Referring now to FIG. 7, in addition to the rotary actuators 212, 214, 216, 218 that operate the latches 110, 120, 130, 140, respectively, the elevator 100 can also include a rotary actuator 210 that operates to rotate the elevator housing 102 relative to the links 44. The rotary actuator 210 can be fixedly attached to the housing 102 and a drive shaft of the actuator 210 is coupled to the link interfaces 222, 224 by coupling 230. As the rotary actuator 210 rotates its drive shaft drives the coupling 230 and operates to rotate the link interfaces 222, 224, which rotate together relative to the housing 102. The link interface 222 can include a pair of angled flanges 226a, 226b disposed on opposite sides of a first link 44, and the link interface 224 can include a pair of angled flanges 228a, 228b disposed on opposite sides of a second link 44. When the link interfaces 222, 224 are rotated relative to the housing 102 in response to actuation by the rotary actuator 210, the angled flanges 226a, 226b, 228a, 228b engage the first and second links 44 and thereby rotate the elevator 100 relative to the links 44. The link interface system 220 (which includes the items shown in FIG. 14A) can rotate the elevator +/- 95 degrees from a position that is perpendicular to a longitudinal axis 86 of the links 44. This equates to a possible rotation of at least 190 degrees when the elevator 100 is rotated through its full rotation. Please note that the link interface system 220 is described in more detail below with reference to FIG. 14A.

FIG. 8A is a center cross-sectional view of an elevator 100 similar to the one shown in FIG. 7. The cross-section is generally at the center of the elevator 100 and perpendicular to the axis 80. FIG. 8A illustrates how the latches 110, 120, 130, 140 engage each other when in the engaged position to distribute the compressive forces caused when hanging the tubular 38 from the elevator 100. When the tubular 38 (or tubular string 28) engages the jaws 140a, 140b of the latch 140, compression forces 54, 56 are transmitted diagonally down through the stacked latches as indicated by the arrows 54, 56 to the housing 102. This stack of the latches 110, 120, 130, 140 can reduce lateral forces acting on the latches 110, 120, 130, 140 and allows the latches 110, 120, 130, 140 to be a lighter weight design thereby reducing an overall weight of the elevator 100. As the latches are sequentially rotated into a disengaged position, then the diameter of the opening through the elevator 100 can increase allowing larger tubulars 38 to be handled by the elevator 100. As the latches 110, 120, 130, 140 are sequentially disengaged, the latches that remain in the engaged position carries the load of the tubular 38 and transmits the load

protrusions 426 are above the opposite side of the second plate 406 and the removable retainer 410 can be rotated as shown by arrows 430 to align the protrusions 426 with the recesses 414. With the protrusions 426 aligned with the recesses 414, the compression force applied to the compression handles 418 can be released and the biasing devices 408 will again urge the first and second plates 404, 406 away from each other forcing the protrusions 426 into the recesses 414. With the protrusions 426 seated in the recesses 414, the removable device 410 is prevented from rotating further and thereby secures the removable device 410 to the retainer mount 420.

FIG. 24 is a cross-sectional view of the link retainer 400 with the protrusions 426 seated in the recesses 414. It should be understood that the protrusions can be various shapes and sizes as long as the openings 412 match those shapes and sizes with appropriate clearances, and that the rotation into the secured position is possible.

FIG. 25 shows an elevator with a link interface system 220 that can include link interfaces 222, 224 which are similar to the link interface 222 shown in FIG. 14B that has adjustable angled flanges 226a, 226b. FIG. 25 also shows a link retainer 400 with extended handles 418 that can include an opening for improved operator grasping and manipulation of the handles 418.

FIG. 25 is a representative perspective view a housing 102 of an elevator 100 with latch assemblies of the elevator 100 removed to observe a circular weight sensor 480 positioned around a center of the elevator 100. A spacer ring 108 (not shown) can be mounted above it and transfer weight of a tubular 34 captured in the elevator 100 to the circular weight sensor 480. In operation of the elevator 100, the latches, when in a closed position, will engage the spacer ring 108 and, through the spacer ring 108, transfer the weight of a captured tubular 34 to the circular weight sensor 480.

