not return to its original dimensions and poses a potential failure point. In addition, some tubulars become worn on the inside due to the flow of abrasive drilling fluids. These worn points are often not visible from outside the drill pipe, and also present potential failure points.

In order to identify tubulars that may have been exposed to excessive stress or wear, tubulars that are intended to be re-used on a rig are validated through independent inspections between wells, and prior to be introduced to the drilling rig. Validation requires an inspector to manually measure and record dimensions and specifications of the tubular.

Tubulars exhibiting excessive levels of elongation or deformation may be deemed unsuitable for continued use. However, since tubulars are a consumable commodity and extremely expensive, it is desirable to use as much of their useful life as possible. However, the process of validating by manually measuring each tubular for dimensional discrepancies can be time consuming and tedious work.

Pad drilling, which requires a rig to be on site drilling multiple wells, presents additional challenges for ensuring safe and proper validation for the drill pipe. The time required to remove tubulars from a rig for measurement and quality control can slow the process and decrease efficiency of the drilling operation.

The present disclosure is directed to systems and methods that overcome one or more of the shortcomings of the prior art.

SUMMARY

According to a first aspect, there is provided a drilling rig apparatus comprising: a racker device structurally arranged to move a tubular or stand on a drilling rig; a catwalk structurally arranged to introduce a tubular or stand to the drilling rig; a sensing arrangement cooperatively associated with at least one of the racker device and the catwalk and configured to sense an aspect of a tubular or stand while the tubular or stand is being handled at the drilling rig and to output a signal representative of the aspect of the tubular or stand; and a tubular validation system configured to receive the sensed aspect of the tubular or stand obtained by the sensing arrangement and to determine a specification characteristic of the tubular or stand based on the sensed aspect.

According to a second aspect, there is provided a drilling rig apparatus comprising: a racker device structurally arranged to move a tubular or stand on a drilling rig; a length sensing arrangement cooperatively associated with the racker device and configured to sense

a positional aspect of a tubular or stand while the tubular or stand is being operatively associated with the racker device and output a signal representative of the positional aspect of the tubular or stand; a weight sensing arrangement cooperatively associated with the racker device and configured to sense a weight aspect of a tubular or stand while the tubular or stand is associated with the racker device and output a signal representative of the weight aspect of the tubular or stand; and a tubular validation system configured to receive the sensed positional aspect of the tubular or stand obtained by the length sensing arrangement and determine a specification characteristic indicative of a length of the tubular or stand based on the sensed positional aspect, the tubular validation system also being configured to receive the sensed weight aspect of the tubular or stand obtained by the weight sensing arrangement and determine a specification characteristic indicative of a weight of the tubular or stand based on the sensed weight aspect.

According to a third aspect, there is provided a drilling rig apparatus comprising: a catwalk structurally arranged to move a tubular or stand to a drilling rig; a length sensing arrangement cooperatively associated with the catwalk and configured to sense a positional aspect of a tubular or stand while the tubular or stand is operatively associated with the catwalk and output a signal representative of the positional aspect of the tubular or stand; a weight sensing arrangement cooperatively associated with the catwalk and configured to sense a weight aspect of a tubular or stand while the tubular or stand is operatively associated with the catwalk and output a signal representative of the weight aspect of the tubular or stand; and a tubular validation system configured to receive the sensed positional aspect of the tubular or stand obtained by the length sensing arrangement and determine a specification characteristic indicative of a length of the tubular or stand based on the sensed positional aspect, the tubular validation system also being configured to receive the sensed weight aspect of the tubular or stand obtained by the weight sensing arrangement and determine a specification characteristic indicative of a weight of the tubular or stand based on the sensed weight aspect.

According to a fourth aspect, there is provided a method of validating a tubular or stand, comprising: sensing a location of an aspect of a tubular or stand or a weight of the tubular or stand supported on a portion of a drilling rig ; communicating information indicative of the sensed location or weight to a tubular validation system; comparing the communicated information to a tubular or stand validation threshold in the tubular validation system to determine whether the tubular or stand meets specification criteria justifying use of the tubular or stand in a drilling operation; and notifying a user when the tubular or stand fails

to meet the specification criteria.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure is best understood from the following detailed description when read with the accompanying figures. It is emphasized that, in accordance with the standard practice in the industry, various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion.

