The sixth and eighth drive shafts 174, 178 are rotatably attached to the housing 102 along the axis 96 and rotate the respective jaws about the axis 96. The second and fourth drive shafts are also adjacent each other along the axis 96, and are laterally spaced apart along the axis 96. A portion of the jaw 140b adjacent the fourth drive shaft 178 does not overlap the jaw 130b when the jaws 130b and 140b are in the engaged position. However, an engagement portion of the jaw 140b overlaps and engages an engagement portion of the jaw 130b when the jaws 130b and 140b are in the engaged position.

When operating the latches 110, 120, 130, 140, the first latch 110 is rotated into an engaged position before the other latches 120, 130, 140. The second latch 120 can be rotated into an engaged position after the first latch 110 is actuated to the engaged position and before the other latches 130, 140 are actuated. The third latch 130 can be rotated into an engaged position after the first and second latches 110, 120 are actuated to the engaged position and before the other latch 140 is actuated. The fourth latch 140 can be rotated into an engaged position after the first, second, and third latches 110, 120, 130 are actuated to the engaged position. With all four latches in the engaged position, (as seen in Fig. 7) the elevator 100 is configured with a minimal diameter opening through the engaged latches 110, 120, 130, 140. With each successive closure of the latches 110, 120, 130, 140, the minimum diameter of the opening through the latches decreases. Conversely, as the latches are sequentially rotated from the engaged positions to disengaged positions in reverse order, the minimum diameter of the opening through the latches increases. This allows the elevator 100 to be reconfigured to handle tubulars 38 with a wide range of diameters. The elevator can be automatically reconfigured by the controller 50 and/or processors in the enclosure 150 based on sensor date, and/or manually configured by the controller 50 and/or the processors in the enclosure 150 based on user inputs.

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

protrusions 426 to allow the removable device 410 to receive the protrusions 426 into the openings 412 (see FIG. 22). When the protrusions 426 and the openings 412 are aligned, the first plate 404 can engage the mounting flange 425. However, since the biasing devices 408 urge the first and second plates 404, 406 away from each other, the removable device 410 cannot be rotated relative to the protrusions 426 (and retention feature 422) because the distance the mounting flange 425 to the opposite side of the second plate 406 is larger than the gap 428.

FIG. 23 shows the removable device 410 mounted onto the retainer mount 420 with a compression force applied to the second plate 406 via the compression handles 418, thereby compressing the springs 418 and reducing the distance from the mounting flange 425 to the opposite side of the second plate 406 to be less than the gap 428. In this configuration, the 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

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;

a first latch comprising first and second jaws, with each of the first and second jaws configured to be moveable between an engaged position and a disengaged position, and when the first and second jaws are in the engaged position, engagement portions of the first and second jaws are positioned in the central bore on opposite sides of, with respect to each other, a central axis of the central bore and define an opening of a first diameter; and

a second latch comprising third and fourth jaws, with each of the third and fourth jaws configured to be moveable between an engaged position and a disengaged position, and when the third and fourth jaws are in the engaged position, engagement portions of the third and fourth jaws are positioned in the central bore on opposite sides of, with respect to each other, the central axis of the central bore and define an opening of a second diameter which is different than the first diameter,

wherein the first jaw is fixedly attached to a first drive shaft and the first drive shaft is rotationally attached to the housing,

wherein the third jaw is fixedly attached to a third drive shaft and the third drive shaft is rotationally attached to the housing, and

wherein the first and third drive shafts independently rotate the first and third jaws, respectively, about a first axis.

2. The system of claim 1, wherein the second jaw is fixedly attached to a second drive shaft and the second drive shaft is rotationally attached to the housing,

wherein the fourth jaw is fixedly attached to a fourth drive shaft and the fourth drive shaft is rotationally attached to the housing, and

wherein the second and fourth drive shafts independently rotate the second and fourth jaws, respectively, about a second axis.

3. The system of claim 2, wherein each of the engagement portions of the first and second jaws has a lateral portion and a tapered portion, with the tapered portion extending from the lateral portion at an angle, and wherein the lateral portion of the first jaw is substantially parallel

to the lateral portion of the second jaw when the first and second jaws are in the engaged position.

4. The system of claim 2, wherein the elevator is configured to be operated in an explosive environment, and an electronics controller configured to control the elevator is disposed within a chamber of the housing.

5. The system of claim 2, wherein the first and second jaws of the first latch are configured to form a first frustoconically shaped portion of the first latch when the first latch is in the engaged position,

wherein the third and fourth jaws of the second latch are configured to form a second frustoconically shaped portion of the second latch when the second latch is in the engaged position.

6. The system of claim 5, wherein the first frustoconically shaped portion includes a first gap between the first and second jaws when the first latch is in the engaged position, and wherein the second frustoconically shaped portion includes a second gap between the third and fourth jaws when the second latch is in the engaged position.

7. The system of claim 6, wherein the first and second gaps are parallel to the central axis of the center bore, and the first and second gaps are circumferentially aligned with each other relative to the central axis, or the first and second gaps are circumferentially offset from each other relative to the central axis.

8. The system of claim 2, wherein a first rotary actuator is coupled to the first and second drive shafts and simultaneously rotates the first and second drive shafts in opposite directions, thereby rotating the first and second jaws between engaged and disengaged positions, and

wherein a second rotary actuator is coupled to the third and fourth drive shafts and simultaneously rotates the third and fourth drive shafts in opposite directions, thereby rotating the third and fourth jaws between engaged and disengaged positions.

9. The system of claim 2, further comprising:

a third latch comprising fifth and sixth jaws, with each of the fifth and sixth jaws configured to be moveable between an engaged position and a disengaged position, and when the fifth and sixth jaws are in the engaged position, engagement portions of the fifth and sixth jaws are positioned in the central bore on opposite sides of, with respect to each other, the central axis

of the central bore and define an opening of a third diameter which is different than the first and second diameters, and

a fourth latch comprising seventh and eighth jaws, with each of the seventh and eighth jaws configured to be moveable between an engaged position and a disengaged position, and when the seventh and eighth jaws are in the engaged position, engagement portions of the seventh and eighth jaws are positioned in the central bore on opposite sides of, with respect to each other, the central axis of the central bore and define an opening of a fourth diameter which is different than the first, second, and third diameters.

10. The system of claim 1, further comprising an electronics controller disposed in an electronics enclosure and configured to control the elevator to handle the tubular.

11. The system of claim 10, further comprising a hydraulic generator and an energy storage device, wherein the hydraulic generator generates electrical energy for operation of the elevator and stores a portion of the electrical energy in the energy storage device, and wherein the energy storage device is disposed within the electronics enclosure.