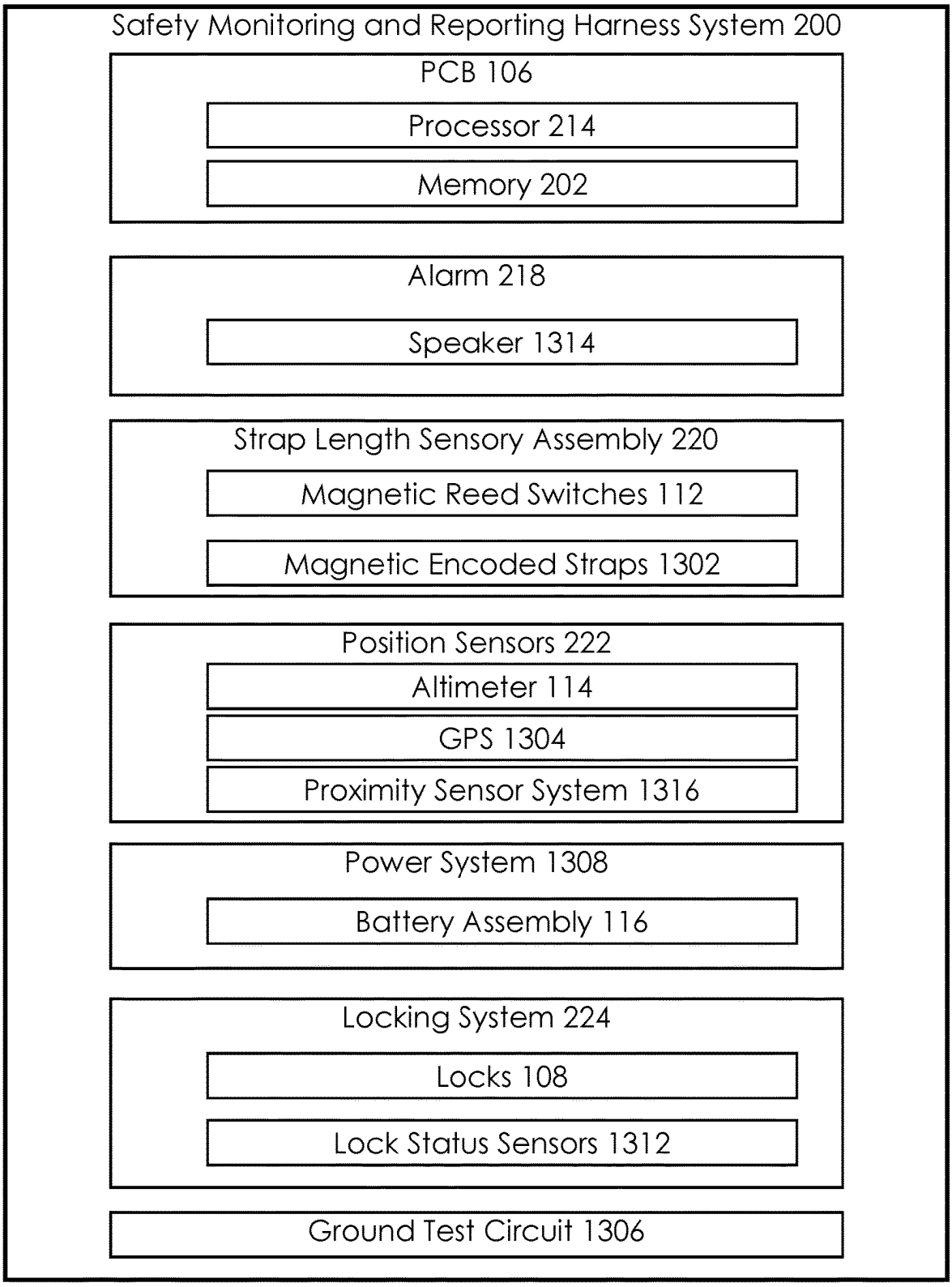

Safety Monitoring and Reporting Harness System 200
PCB 106
Processor 214
Memory 202
Alarm 218
Speaker 1314
Strap Length Sensory Assembly 220
Magnetic Reed Switches 112
Magnetic Encoded Straps 1302
Position Sensors 222
Altimeter 114
GPS 1304
Proximity Sensor System 1316
Power System 1308
Battery Assembly 116
Locking System 224
Locks 108
Lock Status Sensors 1312
Ground Test Circuit 1306

FIG. 13

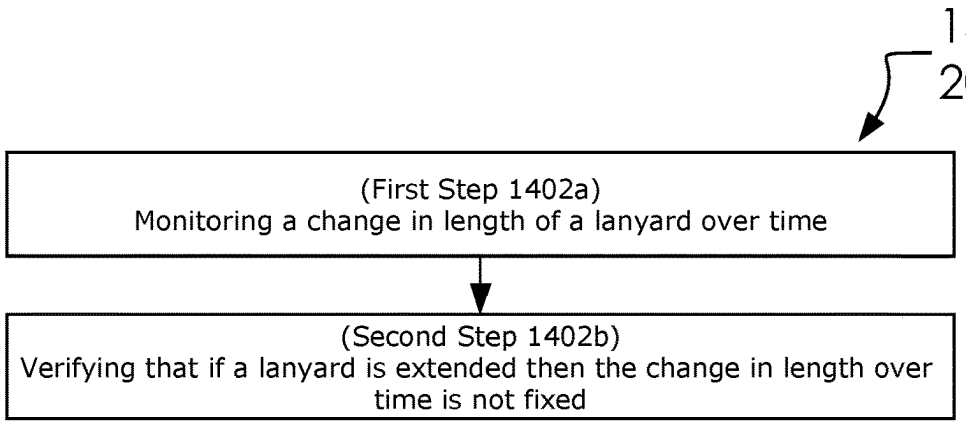


FIG. 14A

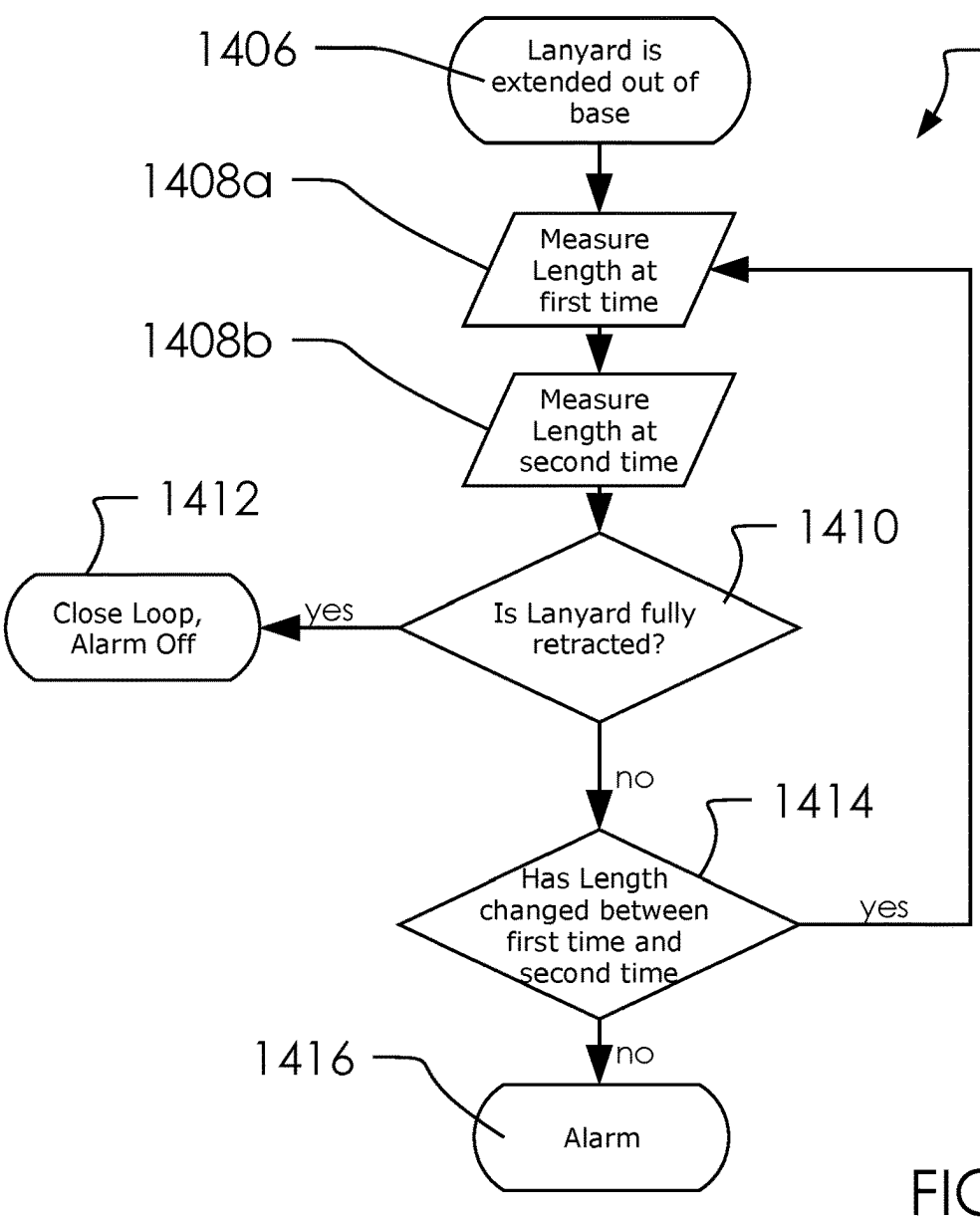


FIG. 14B

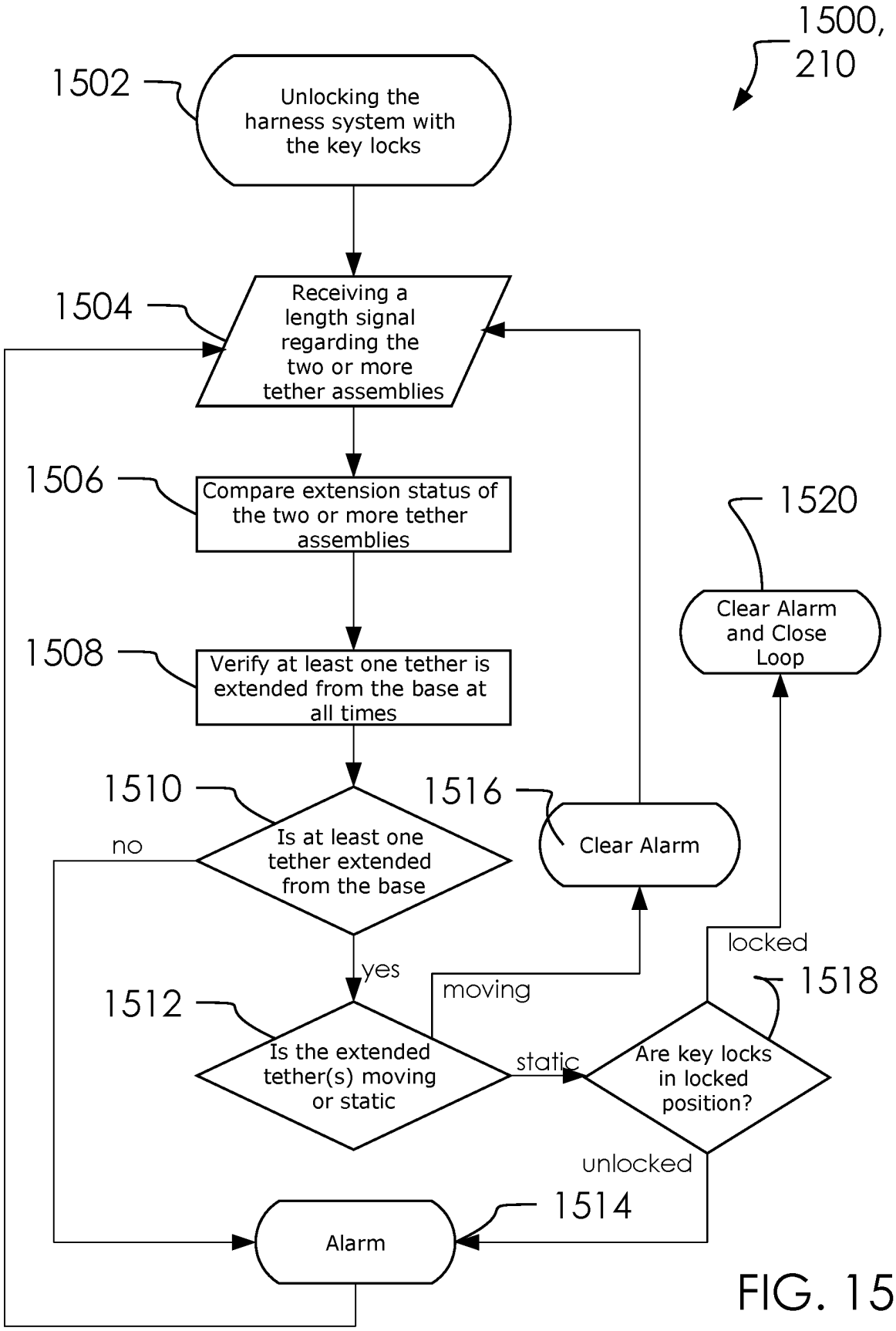

1500, 210
1502
Unlocking the harness system with the key locks
1504
Receiving a length signal regarding the two or more tether assemblies
1506
Compare extension status of the two or more tether assemblies
1508
Verify at least one tether is extended from the base at all times
1510
Is at least one tether extended from the base
no
yes
1512
Is the extended tether(s) moving or static
moving
static
1516
Clear Alarm
1518
Are key locks in locked position?
locked
unlocked
1520
Clear Alarm and Close Loop
1514
Alarm