FIG. 1 is a schematic of an exemplary apparatus according to one or more aspects of the present disclosure.

FIG. 2 is a schematic of a catwalk portion an exemplary apparatus according to one or more aspects of the present disclosure.

FIG. 3 is a schematic of an exemplary racker device apparatus according to one or more aspects of the present disclosure.

FIG. 4 is a schematic of an exemplary racker device apparatus according to one or more aspects of the present disclosure.

CLAIMS

~~What is claimed is:~~

1. A drilling rig apparatus ~~(100)~~ comprising:

a racker device ~~(104)~~ structurally arranged to move a tubular or stand on a drilling rig ~~(101)~~;

a catwalk ~~(162)~~ structurally arranged to introduce a tubular or stand to the drilling rig;

a sensing arrangement ~~(170)~~ cooperatively associated with at least one of the racker device and the catwalk and configured to sense an aspect of a tubular or stand while the tubular or stand is being handled at the drilling rig and to output a signal representative of the aspect of the tubular or stand; and

a tubular validation system ~~(242)~~ configured to receive the sensed aspect of the tubular or stand obtained by the sensing arrangement and to determine a specification characteristic of the tubular or stand based on the sensed aspect.

2. The drilling rig apparatus of claim 1, wherein the specification characteristic is one of a tubular or stand total length, an effective length, a pin connector length, and a tubular or stand weight.

3. The drilling rig apparatus of claim 1, wherein the sensing arrangement comprises a weight sensing arrangement configured to automatically detect the weight of the tubular or stand and configured to communicate the weight to the tubular validation system.

4. The drilling rig apparatus of claim 1, wherein the sensed aspect of the tubular or stand comprises a position of at least one end the tubular or stand relative to a portion of the drilling rig.

5. The drilling rig apparatus of claim 1, wherein the sensed aspect of the tubular or stand comprises a position of a portion of the racker device or a portion of the catwalk relative to an end of the tubular or stand.

6. The drilling rig apparatus of claim 1, wherein the sensing arrangement comprises an encoder integrated into the catwalk and indicates a position representative of a bottom end of the tubular or stand relative to the catwalk.

7. The drilling rig apparatus of claim 1, wherein the sensing arrangement comprises a sensor carried on a racker arm of the racker and is configured to indicate a position representative of a top end of the tubular or stand relative to the racker arm.

8. The drilling rig apparatus of claim 7, wherein the sensor comprises a plurality of linear and rotary encoders disposed about the racker arm and usable to determine the position of the racker arm relative to the bottom end of the tubular or stand.

9. The drilling rig apparatus of claim 1, wherein the tubular validation system is configured to determine an effective tubular or stand length by subtracting the pin connector length from the total tubular or stand length.

10. The drilling rig apparatus of claim 1, wherein the tubular validation system comprises a memory, the tubular validation system being configured to receive and store the specification characteristic of the tubular or stand in the memory, configured to compare the specification characteristic to a stored threshold specification, and configured to alert an operator when the specification characteristic is beyond the stored threshold specification.

11. A drilling rig apparatus comprising:

a racker device ~~(104)~~ structurally arranged to move a tubular or stand on a drilling rig ~~(101)~~;

a length sensing arrangement cooperatively associated with the racker device and configured to sense a positional aspect of a tubular or stand while the tubular or stand is being operatively associated with the racker device and output a signal representative of the positional aspect of the tubular or stand;

a weight sensing arrangement cooperatively associated with the racker device and configured to sense a weight aspect of a tubular or stand while the tubular or stand is associated with the racker device and output a signal representative of the weight aspect of the tubular or stand; and

a tubular validation system ~~(242)~~ configured to receive the sensed positional aspect of the tubular or stand obtained by the length sensing arrangement and determine a specification characteristic indicative of a length of the tubular or stand based on the sensed positional aspect, the tubular validation system also being configured to receive the sensed weight aspect of the tubular or stand obtained by the weight sensing arrangement and determine a specification characteristic indicative of a weight of the tubular or stand based on the sensed weight aspect.

12. The drilling rig apparatus of claim 11, wherein the tubular validation system is configured to configured to compare the specification characteristic indicative of length and the specification characteristic indicative of weight to stored threshold specifications.

13. The drilling rig apparatus of claim 12, wherein the tubular validation system is configured to output an alert to a system user when the specification characteristic indicative of length or the specification characteristic indicative of weight is outside of the stored threshold specifications.