FIG. 26 is a representative perspective view of a circular weight sensor 480. A support ring 460 engages the elevator housing 102 when the circular weight sensor 480 is installed in the elevator 100. An engagement ring 470 is slidably and sealingly engaged with the support ring 460 creating a sealed chamber 454 between them (see FIG. 27). A fill port 462 can be used to fill the sealed chamber 454 with an incompressible fluid (e.g. oil). A retainer ring 464 can be used to prevent disengagement of the engagement ring 470 from the support ring 460, with fasteners 466 being used to secure the retainer ring 464 to the support ring 460. The engagement

CLAIMS

1. A system for conducting subterranean operations comprising:

an elevator configured to move a tubular, the elevator comprising:

a housing defining a central bore configured to receive the tubular therein; and

a first latch comprising a first jaw with a first lock, the first jaw configured to be rotated between an engaged position and a disengaged position,

wherein the first lock engages a portion of the housing when the first jaw is in the engaged position,

wherein the first jaw comprises a lateral portion and an attachment portion,

wherein the lateral portion mates with the attachment portion forming an overlap between the lateral portion and the attachment portion, and

wherein the first lock extends through the overlap.

2. The system of claim 1, wherein the lateral portion comprises a first protrusion along an end and the attachment portion comprises a first recess along an end, wherein the first protrusion is received by the first recess and forms the overlap.

3. The system of claim 2, wherein the first lock rotated to a first position allows insertion of the first protrusion in the first recess or removal of the first protrusion from the first recess.

4. The system of claim 3, wherein the first lock rotated to a second position allows movement of the first protrusion within the first recess and retains the first protrusion within the first recess.

5. The system of claim 4, wherein the attachment portion is rotatably attached to the housing, wherein rotation of the attachment portion rotates the lateral portion, and wherein lateral movement of the lateral portion causes lateral movement of the first protrusion in the first recess, which prevents lateral movement of the attachment portion in response to the lateral movement of the first protrusion.

6. A system for conducting subterranean operations comprising:

an elevator configured to move a tubular, the elevator comprising:

a housing defining a central bore configured to receive the tubular therein;

a first latch comprising a first jaw with a first lock, the first jaw configured to be rotated between an engaged position and a disengaged position,

wherein the first lock engages a portion of the housing when the first jaw is in the engaged position; and

a spacer ring disposed between the first latch and the housing and a circular weight sensor disposed between the spacer ring and the housing, wherein the portion of the housing is adjacent the spacer ring.

7. The system of claim 6, wherein the first latch engages the spacer ring and the first lock engages the portion of the housing when the first latch is in the engaged position.

8. The system of claim 7, wherein the spacer ring transfers weight from the first latch to the housing through the spacer ring and the circular weight sensor, when the first latch is in the engaged position, and wherein the first lock transfers a rotational force applied to the first jaw to the portion of the housing, when the first latch is in the engaged position.

9. The system of claim 8, further comprising a second latch comprising a second jaw with a second lock, the second jaw configured to be rotated between an engaged position and a disengaged position, wherein the second lock engages the first lock when the second jaw is in the engaged position.

10. The system of claim 9, wherein the second latch transfers weight to the housing through the first latch, the spacer ring, and the circular weight sensor, when the first latch and the second latch are in the engaged positions, and wherein the second lock transfers a rotational force applied to the second jaw through the first lock and to the portion of the housing, when the first latch and the second latch are in the engaged positions.

11. The system of claim 1, further comprising:

a first shaft disposed in the housing, with a first cam attached to one end of the first shaft and a first lever attached to an opposite end of the first shaft; and

a spacer ring at least partially surrounding a central axis of the central bore, the spacer ring having a first recess configured to receive the first cam,

wherein the first lever is configured to engage the first jaw when the first jaw is rotated to the engaged position.

12. The system of claim 11, wherein engagement of the first lever rotates the first cam into engagement with the first recess, such that removal of the spacer ring from the housing is prevented when the first jaw is in the engaged position.

13. The system of claim 1, further comprising a circular weight sensor surrounding the central bore, wherein a weight of the tubular is transferred to the circular weight sensor, which measures a pressure that is proportional to the weight of the tubular.

14. The system of claim 13, wherein the measured pressure is communicated to a controller that is configured to determine the weight of the tubular in response to the measured pressure.

15. The system of claim 13, wherein the circular weight sensor comprises:

a support ring;

an engagement ring slidably attached to the support ring;

a sealed chamber disposed between the support ring and the engagement ring;

a reservoir in pressure communication with the sealed chamber; and

a pressure sensor in pressure communication with the reservoir.