FIG. 15

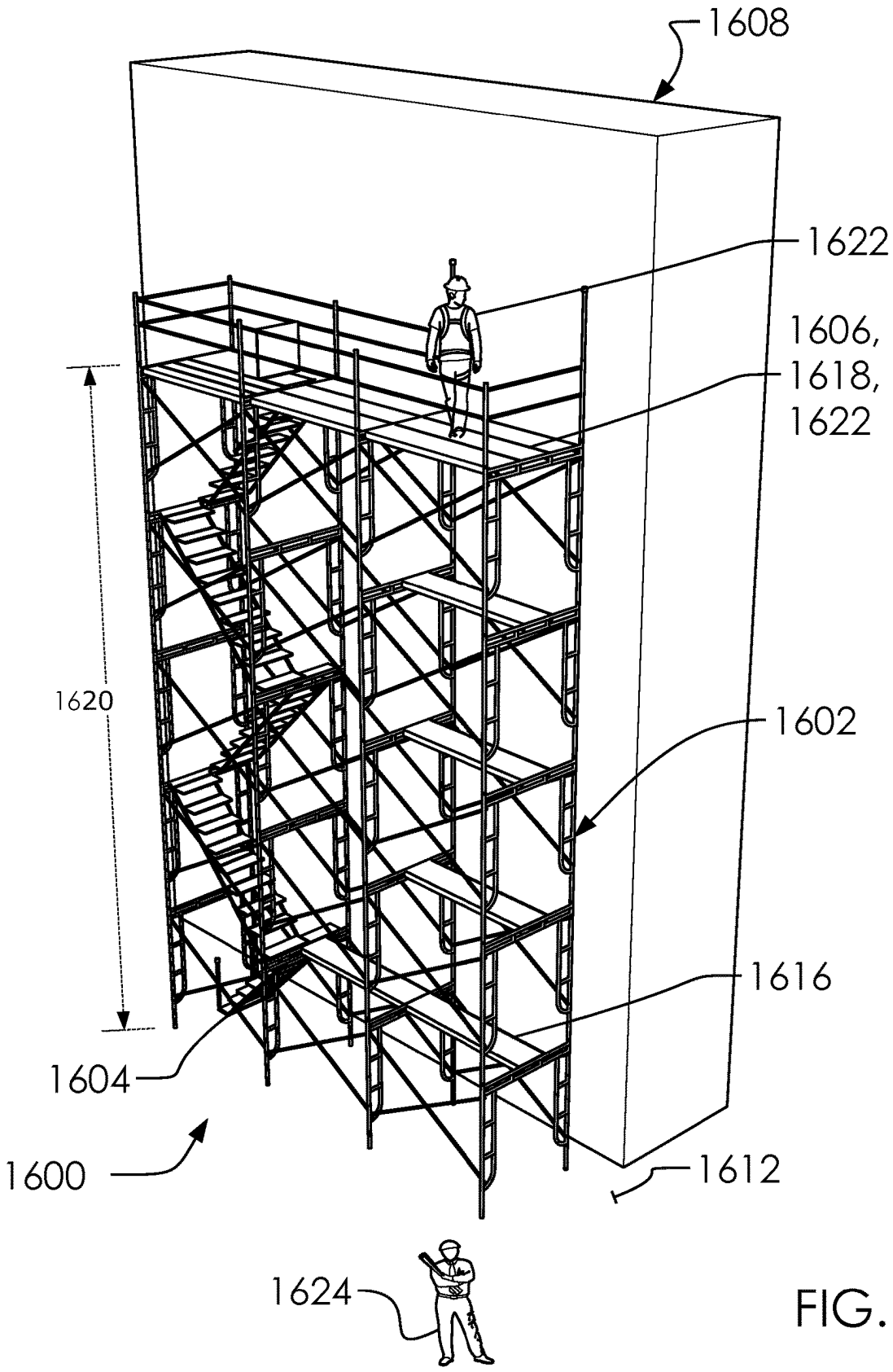


FIG. 16

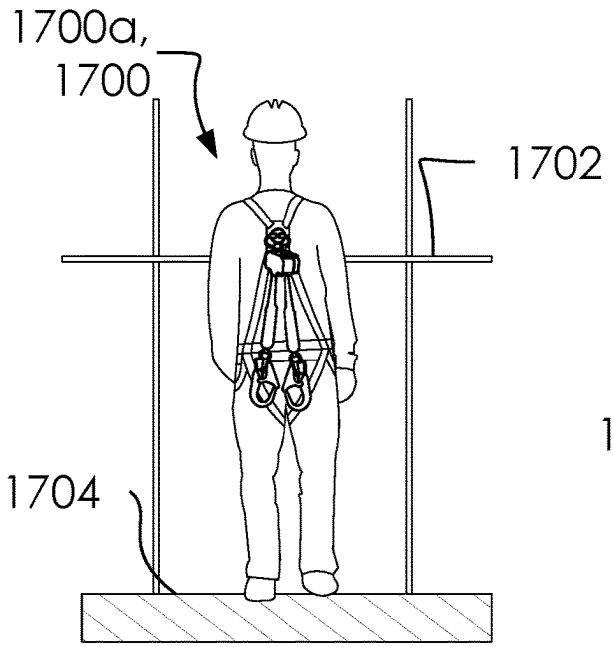


FIG. 17A

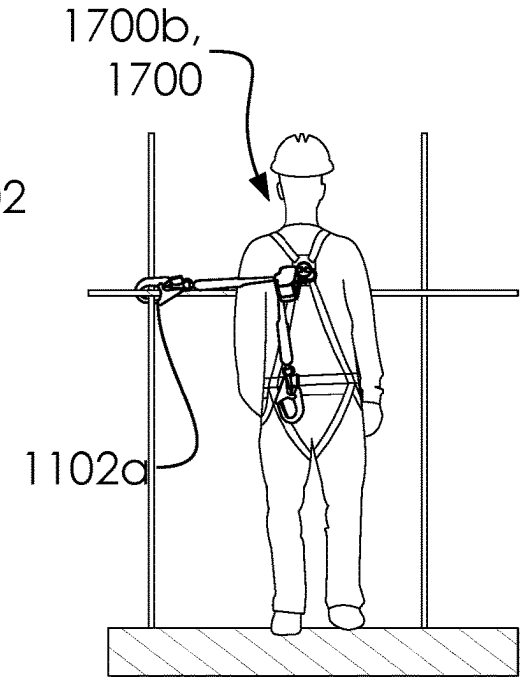


FIG. 17B

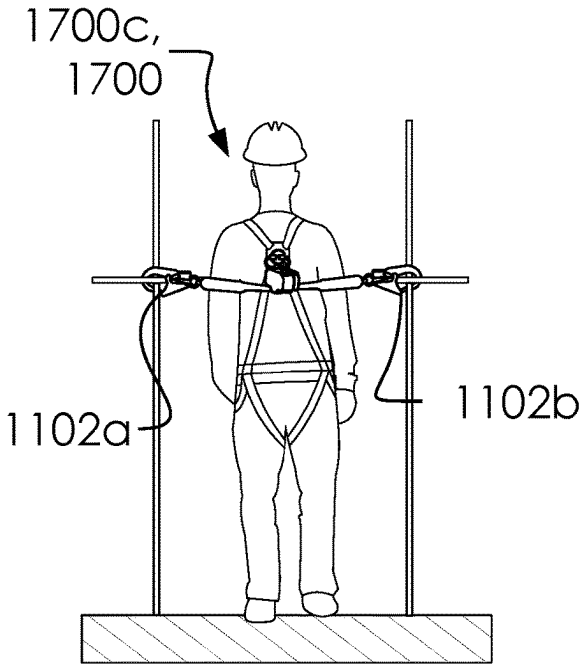


FIG. 17C

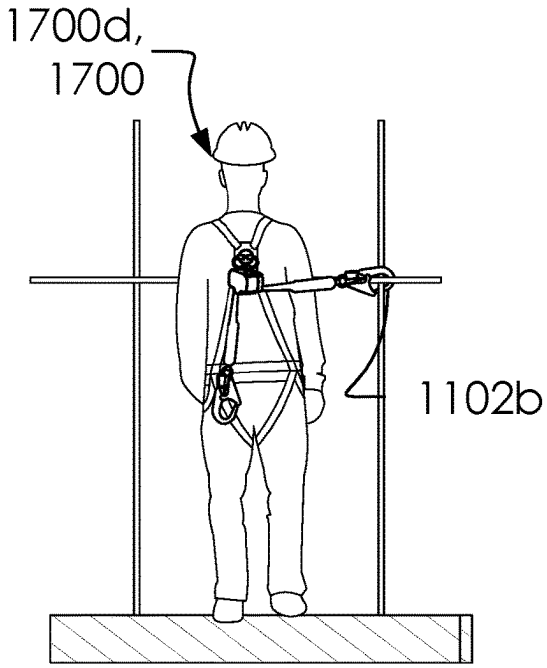


FIG. 17D

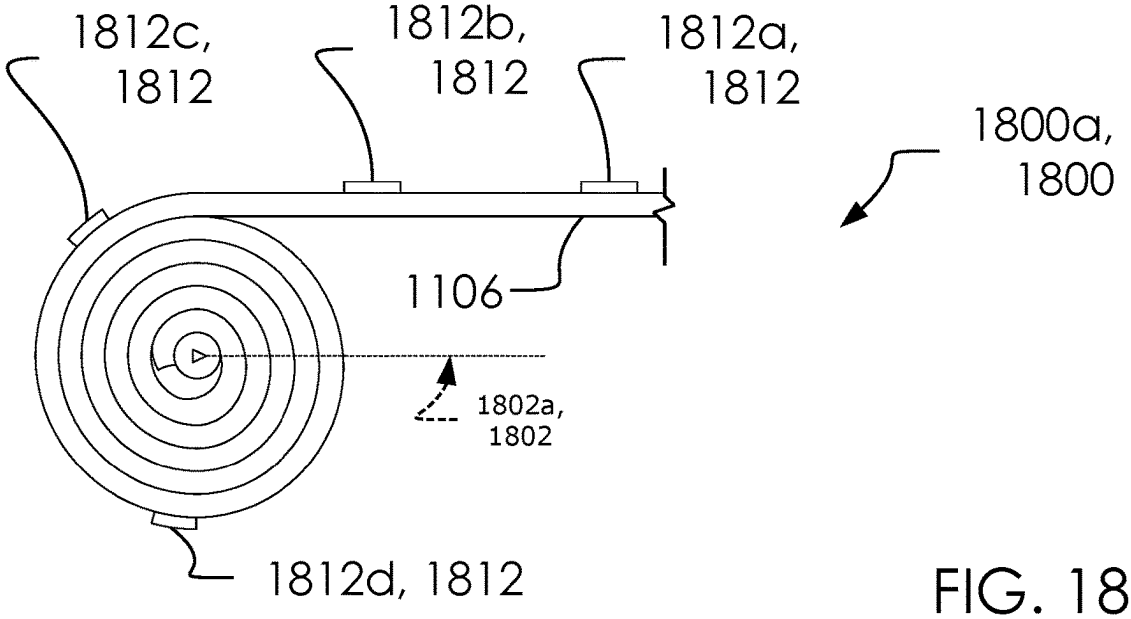


FIG. 18A

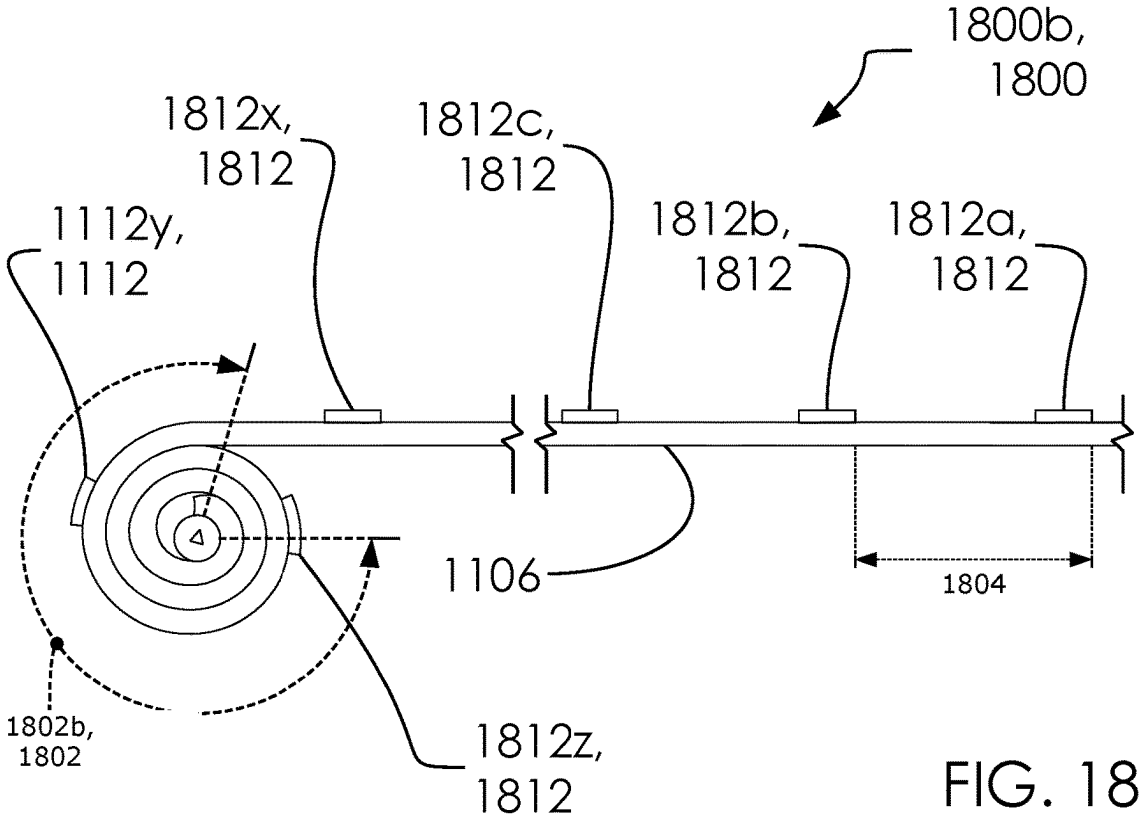


FIG. 18B

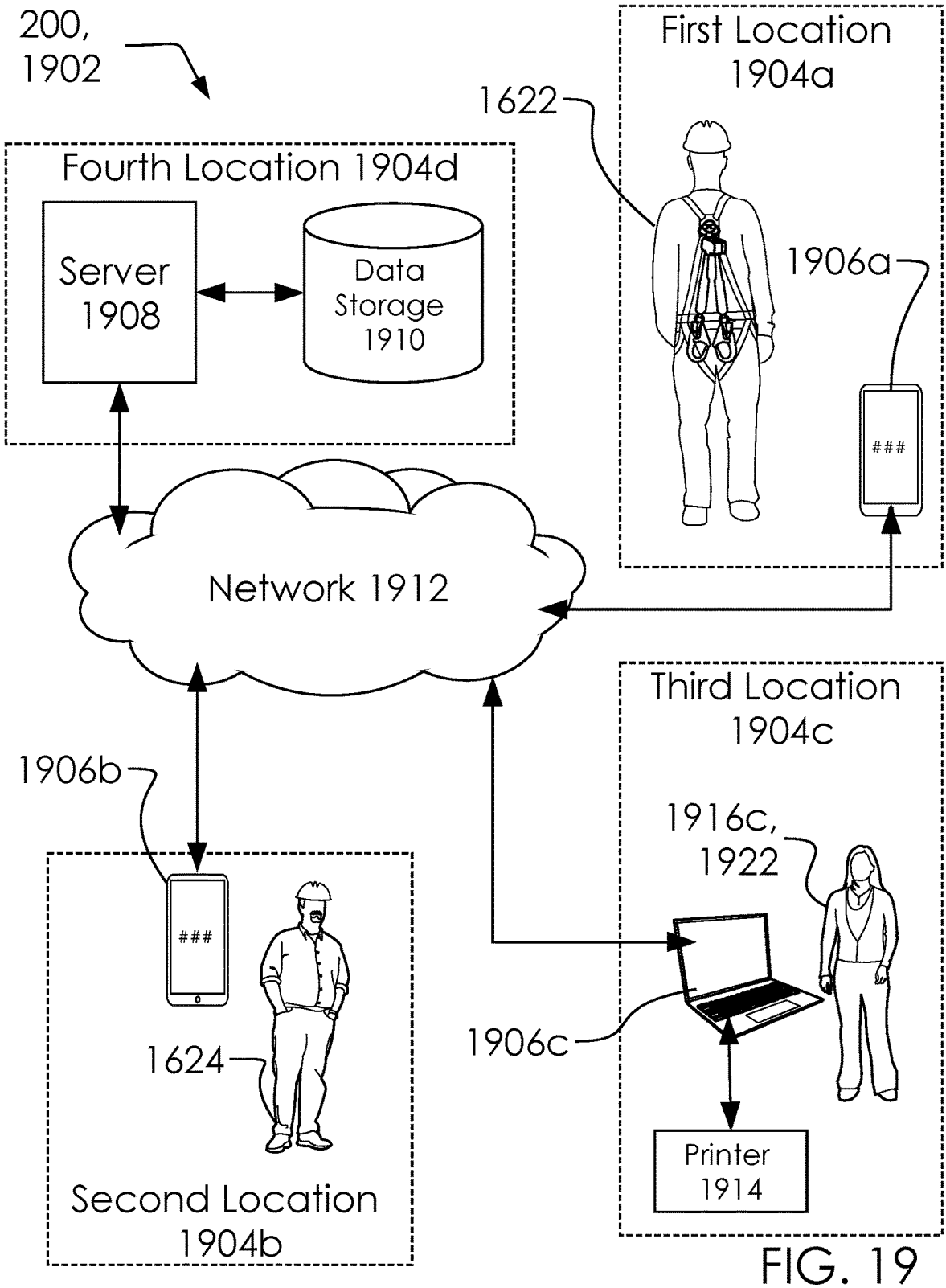

200,
1902
First Location
1904a
1622
1906a
###
Fourth Location 1904d
Server
1908
Data
Storage
1910
Network 1912
Third Location
1904c
1916c,
1922
1906b
###
1624
1906c
Printer
1914
Second Location
1904b

FIG. 19

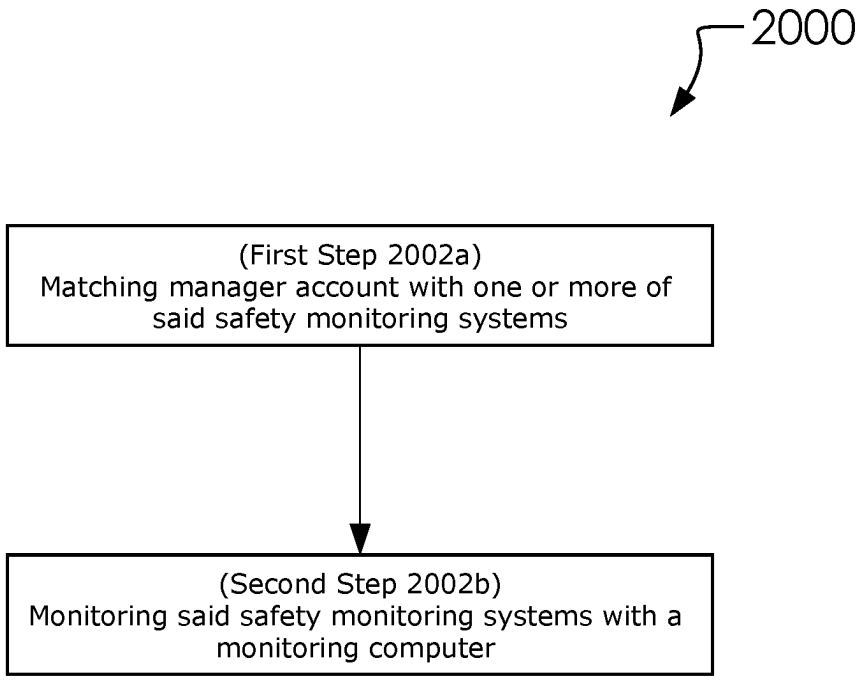

2000
(First Step 2002a)
Matching manager account with one or more of said safety monitoring systems
(Second Step 2002b)
Monitoring said safety monitoring systems with a monitoring computer