14. The drilling rig apparatus of claim 11, comprising

a catwalk structurally arranged to introduce a tubular or stand to the drilling rig, the catwalk comprising a sensing arrangement configured to sense a positional aspect of a tubular or stand while the tubular or stand is being handled by the catwalk and output a signal representative of the positional aspect of the tubular or stand,

wherein the tubular validation system is configured to receive the signal output from the catwalk sensing arrangement and determine a specification characteristic indicative of a tubular or stand length.

15. The drilling rig apparatus of claim 14, wherein the sensing arrangement comprises an encoder integrated into the catwalk and indicates a position representative of a bottom end of the tubular or stand on the catwalk.

16. The drilling rig apparatus of claim 11, wherein the sensed positional aspect of the tubular or stand comprises a relative position of at least one end the tubular or stand.

17. The drilling rig apparatus of claim 11, wherein the sensed positional aspect of the tubular or stand handled by the racker device comprises a position of a portion of the racker device relative to an end of the tubular or stand.

18. The drilling rig apparatus of claim 11, wherein the sensing arrangement comprises a sensor carried on a racker arm of the racker and is configured to indicate a position representative of a top end of the tubular or stand.

19. The drilling rig apparatus of claim 11, wherein the racker device comprises a gripping mechanism configured to grip the tubular or stand, the weight sensing arrangement being disposed on the gripping mechanism.

20. A drilling rig apparatus comprising:

a catwalk ~~(162)~~ structurally arranged to move a tubular or stand to a drilling rig;

a length sensing arrangement cooperatively associated with the catwalk and configured to sense a positional aspect of a tubular or stand while the tubular or stand is operatively associated with the catwalk and output a signal representative of the positional aspect of the tubular or stand;

a weight sensing arrangement cooperatively associated with the catwalk and configured to sense a weight aspect of a tubular or stand while the tubular or stand is operatively associated with the catwalk and output a signal representative of the weight aspect of the tubular or stand; and

a tubular validation system ~~(242)~~ configured to receive the sensed positional aspect of the tubular or stand obtained by the length sensing arrangement and determine a specification characteristic indicative of a length of the tubular or stand based on the sensed positional aspect, the tubular validation system also being configured to receive the sensed weight aspect of the tubular or stand obtained by the weight sensing arrangement and determine a specification characteristic indicative of a weight of the tubular or stand based on the sensed weight aspect.

21. The drilling rig apparatus of claim 20, wherein the tubular validation system is configured to configured to compare the specification characteristic indicative of length and the specification characteristic indicative of weight to stored threshold specifications.

22. The drilling rig apparatus of claim 21, wherein the tubular validation system is configured to output an alert to a system user when the specification characteristic indicative of length or the specification characteristic indicative of weight is outside of the stored threshold specifications.

23. The drilling rig apparatus of claim 20, wherein the length sensing arrangement comprises an encoder integrated into the catwalk and indicates a position representative of a bottom end of the tubular or stand on the catwalk.

24. A method of validating a tubular or stand, comprising:

sensing a location of an aspect of a tubular or stand or a weight of the tubular or stand supported on a portion of a drilling rig ~~(101)~~;

communicating information indicative of the sensed location or weight to a tubular validation system ~~(242)~~;

comparing the communicated information to a tubular or stand validation threshold in the tubular validation system to determine whether the tubular or stand meets specification criteria justifying use of the tubular or stand in a drilling operation; and

notifying a user when the tubular or stand fails to meet the specification criteria.

25. The method of claim 24, comprising determining a specification characteristic of the tubular or stand based on the communicated information and comparing the specification characteristic to the tubular or stand validation threshold.

26. The method of claim 24, wherein sensing a location of an aspect of the tubular or stand comprises sensing a first positional aspect of a portion of the tubular or stand and sensing a second positional aspect of a portion of the tubular or stand.

27. The method of claim 26, wherein sensing a first positional aspect comprises sensing a position of a first end of the tubular or stand and wherein sensing a second position aspect comprises sensing a position of a second end of the tubular or stand.

28. The method of claim 26, wherein communicating information comprises communicating a sensed weight to the tubular validation system, the tubular validation system being arranged to compare the communicated weight to a tubular or stand validation weight threshold to determine whether the tubular or stand meets weight criteria justifying use of the tubular or stand in a drilling operation.