FIG. 20

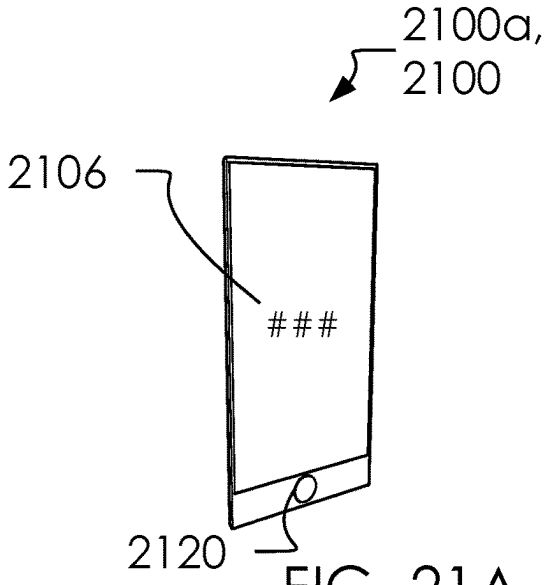


FIG. 21A

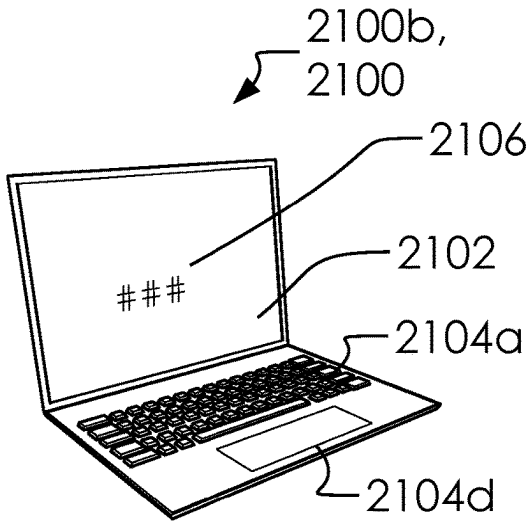


FIG. 21B

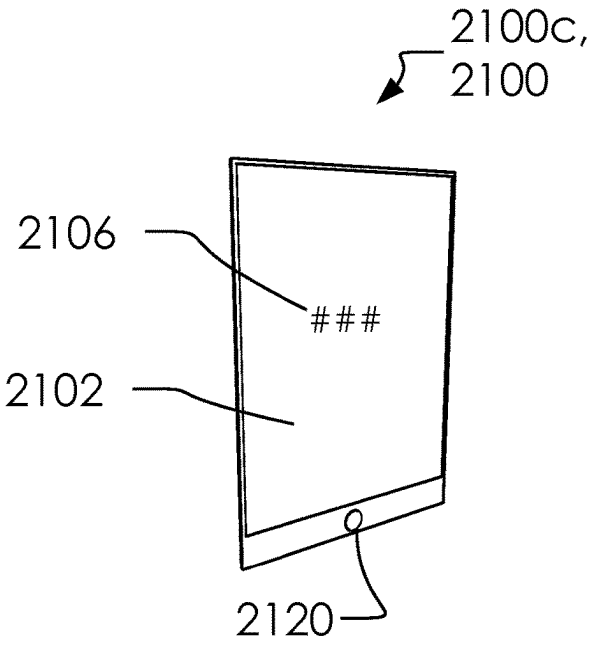


FIG. 21C

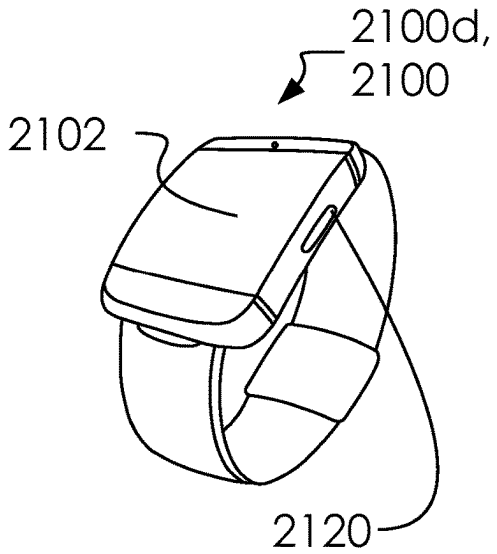


FIG. 21D

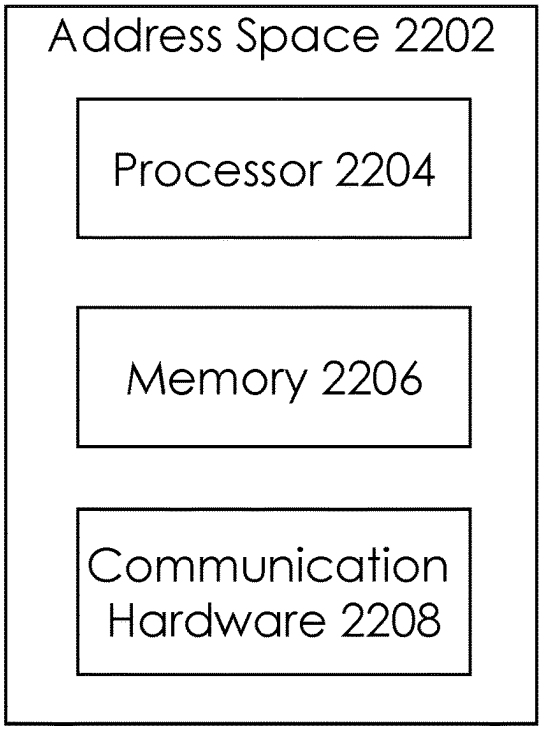


FIG. 22A

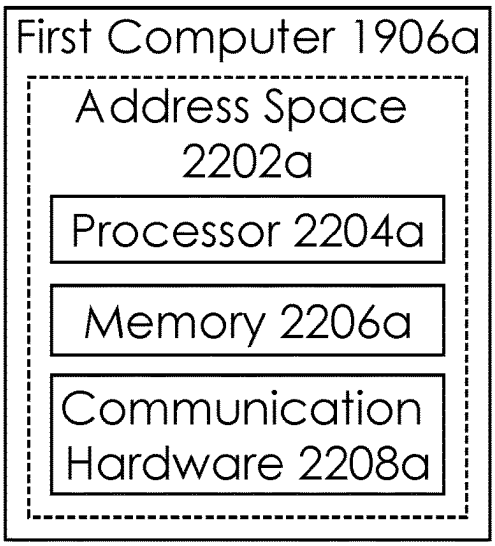


FIG. 22B

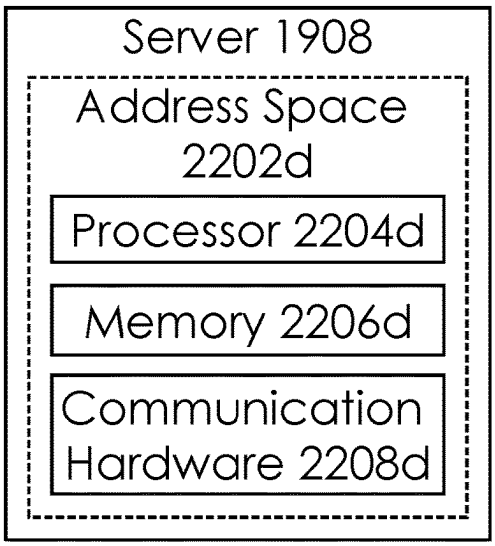


FIG. 22C

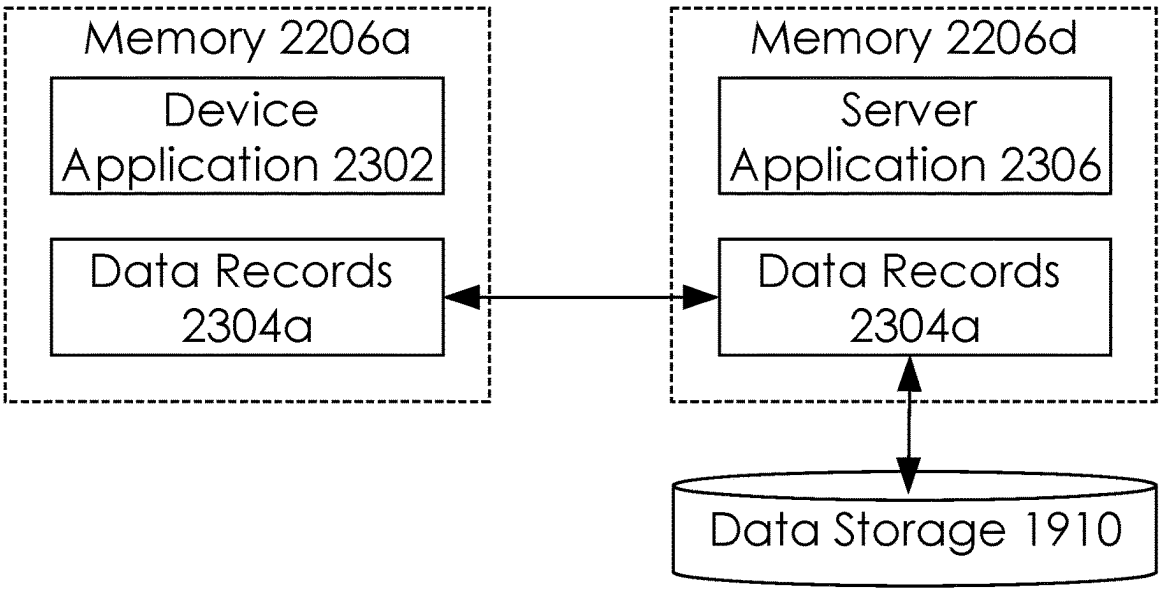
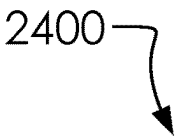

Memory 2206a
Device Application 2302
Data Records 2304a
Memory 2206d
Server Application 2306
Data Records 2304a
Data Storage 1910

FIG. 23



	number of markers (2402a)	strap length (2402b)	current movement (2402c)	last movement (2402d)	number markers outside case (2402e)	absolute velocity average last minute (2402f)
first tether (2404a)	24	5 meters	TRUE	0 seconds	10	20 cm
second tether (2404b)	24	5 meters	FALSE	33 seconds	0	1 cm

FIG. 24

2502

2500

BaseID (2502a)	timeReading (2502b)	timeSeconds (2502c)	timeSeconds BaseZero (1602d)	strapLengthMeters (2502e)	markersOutsideCase (2502f)
first base (2504a)	15:27:52.0	00:00:00.0	0	0.4167	2
first base (2504a)	15:27:52.1	00:00:00.1	0.05	0.4412	3
first base (2504a)	15:27:52.2	00:00:00.2	0.1	0.5147	3
first base (2504a)	15:27:52.3	00:00:00.3	0.15	0.6372	4
first base (2504a)	15:27:52.4	00:00:00.4	0.2	0.8087	4
first base (2504a)	15:27:52.5	00:00:00.5	0.25	1.0292	5
first base (2504a)	15:27:52.5	00:00:00.6	0.3	1.2987	7
first base (2504a)	15:27:52.6	00:00:00.7	0.35	1.6172	8
first base (2504a)	15:27:52.8	00:00:00.8	0.4	1.9847	10
first base (2504a)	15:27:52.8	00:00:00.9	0.45	2.4012	12
first base (2504a)	15:27:53.0	00:00:01.0	0.5	2.8667	14
first base (2504a)	15:27:53.1	00:00:01.1	0.55	3.3812	17
first base (2504a)	15:27:53.1	00:00:01.2	0.6	3.9447	19
first base (2504a)	15:27:53.3	00:00:01.3	0.65	4.5572	22
first base (2504a)	15:27:53.3	00:00:01.4	0.7	5.0000	24
first base (2504a)	15:27:53.5	00:00:01.5	0.75	5.0000	24
first base (2504a)	15:27:53.6	00:00:01.6	0.8	5.0000	24
first base (2504a)	15:27:53.7	00:00:01.7	0.85	5.0000	24
first base (2504a)	15:27:53.8	00:00:01.8	0.9	5.0000	24

FIG. 25A

2508

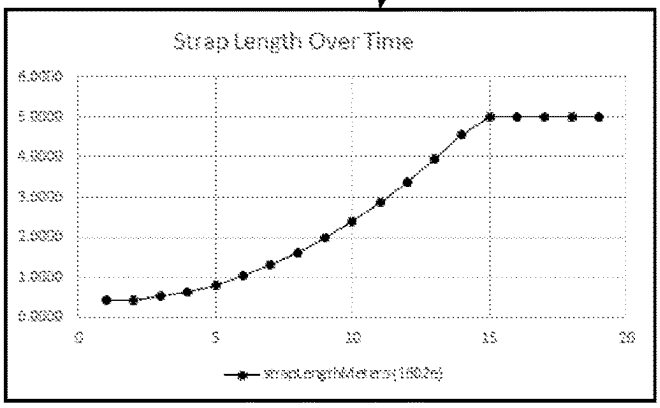


FIG. 25B

2506

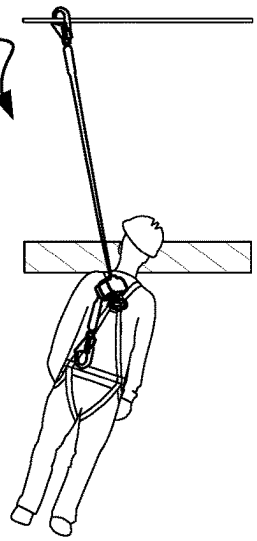
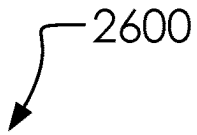
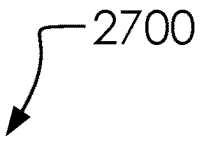


FIG. 25C



UserID 2602	Location 2604	TimeUp 2606	PercentTiedoff 2608	CurrentStatus 2610
first climber 2612a	Up	1.5 hours	1	Safe
second climber 2612b	Up	0.2 hours	1	Safe
third climber 2612c	Ground	0 hours	N/A	Safe
fourth climber 2612d	Hanging	2.1 hours	0.97	Safe - Fall Event

FIG. 26



UserID 2702	first tether status 2704	seceond tether status 2706	safety status 2708	eventTime 2710	statePeriod 2714
first climber 2712a	On	Off	Safe	13:18:20	.81
first climber 2712a	Off	On	Safe	13:18:20	.80.2
first climber 2712a	On	Off	Safe	13:18:20	.80.6
first climber 2712a	Off	Off	Not Safe	13:18:20	.80.3
first climber 2712a	Off	On	Safe	13:18:20	.80.5
first climber 2712a	On	Off	Safe	13:18:20	.80.4

FIG. 27

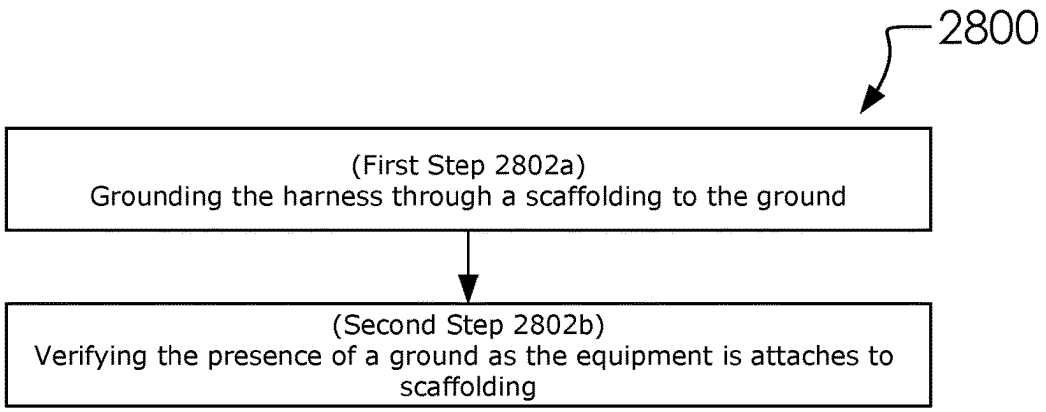


FIG. 28A

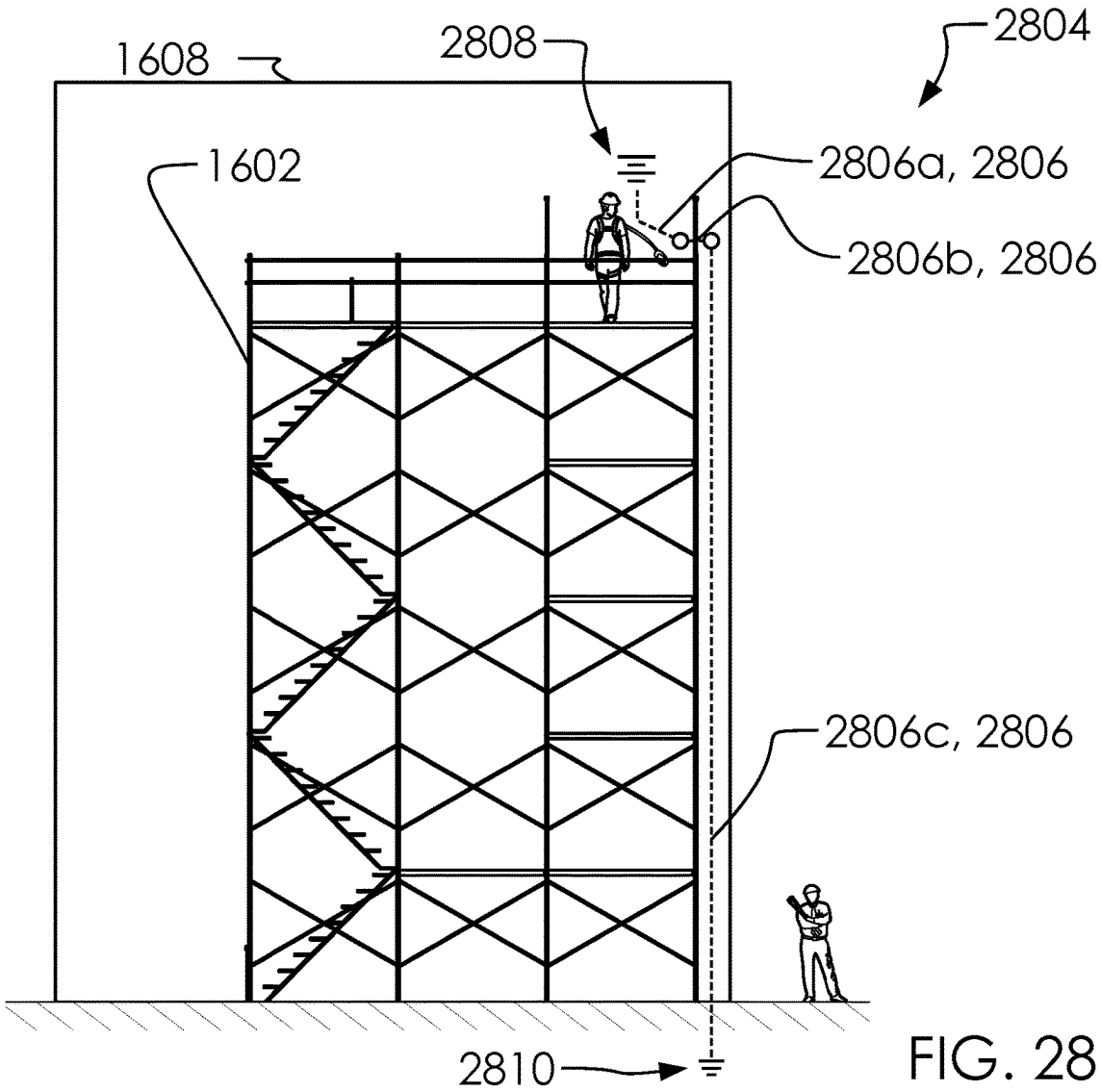


FIG. 28B

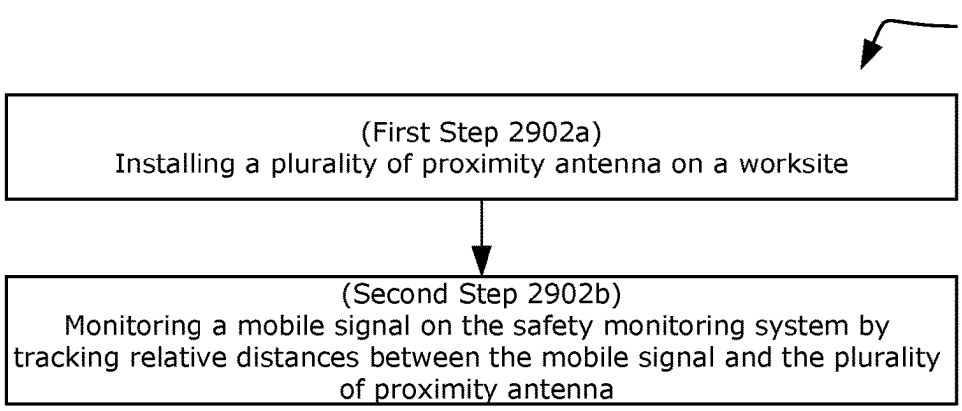


FIG. 29A

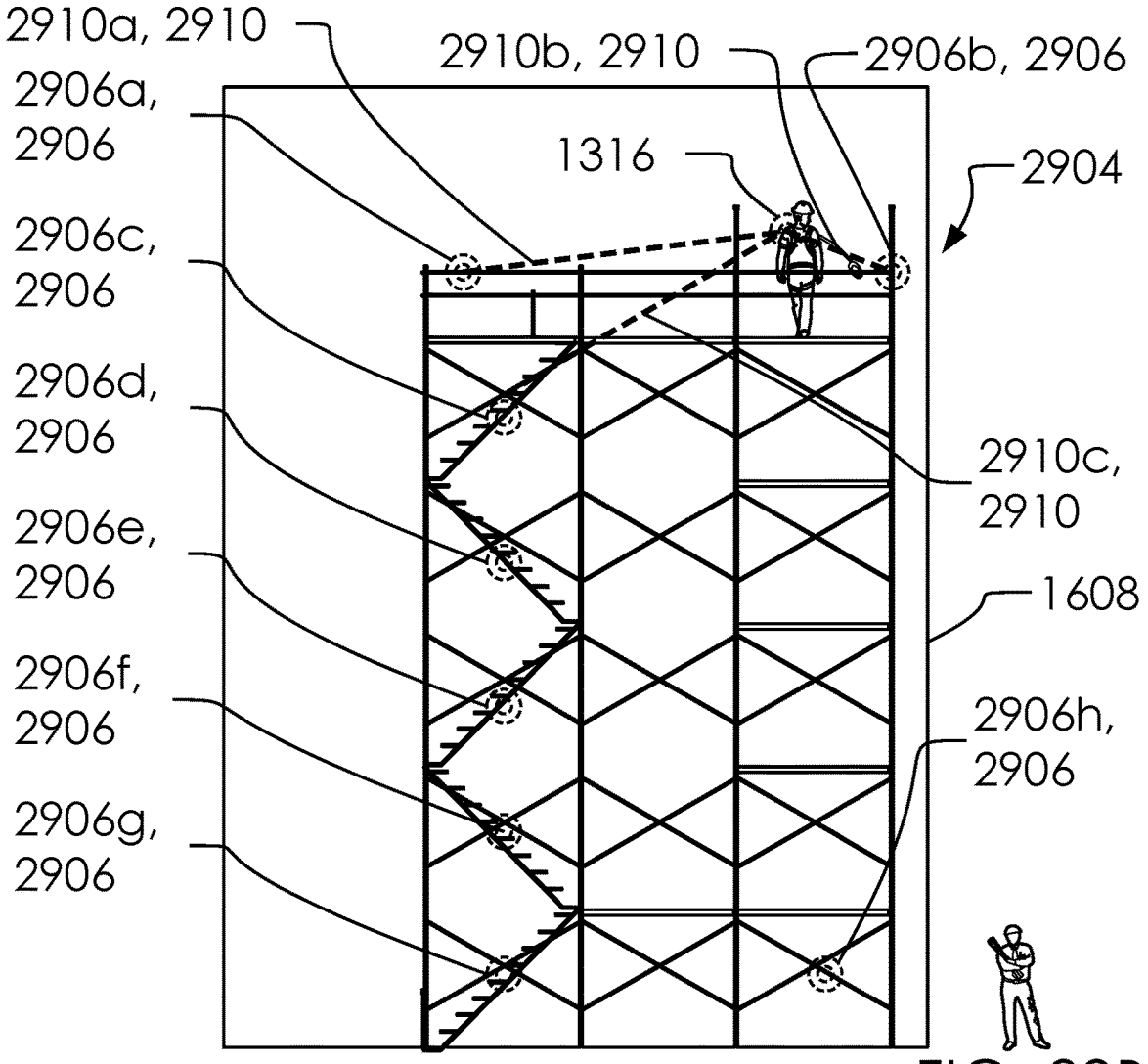


FIG. 29B

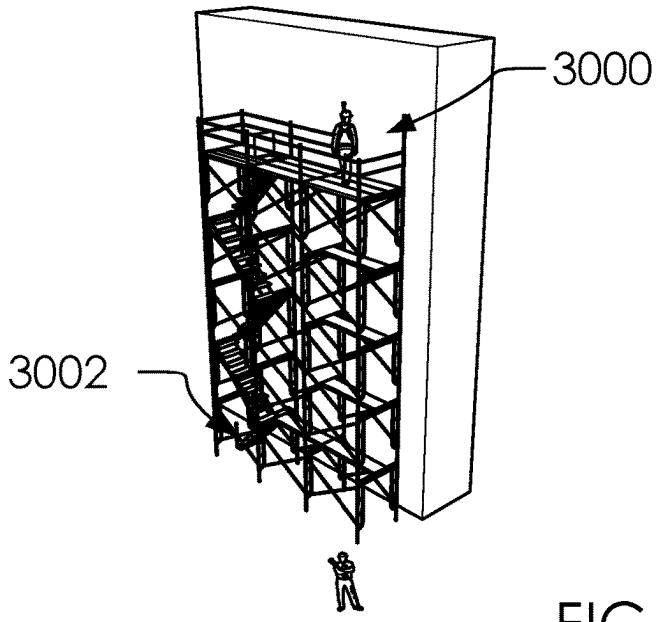


FIG. 30A

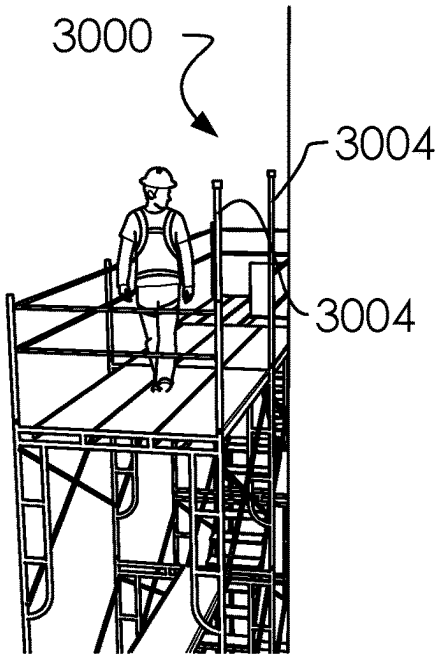


FIG. 30B

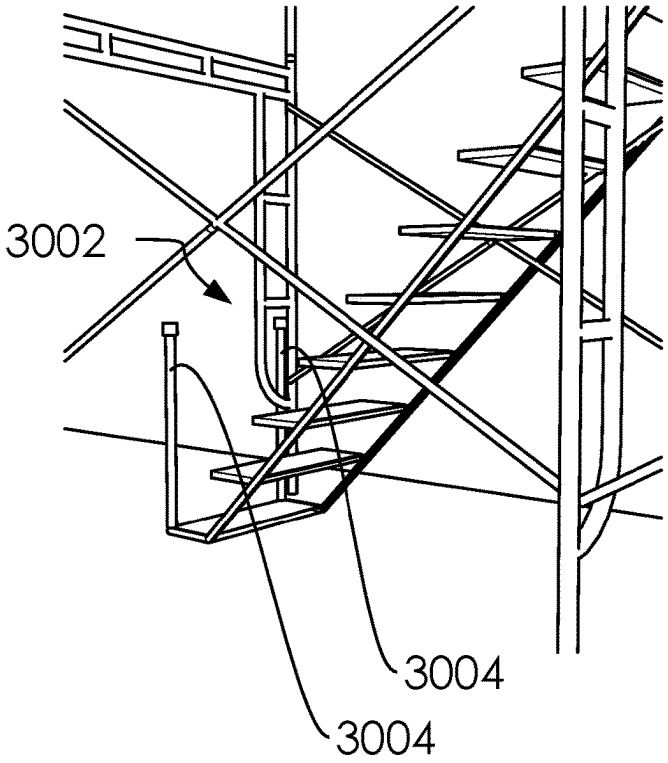


FIG. 30C

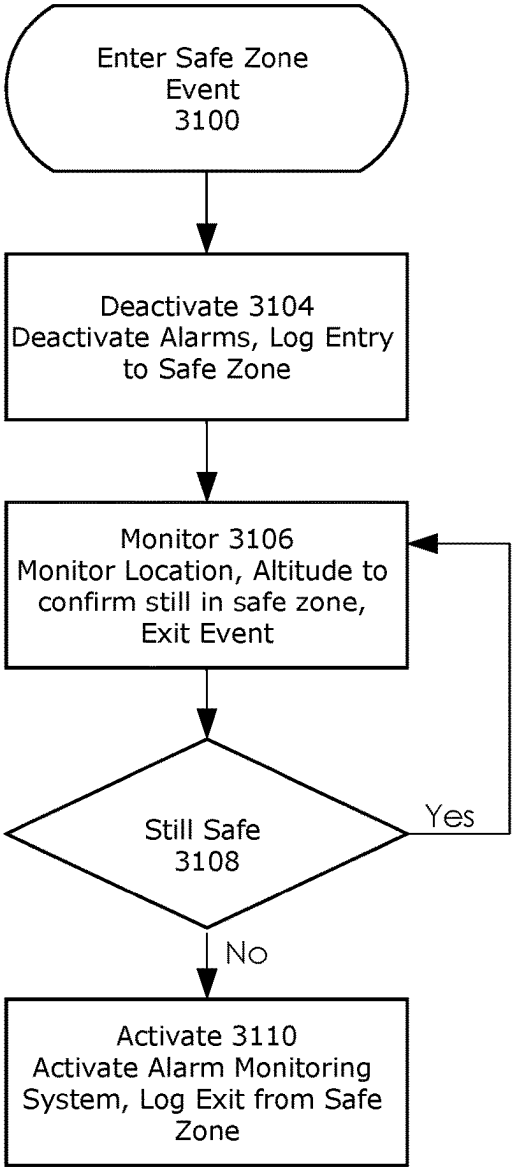


FIG. 31A

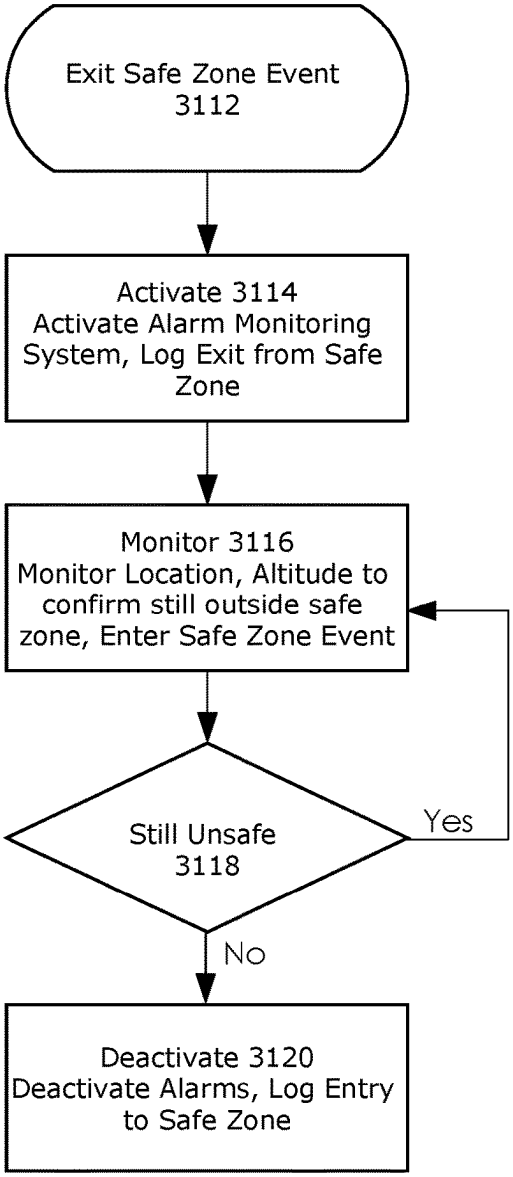


FIG. 31B

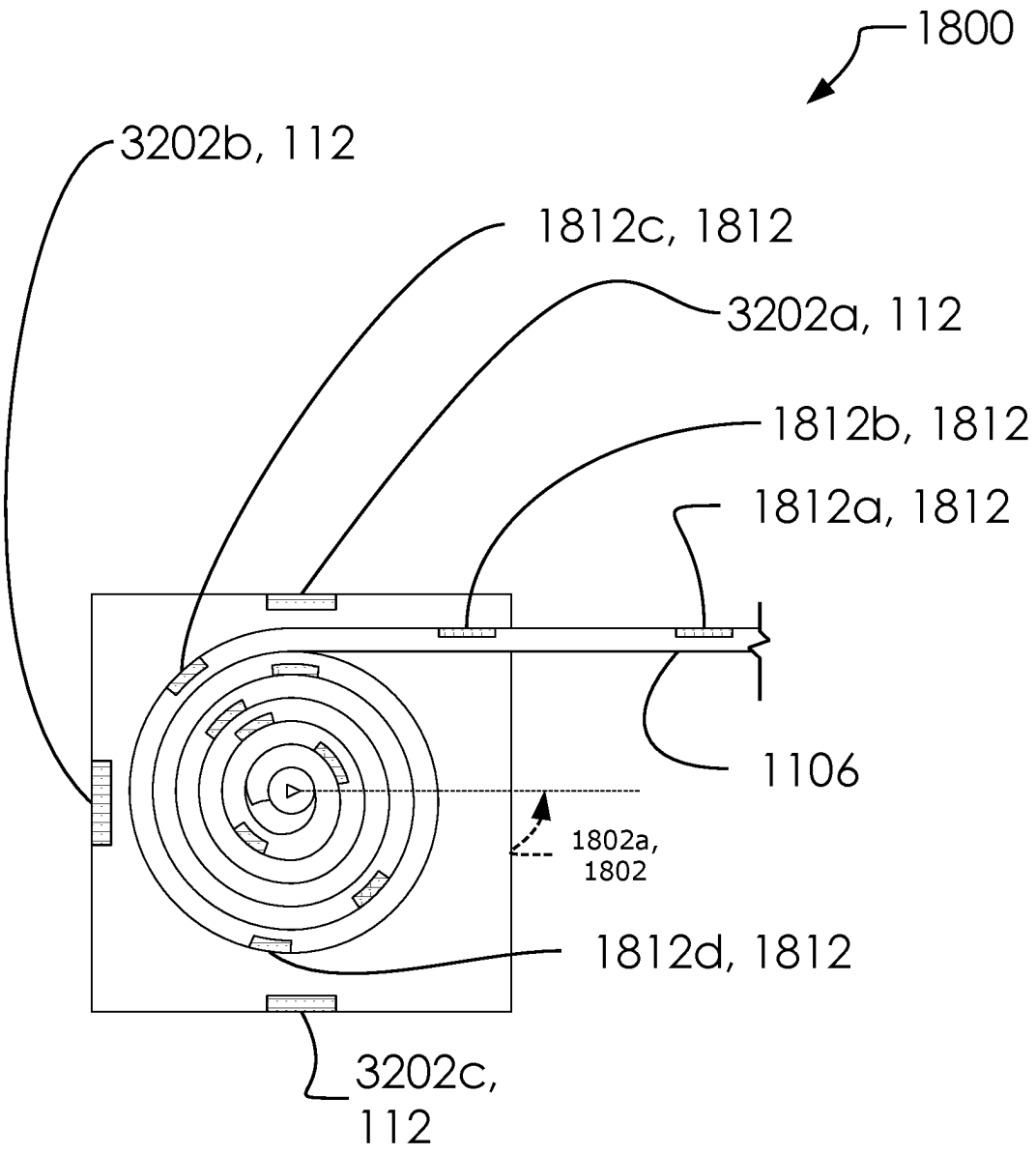

1800
3202b, 112
1812c, 1812
3202a, 112
1812b, 1812
1812a, 1812
1106
1802a, 1802
1812d, 1812
3202c, 112

FIG. 32

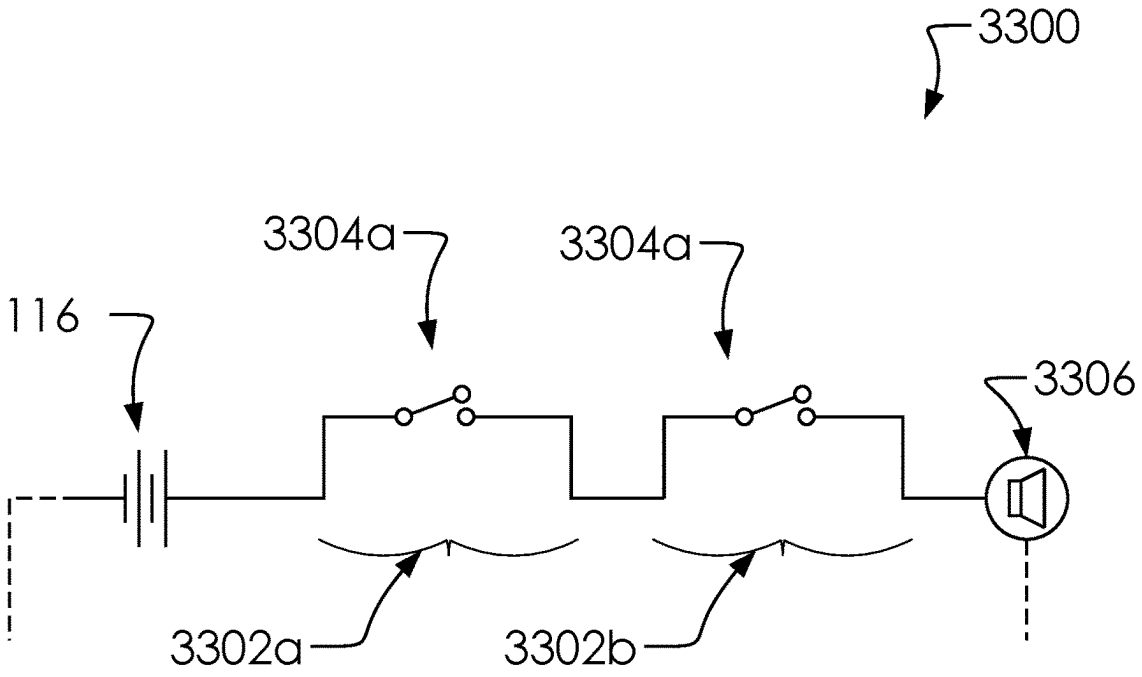


FIG. 33

SAFETY SYSTEM WITH DIGITAL TRACKING AND REPORTING AND METHOD OF USE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims benefit to US Patent Application Nos. 62/533,898 filed on Jul. 18, 2017 and 62/583,295 filed on Nov. 8, 2017.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT (IF APPLICABLE)

Not applicable.

REFERENCE TO SEQUENCE LISTING, A TABLE, OR A COMPUTER PROGRAM LISTING COMPACT DISC APPENDIX (IF APPLICABLE)

Not applicable.

BACKGROUND OF THE INVENTION

Prior art known to the Applicant includes US20150276521A1, US20140323271A1, US20150265860A1, US20120217091A1, US20110103558A1, US20110090079A1, U.S. Pat. No. 8,325,053B2, and U.S. Pat. No. 9,480,866B2

None of the known inventions and patents, taken either singularly or in combination, is seen to describe the instant disclosure as claimed.

BRIEF SUMMARY OF THE INVENTION

A safety monitoring harness system for the protection of a climber comprising: said safety monitoring harness system comprising a base, a one or more tether assemblies, a retraction assembly, an alarm system, a strap length sensor assembly, and a power system. Said one or more tether assemblies comprising at least a first tether assembly and a second tether assembly. Said one or more tether assemblies each comprising a strap, and an anchoring hook. Said safety monitoring harness system is configured to selectively attach to said climber by: attaching a harness assembly to said climber, and securing said base to said harness assembly. A portion of said retraction assembly is enclosed within said base. Said retraction assembly are configured to selectively retract and release portions of said strap from within said base. Said base tracks the position of said one or more tether assemblies by measuring portions of said strap inside and outside of said base. Said anchoring hook selectively retract and extend between a plurality of lengths. Said plurality of lengths comprise at least a retracted length and a fully extended length. Said anchoring hook are configured to selectively attach to an anchor point. Said safety monitoring harness system is configured to measure the movement of said strap by measuring movement of a plurality of strap markers relative to a one or more mag reed switches. Said safety monitoring harness system is configured to monitor use of said one or more tether assemblies by said climber by: monitoring a change in the position of said one or more tether assemblies over time, verifying that at least one among said one or more tether assemblies is extended, and

verifying that at least one among said one or more tether assemblies which is extended is showing movement rather than a fixed length.

A safety monitoring harness system for the protection of a climber comprising: said safety monitoring harness system comprising a base, a one or more tether assemblies, a retraction assembly, an alarm system, a strap length sensor assembly, and a power system. Said one or more tether assemblies comprising at least a first tether assembly and a second tether assembly. Said one or more tether assemblies each comprising a strap, and an anchoring hook. Said safety monitoring harness system is configured to selectively attach to said climber by: attaching a harness assembly to said climber, and securing said base to said harness assembly. A portion of said retraction assembly is enclosed within said base. Said retraction assembly are configured to selectively retract and release portions of said strap from within said base. Said anchoring hook selectively retract and extend between a plurality of lengths. Said plurality of lengths comprise at least a retracted length and a fully extended length. Said anchoring hook of said one or more tether assemblies are configured to selectively attach to an anchor point. Said safety monitoring harness system is configured to monitor use of said one or more tether assemblies by said climber by: verifying that at least one among said one or more tether assemblies is extended.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. **1** illustrates perspective overview of base **100**.

FIG. **2** illustrates block diagram of safety monitoring harness system **200**.

FIG. **3**A illustrates elevated exploded side view of case assembly **102**.

FIG. **3**B illustrates perspective overview of mid case portion **102***c*.

FIG. **3**C illustrates perspective backside view of mid case portion **102***c*.

FIG. **4**A illustrates a perspective overview view of retraction assembly **124**.

FIG. **4**B illustrates a perspective overview view of case assembly **102**.

FIG. **5**A illustrates perspective front view of retraction assembly **124**.

FIG. **5**B illustrates perspective overview of one or more key locks **108**.

FIG. **6**A illustrates elevated side view of base **100**.

FIG. **6**B illustrates elevated front view of base **100**.

FIG. **6**C illustrates elevated backside view of base **100**.

FIG. **7** illustrates perspective overview of base **100**.

FIG. **8**A illustrates perspective front view user **800**.

FIG. **8**B illustrates perspective overview of user **800**.

FIG. **9** illustrates elevated front view of said harness assembly **802**.

FIG. **10** illustrates elevated front view one or more tether assemblies **804**.

FIG. **11** illustrates perspective overview safety monitoring harness system **200** with base **100** and one or more tether assemblies **804**.

FIG. **12**A illustrates elevated overview of retracted configuration **1200***a*.

FIG. **12**B illustrates elevated overview of second configuration **1200***b*.

FIG. **12**C illustrates elevated overview of fully extended configuration **1200***c*.

FIG. **13** illustrates detailed block diagram of safety monitoring harness system **200**.

FIG. **14**A illustrates said safety monitoring method **1400**.

FIG. **14**B illustrates said length monitoring method flow chart **1404**.

FIG. **15** illustrates said safety arming and monitoring method **1500**.

FIG. **16** illustrates a perspective overview view of worksite **1600**.

FIG. **17**A illustrates an elevated back side view of unattached configuration **1700***a*.

FIG. **17**B illustrates an elevated back side view of first partially attached configuration **1700***b*.

FIG. **17**C illustrates an elevated back side view of fully attached configuration **1700***c*.

FIG. **17**D illustrates an elevated back side view of second partially attached configuration **1700***d*.

FIG. **18**A illustrates an elevated front side view of first retraction stage **1800***a*.

FIG. **18**B illustrates an elevated front side view of second retraction stage **1800***b*.

FIG. **19** illustrates a flow chart view of network diagram **1902**.

FIG. **20** illustrates a flow chart view of method of use **2000**.

FIG. **21**A illustrates a perspective overview view of mobile phone **2100***a*.

FIG. **21**B illustrates a perspective overview view of personal computer **2100***b*.

FIG. **21**C illustrates a perspective overview view of tablet computer **2100***c*.

FIG. **21**D illustrates a perspective overview view of wearable computer **2100***d*.

FIG. **22**A illustrates view of address space **2200**.

FIG. **22**B illustrates view of address space **2200***a*.

FIG. **22**C illustrates view of address space **2200***d*.

FIG. **23** illustrates device application **2302** and server application **2306**.

FIG. **24** illustrates said tether status table **2400**.

FIG. **25**A illustrates said tether log table **2500**.

FIG. **25**B illustrates said strap length chart **2508**.

FIG. **25**C illustrates said falling illustration **2506**.

FIG. **26** illustrates said supervisor status table **2600**.

FIG. **27** illustrates said climber status table **2700**.

FIG. **28**A illustrates said grounding calculation method **2800**.

FIG. **28**B illustrates elevated front view of grounding diagram **2804**.

FIG. **29**A illustrates said proximity sensing method **2900**.

FIG. **29**B illustrates an elevated front side view of proximity safety zone illustration **2904**.

FIG. **30**A illustrates a perspective overview view of worksite **1600**.

FIG. **30**B illustrates a perspective overview view of safe zone exit **3000**.

FIG. **30**C illustrates a perspective overview view of safe zone entry **3002**.

FIG. **31**A illustrates view of enter safe zone event **3100**.

FIG. **31**B illustrates view of exit safe zone event **3112**.

FIG. **32** illustrates an elevated front side view of strap **1106**.

FIG. **33** illustrates an analog circuit configuration **3300**.

DETAILED DESCRIPTION OF THE INVENTION

The following description is presented to enable any person skilled in the art to make and use the invention as claimed and is provided in the context of the particular examples discussed below, variations of which will be readily apparent to those skilled in the art. In the interest of clarity, not all features of an actual implementation are described in this specification. It will be appreciated that in the development of any such actual implementation (as in any development project), design decisions must be made to achieve the designers' specific goals (e.g., compliance with system- and business-related constraints), and that these goals will vary from one implementation to another. It will also be appreciated that such development effort might be complex and time-consuming, but would nevertheless be a routine undertaking for those of ordinary skill in the field of the appropriate art having the benefit of this disclosure. Accordingly, the claims appended hereto are not intended to be limited by the disclosed embodiments, but are to be accorded their widest scope consistent with the principles and features disclosed herein.

These parts are illustrated in the figures and discussed below:

a base **100**
a case assembly **102**
a front case portion **102***a*
a rear case portion **102***b*
a mid case portion **102***c*
a PCB **106**
a one or more key locks **108**
a first key lock **108***a*
a second key lock **108***b*
a LED **110**
a one or more mag reed switches **112**
a first mag reed switch **112***a*
a second mag reed switch **112***b*
an altimeter **114**
a battery assembly **116**
a MSP **118**
a buzzer **120**
a retraction assembly **124**
a one or more lock-pin enclosures **126**
a first lock-pin enclosure **126***a*
a second lock-pin enclosure **126***b*
a safety monitoring harness system **200**
a memory **202**
a controller assembly **204**
an extension detection system **206**
a safe zone detection system **208**
an activation system **210**
an alert system **212**
a processors **214**
a communication hardware **216**
an alarm system **218**
a strap length sensor assembly **220**
a position sensors **222**
a locking system **224**
a first cavity **300**
a second cavity **302**
a one or more key lock apertures **304**
a first key lock aperture **304***a*
a second key lock aperture **304***b*
a one or more lock pin apertures **306**
a first lock pin aperture **306***a*
a second lock pin aperture **306***b*
a two or more strap apertures **400**
a first strap aperture **400***a*
a second strap aperture **400***b*
a two or more spools **402**
a first spool **402***a*

a second spool **402***b*
a frame **404**
an aperture divider **406**
a one or more pin catches **500**
a first pin catch **500***a*
a second pin catch **500***b*
a plurality of configurations **502**
an unlocked configuration **502***a*
a locked configuration **502***b*
a keyhole **504**
a one or more cavities **506**
a first cavity **506***a*
a second cavity **506***b*
a pins **508**
a first pin **508***a*
a second pin **508***b*
an user **800**
a harness assembly **802**
a one or more tether assemblies **804**
a first tether assembly **804***a*
a second tether assembly **804***b*
a leg straps **902**
a first leg strap **902***a*
a second leg strap **902***b*
a shoulder straps **904**
a first shoulder strap **904***a*
a second shoulder strap **904***b*
a chest strap **906**
a waist strap **908**
a chest buckle **910**
a waist buckle **912**
a leg buckles **914**
a first leg buckle **914***a*
a second leg buckle **914***b*
a back attaching buckle **916**
a carabiner **1004**
an anchoring hook **1102**
a first hook **1102***a*
a second hook **1102***b*
a strap **1106**
an eye **1108**
a deceleration portion **1110**
a hook **1112**
a clasping mechanism **1114**
an extension configurations **1200**
a retracted configuration **1200***a*
a second configuration **1200***b*
a fully extended configuration **1200***c*
a plurality of lengths **1202**
a retracted length **1202***a*
a second length **1202***b*
a fully extended length **1202***c*
a magnetic encoded straps **1302**
a GPS **1304**
a ground test circuit **1306**
a power system **1308**
an altimeter **1310**
a lock status sensors **1312**
a speaker **1314**
a proximity sensor system **1316**
a safety monitoring method **1400**
a one or more steps **1402**
a first step **1402***a*
a second step **1402***b*
a length monitoring method flow chart **1404**
an initial step **1406**
a one or more measure length over time steps **1408**
a measure length at first time step **1408***a*
a measure length at second time step **1408***b*
a verify change in length over time step **1410**
a close loop step **1412**
a verify length change over time step **1414**
an alarm step **1416**
a safety arming and monitoring method **1500**
an unlocking step **1502**
a receiving tether status signal step **1504**
a comparing tether statuses step **1506**
a verifying safe extension status step **1508**
a verify one tether is extended step **1510**
a verifying not static step **1512**
an alarm step **1514**
a clear alarm step **1516**
a verify lock status step **1518**
a clear alarm and close loop step **1520**
a worksite **1600**
a scaffolding **1602**
a stairs **1604**
an elevated platform **1606**
a construction project **1608**
a ground **1612**
an unsafe zone **1614**
a starting point **1616**
a height **1618**
a safe zone **1620**
a climber **1622**
a supervisor **1624**
a tether configurations **1700**
an unattached configuration **1700***a*
a first partially attached configuration **1700***b*
a fully attached configuration **1700***c*
a second partially attached configuration **1700***d*
an anchor point **1702**
a platform **1704**
a plurality of retraction stages **1800**
a first retraction stage **1800***a*
a second retraction stage **1800***b*
a plurality of radial stages **1802**
a first radial stage **1802***a*
a second radial stage **1802***b*
a marker interval **1804**
a plurality of strap markers **1812**
a fourth strap marker **18122**
a first strap marker **1812***a*
a second strap marker **1812***b*
a third strap marker **1812***c*
a fifth strap marker **1812***y*
a sixth strap marker **1812***z*
a safety monitoring system **1900**
a network diagram **1902**
a one or more locations **1904**
a first location **1904***a*
a second location **1904***b*
a third location **1904***c*
a fourth location **1904***d*
a one or more computers **1906**
a first computer **1906***a*
a second computer **1906***b*
a third computer **1906***c*
a server **1908**
a data storage **1910**
a data storage **1910***a*
a network **1912**
a printer **1914**
a one or more users **1916**

a first user **1916***a*
a second user **1916***b*
a third user **1916***c*
a climber **1918**
an administrator **1922**
a method of use **2000**
a one or more steps **2002**
a first step **2002***a*
a second step **2002***b*
a computers types **2100**
a mobile phone **2100***a*
a personal computer **2100***b*
a tablet computer **2100***c*
a wearable computer **2100***d*
a screen **2102**
a one or more input devices **2104**
a keyboard **2104***a*
a trackball **2104***b*
a one or more cameras **2104***c*
a track pad **2104***d*
a data **2106**
a home button **2120**
an address space **2200**
an address space **2200***a*
an address space **2200***d*
a processor **2202**
a processor **2202***a*
a processor **2202***d*
a memory **2204**
a memory **2204***a*
a memory **2204***d*
a communication hardware **2206**
a communication hardware **2206***a*
a communication hardware **2206***d*
a device application **2302**
a data records **2304***a*
a data records **2304***b*
a server application **2306**
a tether status table **2400**
a number of markers **2402***a*
a strap length **2402***b*
a current movement **2402***c*
a last movement **2402***d*
a number markers outside of case **2402***e*
an absolute velocity average last minute **2402***f*
a plurality of tethers status records **2404**
a first tether status record **2404***a*
a second status record **2404***b*
a tether log table **2500**
a tether record fields **2502**
a tether ID field **2502***a*
a time reading field **2502***b*
a time field **2502***c*
a time base zero field **2502***d*
a strap length field **2502***e*
a markers outside field **2502***f*
an exemplary data for first tether **2504***a*
a falling illustration **2506**
a strap length chart **2508**
a supervisor status table **2600**
an user ID field **2602**
a location field **2604**
a time up field **2606**
a percent tied off field **2608**
a current status field **2610**
a one or more climbers monitored **2612**
a first climbers monitored **2612***a*
a second climbers monitored **2612***b*
a third climbers monitored **2612***c*
a fourth climbers monitored **2612***d*
a climber status table **2700**
an user ID field **2702**
a first tether status field **2704**
a second tether status field **2706**
a safety status field **2708**
an event time field **2710**
an exemplary climber records **2712***a*
a state period field **2714**
a grounding calculation method **2800**
a verifying ground step **2802***a*
a grounding step **2802***a*
a grounding diagram **2804**
a one or more ground paths **2806**
a first ground path **2806***a*
a second ground path **2806***b*
a third ground path **2806***c*
an attachment point **2808**
a ground **2810**
a proximity sensing method **2900**
an installing proximity antenna steps **2902***a*
a monitoring proximity steps **2902***b*
a proximity safety zone illustration **2904**
a plurality of proximity antennas **2906**
a first proximity antenna **2906***a*
a second proximity antenna **2906***b*
a third proximity antenna **2906***c*
a fourth proximity antenna **2906***d*
a fifth proximity antenna **2906***e*
a sixth proximity antenna **2906***f*
a seventh proximity antenna **2906***g*
an eighth proximity antenna **2906***h*
a plurality of antenna distances **2910**
a first antenna distance **2910***a*
a second antenna distance **2910***b*
a third antenna distance **2910***c*
a safe zone exit **3000**
a safe zone entry **3002**
an entry and exit sensors **3004**
an enter safe zone event **3100**
a deactivate step **3104**
a monitoring step **3106**
an assess safety **3108**
an activation step **3110**
an exit safe zone event **3112**
an activation step **3114**
a monitoring step **3116**
an assessing safety step **3118**
a deactivation step **3120**
a one or more side switches **3202**
a first side switch **3202***a*
a second side switch **3202***b*
a third side switch **3202***c*

FIG. **1** illustrates perspective overview of base **100**.

In one embodiment, said base **100** can comprise said case assembly **102**, said mid case portion **102***c*, said PCB **106**, said one or more key locks **108**, said LED **110**, said one or more mag reed switches **112**, said first mag reed switch **112***a*, said second mag reed switch **112***b*, said altimeter **114**, said battery assembly **116**, said MSP **118**, said buzzer **120**, said retraction assembly **124**, said retraction assembly **124** and said one or more lock-pin enclosures **126**.

In one embodiment, said one or more mag reed switches **112** can comprise said first mag reed switch **112***a* and said second mag reed switch **112***b*.

In one embodiment, said case assembly **102** can comprise said front case portion **102***a*, said rear case portion **102***b* and said mid case portion **102***c*.

In one embodiment, said one or more key locks **108** can comprise said first key lock **108***a* and said second key lock **108***b*.

In one embodiment, said one or more lock-pin enclosures **126** can comprise said first lock-pin enclosure **126***a* and said second lock-pin enclosure **126***b*.

Said base **100** can comprise an enclosure and a plurality of components to be used in the tracking, monitoring and alerting industrial workers, such as construction crews who must tether themselves to a structure while climbing and working above the ground.

Said base **100** can comprise case assembly **102** being adapted to enclose parts **104-124**, as described herein. Said mid case portion **102***c* can comprise a divider between said front case portion **102***a* and rear case portion **102***b* and can be useful for separating said retraction assembly **124** (a moving part) from other components within said base **100**.

In one embodiment, said one or more key locks **108** can selectively lock and release said retraction assembly **124** for movement. Said one or more lock-pin enclosures **126** can be used to selectively protect portions of said one or more key locks **108**.

Said PCB **106** can comprise a processor, memory, communication hardware, and other components, as is known in the art, and discussed herein.

Said LED **110** can comprise a light for communicating a status of said base **100**, as is known in the art.

Said one or more mag reed switches **112** can be configured to sense changes in said retraction assembly **124**, as described herein.

FIG. **2** illustrates block diagram of safety monitoring harness system **200**.

In one embodiment, said safety monitoring harness system **200** can comprise said memory **202**, said alarm system **218**, said strap length sensor assembly **220**, said position sensors **222** and said locking system **224**.

In one embodiment, said memory **202** can comprise said extension detection system **206**, said safe zone detection system **208**, said activation system **210** and said alert system **212**.

In one embodiment, said controller assembly **204** can comprise said processors **214** and said communication hardware **216**.

In one embodiment, said base **100** can comprise said locking system **224**.

In one embodiment, said PCB **106** can comprise said controller assembly **204**.

In one embodiment, said safety monitoring harness system **200** can comprise an overview of the components configured for life saving and monitoring as disclosed herein. Said safety monitoring harness system **200** can further comprise server based tracking and reporting on components within FIG. **2**.

In one embodiment, said safety monitoring harness system **200** can comprise a plurality of components configured in a system-on-a-chip (said PCB **106**) which can comprise said memory **202**, said controller assembly **204** said position sensors **222**, said alarm system **218**, and so on, as is known in the art.

In one embodiment, memory **202** can comprise a plurality of software algorithms for operating said safety monitoring harness system **200**, such as said extension detection system **206**, safe zone detection system **208**, activation system **210**, and said alert system **212**. In one embodiment, such programs can be configured to communicate with and collect data from said alarm system **218**, strap length sensor assembly **220**, position sensors **222**, locking system **224** and said LED **110**.

In one embodiment, said alarm system **218** can comprise an audio alarm, a vibration alarm, or similar, as is known in the art.

FIG. **3**A illustrates elevated exploded side view of case assembly **102**.

FIG. **3**B illustrates perspective overview of mid case portion **102***c*.

FIG. **3**C illustrates perspective backside view of mid case portion **102***c*.

In one embodiment, said one or more key lock apertures **304** can comprise said first key lock aperture **304***a* and said second key lock aperture **304***b*.

In one embodiment, said one or more lock pin apertures **306** can comprise said first lock pin aperture **306***a* and said second lock pin aperture **306***b*.

In one embodiment, said base **100** can comprise said second lock pin aperture **306***b*.

In one embodiment, said case assembly **102** can comprise said first cavity **300**, said second cavity **302**, said second cavity **302**, said one or more key lock apertures **304**, said second key lock aperture **304***b* and said one or more lock pin apertures **306**.

In one embodiment, said first cavity **300** can comprise a space between rear case portion **102***b* and mid case portion **102***c* and can be configured to hold said battery assembly **116**, LED **110**, one or more lock-pin enclosures **126**, portions of said one or more key locks **108**, said MSP **118**, said buzzer **120**, said PCB **106**, and said altimeter **114**. Said second cavity **302** can comprise a space between said front case portion **102***a* and said mid case portion **102***c* and can be configured to hold said retraction assembly **124**, said one or more mag reed switches **112** and portions of said one or more key locks **108** in a locked configuration.

FIG. **4**A illustrates a perspective overview view of retraction assembly **124**.

FIG. **4**B illustrates a perspective overview view of case assembly **102**.

In one embodiment, said two or more strap apertures **400** can comprise said first strap aperture **400***a*, said second strap aperture **400***b* and said aperture divider **406**.

In one embodiment, said two or more spools **402** can comprise said first spool **402***a*, said second spool **402***b* and said aperture divider **406**.

In one embodiment, said base **100** can comprise said two or more strap apertures **400** and said second strap aperture **400***b*.

In one embodiment, said retraction assembly **124** can comprise said second strap aperture **400***b*, said two or more spools **402** and said frame **404**.

In one embodiment, said retraction assembly **124** can be enclosed within said base **100** in said first cavity **300**. In one embodiment, portions of said retraction assembly **124** can extend outside of said base **100** through said two or more strap apertures **400**, as discussed herein.

In one embodiment, said aperture divider **406** can be arranged between said first strap aperture **400***a* and said second strap aperture **400***b* to ensure the straps on said two or more spools **402** do not be come entangled during operation of said base **100**.

FIG. **5**A illustrates perspective front view of retraction assembly **124**.

FIG. **5**B illustrates perspective overview of one or more key locks **108**.

In one embodiment, said one or more pin catches **500** can comprise said first pin catch **500***a* and said second pin catch **500***b*.

In one embodiment, said plurality of configurations **502** can comprise said unlocked configuration **502***a* and said locked configuration **502***b*.

In one embodiment, said one or more cavities **506** can comprise said first cavity **506***a* and said second cavity **506***b*.

In one embodiment, said pins **508** can comprise said first pin **508***a* and said second pin **508***b*.

In one embodiment, said one or more key locks **108** can comprise said second pin catch **500***b*, said plurality of configurations **502**, said keyhole **504**, said keyhole **504** and said pins **508**.

In one embodiment, said first key lock **108***a* can comprise said first pin **508***a*.

In one embodiment, said second key lock **108***b* can comprise said second pin **508***b*.

In one embodiment, said one or more lock-pin enclosures **126** can comprise said locked configuration **502***b* and said one or more cavities **506**.

In one embodiment, said two or more spools **402** can comprise said one or more pin catches **500**.

In one embodiment, said first spool **402***a* can comprise said first pin catch **500***a*.

In one embodiment, said second spool **402***b* can comprise said second pin catch **500***b*.

In one embodiment, said retraction assembly **124** can comprise said one or more pin catches **500** configured for catching a portion of said plurality of configurations **502**, such as said pins **508**.

With said one or more key locks **108** in said locked configuration **502***b*, said pins **508** can be rotated down to interfere with rotation of said two or more spools **402**. With said one or more key locks **108** in said unlocked configuration **502***a*, said pins **508** can be rotated back to allow said two or more spools **402** to rotate freely. Said one or more key locks **108** can be selectively engaged between said plurality of configurations **502** by rotating said one or more key locks **108** with said keyhole **504**, as is known in the art. In one embodiment, said activation system **210** can monitor a status of said one or more key locks **108** with respect to said plurality of configurations **502**.

In one embodiment, one or more lock-pin enclosures **126** can protect said pins **508** with said one or more key locks **108** in said unlocked configuration **502***a*.

In one embodiment, said retraction assembly **124** can comprise locking mechanisms similar to that of seatbelts, center fugal locks, or similar.

In one embodiment, said one or more lock-pin enclosures **126** can be used to seal first cavity **300** from second cavity **302**; wherein, moisture may be fed into first cavity **300** through said aperture divider **406**.

In one embodiment, said retraction assembly **124** can comprise cylindrical spools configured to selectively rotate on an axis and resist rotation with a spring; wherein, said retraction assembly **124** are configured for storing, releasing and retracting said strap **1106** (illustrated below), as is known in the art. In one embodiment, said retraction assembly **124** can comprise said first spool **402***a* and said second spool **402***b*; however, said retraction assembly **124** can comprise separate enclosures for storing and dispensing said strap **1106**.

FIG. **6**A illustrates elevated side view of base **100**.

FIG. **6**B illustrates elevated front view of base **100**.

FIG. **6**C illustrates elevated backside view of base **100**.

FIG. **7** illustrates perspective overview of base **100**.

FIG. **8**A illustrates perspective front view user **800**.

FIG. **8**B illustrates perspective overview of user **800**.

In one embodiment, said one or more tether assemblies **804** can comprise said first tether assembly **804***a* and said second tether assembly **804***b*.

In one embodiment, said safety monitoring harness system **200** can comprise said one or more tether assemblies **804**.

In one embodiment, said base **100** can be used in conjunction with said harness assembly **802** and said one or more tether assemblies **804**, as illustrated. In one embodiment, said user **800** can secure said harness assembly **802** to his body, as is known in the art. In one embodiment, said base **100** can replace prior art yo-yo systems which simply extend and retract without monitoring and safety features described herein.

In one embodiment, said one or more tether assemblies **804** can be attached to said retraction assembly **124** on said two or more spools **402** and selectively in and out of said two or more strap apertures **400**.

In one embodiment, said one or more tether assemblies **804** can comprise a one or more tether assemblies, or just said first tether assembly **804***a*. In such an embodiment, such as when a roofer might use said safety monitoring harness system **200**, an alarm can signal when said first tether assembly **804***a* is retracted within said base **100**.

FIG. **9** illustrates elevated front view of said harness assembly **802**.

In one embodiment, said leg straps **902** can comprise said first leg strap **902***a* and said second leg strap **902***b*.

In one embodiment, said shoulder straps **904** can comprise said first shoulder strap **904***a* and said second shoulder strap **904***b*.

In one embodiment, said leg buckles **914** can comprise said first leg buckle **914***a* and said second leg buckle **914***b*.

In one embodiment, said harness assembly **802** can comprise said leg straps **902**, said first leg strap **902***a*, said second leg strap **902***b*, said shoulder straps **904**, said first shoulder strap **904***a*, said second shoulder strap **904***b*, said chest strap **906**, said waist strap **908**, said chest buckle **910**, said waist buckle **912**, said leg buckles **914**, said first leg buckle **914***a*, said second leg buckle **914***b* and said back attaching buckle **916**.

In one embodiment, said harness assembly **802** can comprise a prior art rendering of a harness system. Various embodiments of said harness assembly **802** are known in the art, and are incorporated by reference herein. This illustration is included from U.S. Pat. No. 8,482,401B2.

FIG. **10** illustrates elevated front view one or more tether assemblies **804**.

In one embodiment, said base **100** can attach to said harness assembly **802** with said carabiner **1004** attached to said back attaching buckle **916**. In one embodiment, said base **100** with said one or more tether assemblies **804** be configured to keep said user **800** safe with the added smart-features as well as the physical configuration of said base **100**.

FIG. **11** illustrates perspective overview safety monitoring harness system **200** with base **100** and one or more tether assemblies **804**.

In one embodiment, said anchoring hook **1102** can comprise said first hook **1102***a* and said second hook **1102***b*.

In one embodiment, said eye **1108** attaches to said carabiner **1004** and secures said base **100** to said carabiner **1004**. Said base **100** can selectively dispense and retract said strap **1106**. In one embodiment, said strap **1106** can attach to said base **100** at one end and to said deceleration portion **1110** at

another end. In one embodiment, said strap **1106** can comprise a durable material suitable for supporting and saving the life of said user **800** in the case of a fall, as is known in the art.

In one embodiment, said deceleration portion **1110** can selectively release a tightly packed strap similar to said strap **1106**, but intended to slow the acceleration of a falling person, such as said climber **1622**.

In one embodiment, said anchoring hook **1102** comprise a device configured to secure said user **800** to anchoring points, as discussed below and as is known in the art.

As compared to the prior art, said one or more tether assemblies **804** in said safety monitoring harness system **200** can comprise instrumentation and feedback mechanisms as associated with the interplay between said base **100** and said strap **1106**.

In one embodiment, said base **100** can comprise a single unit configured to accommodate two among one or more tether assemblies **804**.

FIG. **12**A illustrates elevated overview of retracted configuration **1200***a*.

FIG. **12**B illustrates elevated overview of second configuration **1200***b*.

FIG. **12**C illustrates elevated overview of fully extended configuration **1200***c*.

In one embodiment, said extension configurations **1200** can comprise said retracted configuration **1200***a*, said second configuration **1200***b* and said fully extended configuration **1200***c*.

In one embodiment, said plurality of lengths **1202** can comprise said retracted length **1202***a*, said second length **1202***b* and said fully extended length **1202***c*.

As is known in the art, said one or more tether assemblies **804** can retract and dispense portions of said strap **1106**. Illustrated herein, are various lengths of said strap **1106**, labeled as said plurality of lengths **1202**.

In one embodiment, said base **100** can monitor, process and record the state of said strap **1106** between said retracted configuration **1200***a* and said fully extended configuration **1200***c*.

FIG. **13** illustrates detailed block diagram of safety monitoring harness system **200**.

In one embodiment, said strap length sensor assembly **220** can comprise said magnetic encoded straps **1302**.

In one embodiment, said position sensors **222** can comprise said GPS **1304** and said proximity sensor system **1316**.

In one embodiment, said locking system **224** can comprise said lock status sensors **1312**.

In one embodiment, said 1 data storage **1910** can comprise the ability to calculate one or more conditions based on the inputs discussed above. In one embodiment, said x**1100***x*/can comprise said x**1804***x*/for processing, said x**11004***x*/and said altimeter **1310** for calculating location and altitude, said ground test circuit **1306** for storing programs and logs, said power system **1308** for powering said x**1802***x*/, said lock status sensors **1312** for communicating with said one or more computers **1906** and said network **1912**, and said speaker **1314** for communicating alerts to said climber **1622**.

FIG. **14**A illustrates said safety monitoring method **1400**.

FIG. **14**B illustrates said length monitoring method flow chart **1404**.

In one embodiment, said safety monitoring method **1400** can comprise said safety monitoring method **1400**, said one or more steps **1402** and said length monitoring method flow chart **1404**.

In one embodiment, said one or more steps **1402** can comprise said first step **1402***a* and said second step **1402***b*.

In one embodiment, said length monitoring method flow chart **1404** can comprise said initial step **1406**, said initial step **1406**, said one or more measure length over time steps **1408**, said verify change in length over time step **1410**, said close loop step **1412**, said verify length change over time step **1414** and said alarm step **1416**.

In one embodiment, said one or more measure length over time steps **1408** can comprise said measure length at first time step **1408***a* and said measure length at second time step **1408***b*.

In one embodiment, safety monitoring method **1400** can comprise a method of preventing said user **800** from tricking said safety monitoring harness system **200** into giving a safe signal when said user **800** is not properly tied off.

In one embodiment, first step **1402***a* can comprise monitoring a status of said plurality of lengths **1202** (such as retracted length **1202***a* and fully extended length **1202***c*) and recording said plurality of lengths **1202** over a time period. In one embodiment, a change of length over a change of time (delta distance over delta time) can indicate whether said one or more tether assemblies **804** are actively moving or otherwise in a static length. In one embodiment, where said strap **1106** is not in a completely retracted position, then said plurality of lengths **1202** should be changing over time, even when that change is small and alternates from extending and contracting.

In one embodiment, said safety monitoring method **1400** can be expressed more precisely in said length monitoring method flow chart **1404**.

In one embodiment, said safety monitoring harness system **200** can begin said length monitoring method flow chart **1404** when said one or more tether assemblies **804** are extended from said base **100** (said initial step **1406**). Said one or more measure length over time steps **1408** can comprise said measure length at first time step **1408***a* and said measure length at second time step **1408***b*. Said safety monitoring harness system **200** can be configured to measure at meaningful time frequencies to ensure movement can be made by the user between measurements. One such time frequency between the first reading and the second reading might be one second, for example.

Said verify change in length over time step **1410** can verify that said one or more tether assemblies **804** isn't fully retracted, if it is, said length monitoring method flow chart **1404** stops without alarm. In one embodiment, said one or more tether assemblies **804** is extended and said verify length change over time step **1414** can determine if said one or more tether assemblies **804** is moving or not. If said one or more tether assemblies **804** is extended but not moving, an alarm can sound (said alarm step **1416**), otherwise, said length monitoring method flow chart **1404** can return to said one or more measure length over time steps **1408** and repeat said length monitoring method flow chart **1404**.

FIG. **15** illustrates said safety arming and monitoring method **1500**.

In one embodiment, said safety arming and monitoring method **1500** can comprise said receiving tether status signal step **1504**, said comparing tether statuses step **1506**, said verifying safe extension status step **1508**, said verify one tether is extended step **1510**, said verifying not static step **1512**, said alarm step **1514**, said clear alarm step **1516**, said verify lock status step **1518** and said clear alarm and close loop step **1520**.

In one embodiment, said safety arming and monitoring method **1500** can comprise a portion of said activation system **210**.

In one embodiment, said unlocking step **1502** can comprise unlocking said one or more key locks **108** into said unlocked configuration **502***a*; said receiving tether status signal step **1504** can comprise measuring a length of said one or more tether assemblies **804** using said strap length sensor assembly **220** or by measuring a rotary status of said two or more spools **402**; and said verifying not static step **1512** can comprise said safety monitoring method **1400** (described above). Said safety arming and monitoring method **1500** can be configured to alarm (said alarm step **1514**) until the system is either locked or at least one tether is moving once again. In one embodiment, said safety arming and monitoring method **1500** can terminate when the locks are back into said locked configuration **502***b*.

FIG. **16** illustrates a perspective overview view of worksite **1600**.

In one embodiment, said worksite **1600** can comprise said scaffolding **1602**, said stairs **1604**, said elevated platform **1606**, said construction project **1608**, said ground **1612**, said unsafe zone **1614**, said starting point **1616**, said height **1618** and said safe zone **1620**.

In one embodiment, said strap **1106** can comprise said supervisor **1624**.

In one embodiment, said user **800** can comprise said climber **1622** and said supervisor **1624**.

In one embodiment, said safety monitoring harness system **200** can be used on said worksite **1600**. Said worksite **1600** can comprise scaffolding **1602**, and construction project **1608**. Although said safety arming and monitoring method **1500** would cause said safety monitoring harness system **200** to begin looking for use of said one or more tether assemblies **804** immediately after unlocking said one or more key locks **108**, it may be desirable to prevent an alarm condition until said user **800** (such as climber **1622**) has arrived at the end of said safe zone **1620** and ready to climb out into said unsafe zone **1614**. For example, in one embodiment, said stairs **1604** and said elevated platform **1606** can be classified as said safe zone **1620**, even through said elevated platform **1606** is at said safe zone **1620**; where said supervisor **1624** unlocks said one or more key locks **108** at said ground **1612** said safety monitoring harness system **200** would alarm until said one or more tether assemblies **804** are extended and moving.

FIG. **17**A illustrates an elevated back side view of unattached configuration **1700***a*.

FIG. **17**B illustrates an elevated back side view of first partially attached configuration **1700***b*.

FIG. **17**C illustrates an elevated back side view of fully attached configuration **1700***c*.

FIG. **17**D illustrates an elevated back side view of second partially attached configuration **1700***d*.

In one embodiment, said tether configurations **1700** can comprise said unattached configuration **1700***a*, said first partially attached configuration **1700***b*, said fully attached configuration **1700***c* and said second partially attached configuration **1700***d*.

In one embodiment, said safety monitoring harness system **200** can comprise a means of securing and monitoring a state of said one or more tether assemblies **804** when said climber **1622** is in peril while working at unsafe heights.

In one embodiment, said unattached configuration **1700***a* can comprise said climber **1622** completely detached from said anchor point **1702**. Said first partially attached configuration **1700***b* can comprise said first tether assembly **804***a* attached to said anchor point **1702** and said second tether assembly **804***b* detached. Said fully attached configuration **1700***c* can comprise both of said one or more tether assemblies **804** attached to said anchor point **1702**. Said second partially attached configuration **1700***d* can comprise said first tether assembly **804***a* detached and said second tether assembly **804***b* attached to said anchor point **1702**.

In one embodiment, said platform **1704** can comprise any place said climber **1622** might work or otherwise need to be secured. In one embodiment, a safety protocol might require said climber **1622** to be at least partially secured at all times, even while ascending a structure; thus, said climber **1622** would be responsible to alternate between said first partially attached configuration **1700***b*, said fully attached configuration **1700***c*, and said second partially attached configuration **1700***d*, and back again.

FIG. **18**A illustrates an elevated front side view of first retraction stage **1800***a*.

FIG. **18**B illustrates an elevated front side view of second retraction stage **1800***b*.

In one embodiment, said plurality of retraction stages **1800** can comprise said first retraction stage **1800***a* and said second retraction stage **1800***b*.

In one embodiment, said plurality of radial stages **1802** can comprise said first radial stage **1802***a* and said second radial stage **1802***b*.

In one embodiment, said plurality of strap markers **1812** can comprise said fourth strap marker **18122**, said first strap marker **1812***a*, said second strap marker **1812***b*, said third strap marker **1812***c*, said fifth strap marker **1812***y* and said sixth strap marker **1812***z*.

In one embodiment, said strap **1106** can comprise said plurality of retraction stages **1800**, said plurality of radial stages **1802**, said second radial stage **1802***b* and said plurality of strap markers **1812**.

For illustrative purposes, said strap **1106** and said plurality of strap markers **1812** are illustrated as thicker than they could be constructed in a preferred version of said strap **1106**. Accordingly, said plurality of strap markers **1812** and said strap **1106** can comprise a thickness smaller than said two or more strap apertures **400**, and able to freely move into and out of said base **100**.

In one embodiment, said strap **1106** can unwind through said two or more strap apertures **400**, as between said retracted configuration **1200***a* and said fully extended configuration **1200***c*.

In one embodiment, said marker interval **1804** can be aligned with said strap **1106** at known intervals which can be substantially equal to one another.

In one embodiment, said one or more mag reed switches **112** can sense movement of said strap **1106** by measuring interactions between said plurality of strap markers **1812** and said one or more mag reed switches **112**; in turn, said strap length sensor assembly **220** can calculate a position and movement of said strap **1106**. As identified in FIG. **13**, said strap **1106** with said plurality of radial stages **1802** can comprise said magnetic encoded straps **1302**.

In one embodiment, said strap **1106** can be measured using rotary encoders.

FIG. **19** illustrates a flow chart view of network diagram **1902**.

In one embodiment, said network diagram **1902** can comprise said one or more locations **1904**, said one or more computers **1906**, said server **1908**, said data storage **1910**, said network **1912** and said printer **1914**.

In one embodiment, said one or more computers **1906** can comprise said first computer **1906***a*, said second computer **1906***b* and said third computer **1906***c*.

In one embodiment, said one or more locations **1904** can comprise said first location **1904***a*, said second location **1904***b*, said third location **1904***c* and said fourth location **1904***d*.

In one embodiment, said data storage **1910** can comprise said data storage **1910***a*.

In one embodiment, said safety monitoring system **1900** can comprise said one or more computers **1906**, said server **1908**, said data storage **1910**, said network **1912** and said printer **1914**.

In one embodiment, said one or more users **1916** can comprise said first user **1916***a*, said second user **1916***b* and said third user **1916***c*.

In one embodiment, said first user **1916***a* can comprise said climber **1918** and said administrator **1922**.

In one embodiment, a printer **1914** can be hardwired to said network **1912** (not illustrated here), or said printer **1914** can connect to one of said one or more computers **1906** (such as said third computer **1906***c*, illustrated) via network **1912**.

Said network **1912** can be a local area network (LAN), a wide area network (WAN), a piconet, or a combination of LANs, WANs, or piconets. One illustrative LAN is a network within a single business. One illustrative WAN is the Internet.

In one embodiment, said server **1908** represents at least one, but can be many servers, each connected to said network **1912**. Said server **1908** can connect to a data storage **1910**. Said data storage **1910** can connect directly to said server **1908**, as shown in FIG. **19**, or may exist remotely on said network **1912**. In one embodiment, said data storage **1910** can comprise any suitable long-term or persistent storage device and, further, may be separate devices or the same device and may be collocated or distributed (interconnected via any suitable communications network).

In one embodiment, said one or more users **1916** can operate in different roles in relation to said safety monitoring harness system **200**. For example, in one embodiment, a first user can comprise said climber **1622**, a second user can comprise said supervisor **1624**, and a third user can comprise can comprise said administrator **1922**.

In one embodiment, said climber **1622** can comprise a worker with said base **100** connected directly to him.

In one embodiment, said supervisor **1624** can comprise a foreman or safety manager charged with the administration of workers such as said climber **1622**. Said administrator **1922** can comprise a person with access to data concerning said climber **1622** and said supervisor **1624**. In one embodiment, said administrator **1922** can comprise an upper manager at a remove site with a data summary of the status of said climber **1622** and others like him.

In one embodiment, said one or more locations **1904** can comprise various locations related to said safety monitoring harness system **200**. In one embodiment, said first location **1904***a* can comprise a construction site, and in particular, can comprise a construction location at an altitude above the ground where said climber **1622** comprises a workman. Said second location **1904***b* can comprise a location at a construction site where said supervisor **1624** monitors one or more of said climber **1622**. Said third location **1904***c* can comprise an office site used for administrative purposes. Finally, said fourth location **1904***d* can comprise a data center or server room, as is known in the art.

In one embodiment, network diagram **1902** can comprise a part of safety monitoring harness system **200**. Said one or more locations **1904** is another part.

FIG. **20** illustrates a flow chart view of method of use **2000**.

In one embodiment, said method of use **2000** can comprise said method of use **2000** and said one or more steps **2002**.

In one embodiment, said one or more steps **2002** can comprise said first step **2002***a* and said second step **2002***b*.

In one embodiment, said safety monitoring system **1900** can comprise said method of use **2000**.

In one embodiment, first step **2002***a* can comprise pairing said second computer **1906***b* of said supervisor **1624** with one or more among said first computer **1906***a* of said climber **1622**.

In one embodiment, second step **2002***b* can comprise reporting a one or more signals from said safety monitoring harness system **200** to said second computer **1906***b* and/or said first computer **1906***a*.

FIG. **21**A illustrates a perspective overview view of mobile phone **2100***a*.

FIG. **21**B illustrates a perspective overview view of personal computer **2100***b*.

FIG. **21**C illustrates a perspective overview view of tablet computer **2100***c*.

FIG. **21**D illustrates a perspective overview view of wearable computer **2100***d*.

In one embodiment, said one or more input devices **2104** can comprise said keyboard **2104***a*, said trackball **2104***b*, said one or more cameras **2104***c* and said track pad **2104***d*.

In one embodiment, said computers types **2100** can comprise said mobile phone **2100***a*, said personal computer **2100***b*, said tablet computer **2100***c* and said wearable computer **2100***d*.

In one embodiment, said one or more computers **1906** can comprise said computers types **2100**.

In one embodiment, said strap **1106** can comprise said wearable computer **2100***d*.

In the last several years, the useful definition of a computer has become more broadly understood to include mobile phones, tablet computers, laptops, desktops, and similar. For example, Microsoft®, have attempted to merge devices such as a tablet computer and a laptop computer with the release of "Windows® 8" as well as subsequent releases of that operating system.

In one embodiment, said one or more computers **1906** each can include, but is not limited to, a laptop or desktop (such as said personal computer **2100***b*), desktop, workstation, server, mainframe, terminal, a tablet (such as said tablet computer **2100***c*), a phone (such as said mobile phone **2100***a*), said wearable computer **2100***d*, and/or similar. Despite different form-factors, said one or more computers **1906** can have similar basic hardware, such as a screen **2102** and a one or more input devices **2104** (such as a keyboard **2104***a*, a trackball **2104***b*, a one or more cameras **2104***c*, a wireless—such as RFID—reader, a track pad **2104***d*, and/or a home button **2120**). In one embodiment, said screen **2102** can comprise a touch screen. In one embodiment, said track pad **2104***d* can function similarly to a computer mouse as is known in the art.

In one embodiment, said tablet computer **2100***c* and/or said personal computer **2100***b* can comprise a Microsoft® Windows® branded device, an Apple® branded device, or similar. In one embodiment, said tablet computer **2100***c* can be an X86 type processor or an ARM type processor, as is known in the art.

Said network diagram **1902** can transmit said data **2106**. In one embodiment, said data **2106** can comprise data related to said safety monitoring harness system **200**.

In one embodiment, said one or more computers **1906** can be used to input and view said data **2106**. In one embodiment, said data **2106** can be input into said one or more computers **1906** by taking pictures with a camera, by typing in information with said keyboard **2104***a*, or by using gestures on said screen **2102** (where said screen **2102** is a touch screen). Many other data entry means for devices like said one or more computers **1906** are well known and herein also possible with data **2106**. In one embodiment, said first computer **1906***a* can comprise an iPhone®, a BlackBerry®, a smartphone, or similar. In one embodiment, one or more computers **1906** can comprise a laptop computer, a desktop computer, or similar.

FIG. **22**A illustrates view of address space **2200**.

FIG. **22**B illustrates view of address space **2200***a*.

FIG. **22**C illustrates view of address space **2200***d*.

In one embodiment, said address space **2200** can comprise said processor **2202**, said memory **2204** and said communication hardware **2206**.

In one embodiment, said first computer **1906***a* can comprise said address space **2200***a*, said processor **2202***a*, said memory **2204***a* and said communication hardware **2206***a*.

In one embodiment, said server **1908** can comprise said address space **2200***d*, said processor **2202***d*, said memory **2204***d* and said communication hardware **2206***d*.

For discussion purposes, said one or more computers **1906** and said server **1908** are simplified into the component parts of said processor **2202** herein.

FIG. **23** illustrates device application **2302** and server application **2306**.

In one embodiment, said address space **2200***a* can comprise said device application **2302** and said data records **2304***a*.

In one embodiment, said address space **2200***d* can comprise said data records **2304***b* and said server application **2306**.

In one embodiment, said communication hardware **2206***a* and said communication hardware **2206***d* can send and receive data to and from one another and or can communicate with said data storage **1910** across said network **1912**.

In one embodiment, said safety monitoring harness system **200** can comprise said device application **2302** being located partially in said safety monitoring harness system **200**, and possibly partially in said first computer **1906***a*. Said safety monitoring harness system **200** can further comprise said server application **2306** being hosted in said server **1908**. In one embodiment, said safety monitoring harness system **200** can comprise additional functionality by monitoring and logging activities by said climber **1622** in the cloud/on a server.

Accordingly, said data storage **1910** can comprise records related to one or more of said climber **1622**.

In one embodiment, said server **1908** can comprise a third party data storage and hosting provider or privately managed as well.

In one embodiment, said safety monitoring harness system **200** can operate without a data connection out to said server **1908** by creating alarm conditions for use by said climber **1622** without reporting or consulting with said server application **2306**.

FIG. **24** illustrates said tether status table **2400**.

In one embodiment, said tether status table **2400** can comprise said number of markers **2402***a*, said strap length **2402***b*, said current movement **2402***c*, said last movement **2402***d*, said number markers outside of case **2402***e*, said absolute velocity average last minute **2402***f*, said absolute velocity average last minute **2402***f* and said plurality of tethers status records **2404**.

In one embodiment, said plurality of tethers status records **2404** can comprise said first tether status record **2404***a* and said second status record **2404***b*.

In one embodiment, said data records **2304***a* can comprise said tether status table **2400**.

In one embodiment, said tether status table **2400** can comprise a current status table/class related to said one or more tether assemblies **804**. Said plurality of tethers status records **2404** can comprise one record per tether among said one or more tether assemblies **804**. In one embodiment, number of markers **2402***a* can comprise a number of said plurality of strap markers **1812** on said strap **1106**; said strap length **2402***b* can comprise a total length of said strap **1106**; said current movement **2402***c* can comprise a calculation as written in said length monitoring method flow chart **1404**; said last movement **2402***d* can comprise a timer back to the last measured movement in said strap **1106**; said number markers outside of case **2402***e* can comprise a count of the number of said plurality of strap markers **1812** being outside of said two or more strap apertures **400**; and said absolute velocity average last minute **2402***f* can comprise a calculation of the change in position (said strap length **2402***b*) over the last minute to determine the amount of movement over a period of time. In one embodiment, said absolute velocity average last minute **2402***f* can comprise a measurement over a period different than one minute as required for design preferences.

FIG. **25**A illustrates said tether log table **2500**.

FIG. **25**B illustrates said strap length chart **2508**.

FIG. **25**C illustrates said falling illustration **2506**.

In one embodiment, said tether log table **2500** can comprise said tether record fields **2502**, said exemplary data for first tether **2504***a* and said strap length chart **2508**.

In one embodiment, said tether record fields **2502** can comprise said tether ID field **2502***a*, said time reading field **2502***b*, said time field **2502***c*, said time base zero field **2502***d*, said strap length field **2502***e* and said markers outside field **2502***f*.

In one embodiment, said safety monitoring harness system **200** can calculate the event of a free fall of said climber **1622** as opposed to a smaller acceleration event. For example, in one embodiment, said safety monitoring harness system **200** can comprise a one or more data logs including said tether log table **2500**. In one embodiment, said safety monitoring harness system **200** can track a status of each of said one or more tether assemblies **804** the course of a usage period.

In one embodiment, said tether log table **2500** can comprise data related to said base **100** over time. Said exemplary data for first tether **2504***a* can comprise a reference to one among said one or more tether assemblies **804**. Said time reading field **2502***b* can comprise a time of a log entry. In one embodiment, sensitivity and frequency of data collection can be increased to improve fidelity of said safety monitoring harness system **200** and is predictions. In one embodiment, said time field **2502***c* and said time base zero field **2502***d* can comprise calculations based on said time reading field **2502***b* so as to calculate rates of change in the remaining fields. In one embodiment, said strap length field **2502***e* can comprise a length of said strap **1106**, as discussed above. In one embodiment, said markers outside field **2502***f* can comprise a number of said plurality of strap markers **1812** being outside of said base **100**.

In one embodiment, said safety monitoring harness system **200**, can calculate acceleration and velocity of said climber **1622** so as to predict the state of said climber **1622** at a given time. In one embodiment, if said safety monitoring harness system **200** is accelerating at 9.8 m/s^2, it can be concluded that said climber **1622** is in freefall. Herein, for illustrative purposes, said safety monitoring harness system **200** is accelerating at the rate of gravitational acceleration (although this illustration assumes no wind resistance and a free fall straight down). It is further noted that said safety monitoring harness system **200** stops at exactly 5.0 meters, which is the hypothetical maximum length of said strap **1106**. Having established that said safety monitoring harness system **200** has stopped at approximately the full length of said strap **1106**, said safety monitoring harness system **200** can further calculate that said climber **1622** is safely dangling from said anchor point **1702**. This is scenario is illustrated in FIG. **25**C and said falling illustration **2506**.

FIG. **26** illustrates said supervisor status table **2600**.

In one embodiment, said supervisor status table **2600** can comprise said user ID field **2602**, said location field **2604**, said time up field **2606**, said percent tied off field **2608**, said current status field **2610** and said one or more climbers monitored **2612**.

In one embodiment, said one or more climbers monitored **2612** can comprise said first climbers monitored **2612***a*, said second climbers monitored **2612***b*, said third climbers monitored **2612***c* and said fourth climbers monitored **2612***d*.

In one embodiment, said supervisor status table **2600** can comprise a table calculated in said server application **2306** on said server **1908**. In one embodiment, a one or more of said climber **1622** can communicate portions of said tether status table **2400** and said tether log table **2500** to said server **1908** and said server application **2306** can summarize a status of such users for said supervisor **1624**.

In one embodiment, said user ID field **2602** can comprise an identifier to a one or more of said climber **1622** assigned to said supervisor **1624**; said location field **2604** can comprise a short hand calculation of the user's location; said time up field **2606** can comprise a calculation of how much time the user has been in an unsafe zone for a given period (such as during the same calendar day or last 24 hours); said percent tied off field **2608** can comprise a calculation of the users' success in remaining tied off while in danger; and said current status field **2610** can comprise a current bottom line safety calculation.

FIG. **27** illustrates said climber status table **2700**.

In one embodiment, said climber status table **2700** can comprise said user ID field **2702**, said first tether status field **2704**, said second tether status field **2706**, said safety status field **2708**, said event time field **2710**, said exemplary climber records **2712***a* and said state period field **2714**.

Said climber status table **2700** can comprise a log of records of pertaining to a user of said safety monitoring harness system **200** with regard to said safety arming and monitoring method **1500**. Wherein, said user ID field **2702** can comprise a reference to a particular user; said first tether status field **2704** can comprise a record of the status of said first tether assembly **804***a*; said second tether status field **2706** can comprise a record of the status of said second tether assembly **804***b*; said safety status field **2708** can comprise a status change at a particular time; said event time field **2710** can comprise the time and date (showing only time in the illustration, but would include date in an embodiment); and said state period field **2714** can comprise a calculation of how long an unsafe condition existed.

FIG. **28**A illustrates said grounding calculation method **2800**.

FIG. **28**B illustrates elevated front view of grounding diagram **2804**.

In one embodiment, said grounding calculation method **2800** can comprise said verifying ground step **2802***a* and said grounding step **2802***a*.

In one embodiment, said grounding diagram **2804** can comprise said grounding diagram **2804**, said one or more ground paths **2806**, said attachment point **2808** and said ground **2810**.

In one embodiment, said one or more ground paths **2806** can comprise said first ground path **2806***a*, said second ground path **2806***b* and said third ground path **2806***c*.

In one embodiment, said ground test circuit **1306** of said safety monitoring harness system **200** can comprise tracing a ground path from said safety monitoring harness system **200** to said ground **2810**. For this system to function, said safety monitoring harness system **200** must be attached to a grounded structure. By this method, said safety monitoring harness system **200** can calculate whether one or more of said one or more tether assemblies **804** are attached to said scaffolding **1602** or not at any given time.

FIG. **29**A illustrates said proximity sensing method **2900**.

FIG. **29**B illustrates an elevated front side view of proximity safety zone illustration **2904**.

In one embodiment, said proximity sensing method **2900** can comprise said installing proximity antenna steps **2902***a* and said monitoring proximity steps **2902***b*.

In one embodiment, said proximity safety zone illustration **2904** can comprise said proximity safety zone illustration **2904**, said plurality of proximity antennas **2906** and said plurality of antenna distances **2910**.

In one embodiment, said plurality of proximity antennas **2906** can comprise said first proximity antenna **2906***a*, said second proximity antenna **2906***b*, said third proximity antenna **2906***c*, said fourth proximity antenna **2906***d*, said fifth proximity antenna **2906***e*, said sixth proximity antenna **2906***f*, said seventh proximity antenna **2906***g* and said eighth proximity antenna **2906***h*.

In one embodiment, said plurality of antenna distances **2910** can comprise said first antenna distance **2910***a*, said second antenna distance **2910***b* and said third antenna distance **2910***c*.

In one embodiment, said proximity sensor system **1316** can be configured to sense said plurality of antenna distances **2910** between said proximity sensor system **1316** and a portion of said plurality of proximity antennas **2906** to determine the location of said safety monitoring harness system **200**. Once a location of said base **100** is determined, said safety monitoring harness system **200** can determine whether said climber **1622** is in said unsafe zone **1614** or said safe zone **1620**. Said safety monitoring harness system **200** can calculate the location of said base **100** using triangulation or other location calculating means, as is known in the art.

FIG. **30**A illustrates a perspective overview view of worksite **1600**.

FIG. **30**B illustrates a perspective overview view of safe zone exit **3000**.

FIG. **30**C illustrates a perspective overview view of safe zone entry **3002**.

In one embodiment, said safe zone exit **3000** can comprise said entry and exit sensors **3004**.

In one embodiment, said safe zone entry **3002** can comprise said entry and exit sensors **3004**.

In one embodiment, said worksite **1600** can comprise said safe zone exit **3000** and said safe zone entry **3002**.

In one embodiment, said entry and exit sensors **3004** can signal an entry and exit event from said safe zone **1620**. Wherein, said safety monitoring harness system **200** can communicate with said entry and exit sensors **3004** to measure an entrance or exit event. In one embodiment, said safety monitoring harness system **200** and entry and exit sensors **3004** can communicated using RF, as is known in the art.

FIG. **31**A illustrates view of enter safe zone event **3100**.

FIG. **31**B illustrates view of exit safe zone event **3112**.

In one embodiment, said one or more mag reed switches **112** can comprise said deactivation step **3120**.

In one embodiment, said safety monitoring harness system **200** can be configured to assess safety of users using said safe zone exit **3000**, safe zone entry **3002**, entry and exit sensors **3004** and said altimeter **114**, as discussed herein.

FIG. **32** illustrates an elevated front side view of strap **1106**.

In one embodiment, said one or more side switches **3202** can comprise said first side switch **3202***a*, said second side switch **3202***b* and said third side switch **3202***c*.

In one embodiment, said one or more mag reed switches **112** can comprise said one or more side switches **3202**.

In one embodiment, said one or more mag reed switches **112** can comprise said 3safety monitoring harness system **200**; wherein said safety monitoring harness system **200** can measure movement of said strap **1106** by collecting signals from said plurality of strap markers **1812** at various points along a rotary path. In this configuration, fewer of said plurality of strap markers **1812** may be required. In one embodiment, said mag reed switches **112** can be configured to sense pressure from said plurality of strap markers **1812** as they move past said mag reed switches **112** to determine movement in said strap **1106**.

In one embodiment, said plurality of strap markers **1812** can be incorporated within said strap **1106**, as illustrated. This can be asserted with the figures in said plurality of retraction stages **1800** as well.

FIG. **33** illustrates an analog circuit configuration **3300**.

In one embodiment, said analog circuit configuration **3300** can comprise said battery assembly **116**, a first gate circuit **3302***a*, a second gate circuit **3302***b*, a first gate **3304***a*, a second gate **3304***b* and an alarm **3306**. In one embodiment, said first gate circuit **3302***a* can comprise said first gate **3304***a*; and said second gate circuit **3302***b* can comprise said second gate **3304***b*.

In one embodiment, said analog circuit configuration **3300** can trip when said first gate **3304***a* and said second gate **3304***b* are both closed. In one embodiment, said first gate **3304***a* and said second gate **3304***b* can become closed when both of said first mag reed switch **112***a* and said second mag reed switch **112***b* are closed with respect to said strap **1106**.

Accordingly, said safety monitoring harness system **200** can comprise an analog configuration, wherein said alarm system **218** is triggered when both of said one or more tether assemblies **804** are in said retracted configuration **1200***a*.

The following sentences are included for completeness of this disclosure with reference to the claims.

A safety monitoring harness system **200** for the protection of a climber **1622** comprising: said safety monitoring harness system **200** comprising a base **100**, a one or more tether assemblies **804**, a retraction assembly **124**, an alarm system **218**, a strap length sensor assembly **220**, and a power system **1308**. Said one or more tether assemblies **804** comprising at least a first tether assembly **804***a* and a second tether assembly **804***b*. Said one or more tether assemblies **804** each comprising a strap **1106**, and an anchoring hook **1102**. Said safety monitoring harness system **200** is configured to selectively attach to said climber **1622** by: attaching a harness assembly **802** to said climber **1622**, and securing said base **100** to said harness assembly **802**. A portion of said retraction assembly **124** is enclosed within said base **100**. Said retraction assembly **124** are configured to selectively retract and release portions of said strap **1106** from within said base **100**. Said base **100** tracks the position of said one or more tether assemblies **804** by measuring portions of said strap **1106** inside and outside of said base **100**. Said anchoring hook **1102** selectively retract and extend between a plurality of lengths **1202**. Said plurality of lengths **1202** comprise at least a retracted length **1202***a* and a fully extended length **1202***c*. Said anchoring hook **1102** are configured to selectively attach to an anchor point **1702**. Said safety monitoring harness system **200** is configured to measure the movement of said strap **1106** by measuring movement of a plurality of strap markers **1812** relative to a one or more mag reed switches **112**. Said safety monitoring harness system **200** is configured to monitor use of said one or more tether assemblies **804** by said climber **1622** by: monitoring a change in the position of said one or more tether assemblies **804** over time, verifying that at least one among said one or more tether assemblies **804** is extended, and verifying that at least one among said one or more tether assemblies **804** which is extended is showing movement rather than a fixed length. A safety monitoring harness system **200** for the protection of a climber **1622** comprising:

Said safety monitoring harness system **200** comprising a base **100**, a one or more tether assemblies **804**, a retraction assembly **124**, an alarm system **218**, a strap length sensor assembly **220**, and a power system **1308**. Said one or more tether assemblies **804** comprising at least a first tether assembly **804***a* and a second tether assembly **804***b*. Said one or more tether assemblies **804** each comprising a strap **1106**, and an anchoring hook **1102**. Said safety monitoring harness system **200** is configured to selectively attach to said climber **1622** by: attaching a harness assembly **802** to said climber **1622**, and securing said base **100** to said harness assembly **802**. A portion of said retraction assembly **124** is enclosed within said base **100**. Said retraction assembly **124** are configured to selectively retract and release portions of said strap **1106** from within said base **100**. Said anchoring hook **1102** selectively retract and extend between a plurality of lengths **1202**. Said plurality of lengths **1202** comprise at least a retracted length **1202***a* and a fully extended length **1202***c*. Said anchoring hook **1102** of said one or more tether assemblies **804** are configured to selectively attach to an anchor point **1702**. Said safety monitoring harness system **200** is configured to monitor use of said one or more tether assemblies **804** by said climber **1622** by: verifying that at least one among said one or more tether assemblies **804** is extended.

Each of said strap **1106** comprise at least a first strap marker **1812***a*. Said first strap marker **1812***a* are configured to align with a portion of a one or more mag reed switches **112** when said strap **1106** is in said retracted length **1202***a* and not aligned when said strap **1106** is not in said retracted length **1202***a*. Said safety monitoring harness system **200** is configured to verify that at least one of said one or more tether assemblies **804** are deployed by: measuring whether at least one of said strap **1106** are not in said retracted length **1202***a*.

Said safety monitoring harness system **200** further comprising a PCB **106** and an altimeter **114**. Said PCB **106**

comprising a processors **214** and a memory **202**. Said safety monitoring harness system **200** is configured to monitor the safety of a user by: activating said safety monitoring harness system **200**, calculating an initialization altitude using said altimeter **114** at the time of activation, monitoring said altimeter **114**, determining whether said safety monitoring harness system **200** is more than a safe distance above said initialization altitude according to user preference.

Said safety monitoring harness system **200** further comprising a PCB **106**. Said PCB **106** comprising a processors **214** and a memory **202**.

Said strap **1106** each comprise a plurality of strap markers **1812** being attached to said strap **1106** at a marker interval **1804** between each among said plurality of strap markers **1812**. Said base **100** further comprises a one or more mag reed switches **112** configured to sense movement of said plurality of strap markers **1812** as said strap **1106** rotates past said one or more mag reed switches **112**. Said one or more mag reed switches **112** comprise at least a first mag reed switch **112***a* for said strap **1106** of said first tether assembly **804***a* and a second mag reed switch **112***b* for said strap **1106** of said second tether assembly **804***b*.

Said safety monitoring harness system **200** is configured to calculate a safety status of said climber **1622** by: receiving a length signal regarding said one or more tether assemblies **804**, comparing said length signals, calculating whether at least one among said one or more tether assemblies **804** is extended out of said base **100**, calculating an unsafe status if at least one among said one or more tether assemblies **804** is moving outside of said base **100** for a given period, and otherwise setting status to safe.

Said safety monitoring harness system **200** is configured to trigger an alarm if said climber **1622** is not in a safe condition as defined by at least one among said one or more tether assemblies **804** be extended and moving.

Said strap **1106** each comprise a plurality of strap markers **1812** being attached to said strap **1106** at a marker interval **1804** between each among said plurality of strap markers **1812**. Said base **100** further comprises a one or more mag reed switches **112** configured to sense movement of said plurality of strap markers **1812** as said strap **1106** rotates past said one or more mag reed switches **112**. Said one or more mag reed switches **112** comprise at least a first mag reed switch **112***a* for said strap **1106** of said first tether assembly **804***a* and a second mag reed switch **112***b* for said strap **1106** of said second tether assembly **804***b*.

Said base **100** tracks the position of said one or more tether assemblies **804** by measuring portions of said strap **1106** inside and outside of said base **100**. Said safety monitoring harness system **200** is configured to measure the movement of said strap **1106** by measuring movement of a plurality of strap markers **1812** relative to a one or more mag reed switches **112**.

Said retraction assembly **124** each comprise a one or more pin catches **500**. Said base **100** comprises a one or more key locks **108**. Said one or more key locks **108** comprise a pins **508**. Said one or more key locks **108** can be selectively arranged between an unlocked configuration **502***a* and a locked configuration **502***b*. Said pins **508** selectively prevent said retraction assembly **124** from rotating and releasing said one or more tether assemblies **804** with said retraction assembly **124** in said locked configuration **502***b*.

Said safety monitoring harness system **200** further comprises a device application **2302** and a server application **2306**. Said device application **2302** is executed on a first computer **1906***a* associated with said climber **1622**. Said server application **2306** is executed on a server **1908**. A one or more computers **1906** and said server **1908** are in data communication with one another. Said device application **2302** reports safety status of said climber **1622** to said server application **2306**. Said server application **2306** reports on one or more of said climber **1622** to a one or more users **1916** such as a supervisor **1624**.

Said server application **2306** comprises software for matching one or more of said climber **1622** with said supervisor **1624**. Said server application **2306** reports a supervisor status table **2600** summarizing a tether status table **2400** for each among said climber **1622**.

Said safety monitoring harness system **200** is configured to calculate a safety status of said climber **1622** by: receiving a length signal regarding said one or more tether assemblies **804**, comparing said length signals, calculating whether at least one among said one or more tether assemblies **804** is extended out of said base **100**, calculating an unsafe status if at least one among said one or more tether assemblies **804** is moving outside of said base **100** for a given period, and otherwise setting status to safe.

Said safety monitoring harness system **200** is further configured for: signaling an alarm if said climber **1622** is in an unsafe status, and reassessing the safety status of said climber **1622** in order to reset the alarm.

Said strap **1106** each comprise a plurality of strap markers **1812** being attached to said strap **1106** at a marker interval **1804** between each among said plurality of strap markers **1812**. Said base **100** further comprises a one or more mag reed switches **112** configured to sense movement of said plurality of strap markers **1812** as said strap **1106** rotates past said one or more mag reed switches **112**. Said one or more mag reed switches **112** comprise at least a first mag reed switch **112***a* for said strap **1106** of said first tether assembly **804***a* and a second mag reed switch **112***b* for said strap **1106** of said second tether assembly **804***b*.

Said safety monitoring harness system **200** is configured to trigger an alarm if said climber **1622** is not in a safe condition as defined by at least one among said one or more tether assemblies **804** be extended and moving.

Various changes in the details of the illustrated operational methods are possible without departing from the scope of the following claims. Some embodiments may combine the activities described herein as being separate steps. Similarly, one or more of the described steps may be omitted, depending upon the specific operational environment the method is being implemented in. It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-described embodiments may be used in combination with each other. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein."

The invention claimed is:

1. A safety monitoring harness system for the protection of a climber comprising:

said safety monitoring harness system comprising a base, a one or more tether assemblies, a retraction assembly, an alarm system, a strap length sensor assembly, and a power system;

said one or more tether assemblies each comprise a strap, and an anchoring hook;

said safety monitoring harness system is configured to selectively attach to said climber by:

securing a harness assembly to said climber, and

securing said base to said harness assembly;

a portion of said retraction assembly is enclosed within said base;

said anchoring hook retract and extend between a plurality of lengths from said base;

said plurality of lengths for each of said anchoring hooks comprise at least a retracted length and a fully extended length;

said safety monitoring harness system is configured to monitor use of said one or more tether assemblies by said climber by

verifying that at least one among said one or more tether assemblies is extended;

each of said straps comprise at least a first strap marker;

said safety monitoring harness system further comprises a one or more mag reed switches;

said first strap marker, for each of said strap, is configured to align with a portion of a one or more mag reed switches when said strap is in said retracted length and not aligned when said strap is not in said retracted length;

wherein verifying that at least one among said one or more tether assemblies is extended comprises

measuring whether at least one of said strap are not in said retracted length by verifying that at least one among said one or more one or more mag reed switches is not aligned with said first strap marker;

said safety monitoring harness system comprises an analog circuit configuration comprising a circuit between said power system and said alarm system;

said analog circuit configuration comprises a gate circuit for each of said one or more tether assemblies between said battery assembly and said alarm system; and

said gate circuit are each configured as closed with said first strap marker aligned with a first mag reed switch and said strap in said retracted length.

2. A safety monitoring harness system for the protection of a climber comprising:

said safety monitoring harness system comprising a base, a one or more tether assemblies, a retraction assembly, an alarm system, a strap length sensor assembly, and a power system;

said one or more tether assemblies each comprise a strap, and an anchoring hook;

said safety monitoring harness system is configured to selectively attach to said climber by:

securing a harness assembly to said climber, and

securing said base to said harness assembly;

a portion of said retraction assembly is enclosed within said base;

said anchoring hook retract and extend between a plurality of lengths from said base;

said plurality of lengths for each of said anchoring hooks comprise at least a retracted length and a fully extended length;

said safety monitoring harness system is configured to monitor use of said one or more tether assemblies by said climber by

verifying that at least one among said one or more tether assemblies is extended;

each of said straps comprise at least a first strap marker;

wherein verifying that at least one among said one or more tether assemblies is extended comprises

measuring whether at least one of said strap are not in said retracted length by verifying that at least one among said one or more one or more mag reed switches is not aligned with said first strap marker;

said safety monitoring harness system comprises an analog circuit configuration comprising a circuit between said power system and said alarm system;

said analog circuit configuration comprises a gate circuit for each of said one or more tether assemblies between said battery assembly and said alarm system; and

said gate circuit are each configured as closed with said first strap marker aligned with a first mag reed switch and said strap in said retracted length.

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