US 20120111082A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2012/0111082 A1**

(43) **Pub. Date: May 10, 2012**

Garza

(54) **PIPE REPAIR TOOL AND RELATED METHODS**

(75) Inventor: **Ramiro Garza**, Tomball, TX (US)

(73) Assignee: **BLESS OILFIELD SERVICES**, Tomball, TX (US)

(21) Appl. No.: **12/940,609**

(22) Filed: **Nov. 5, 2010**

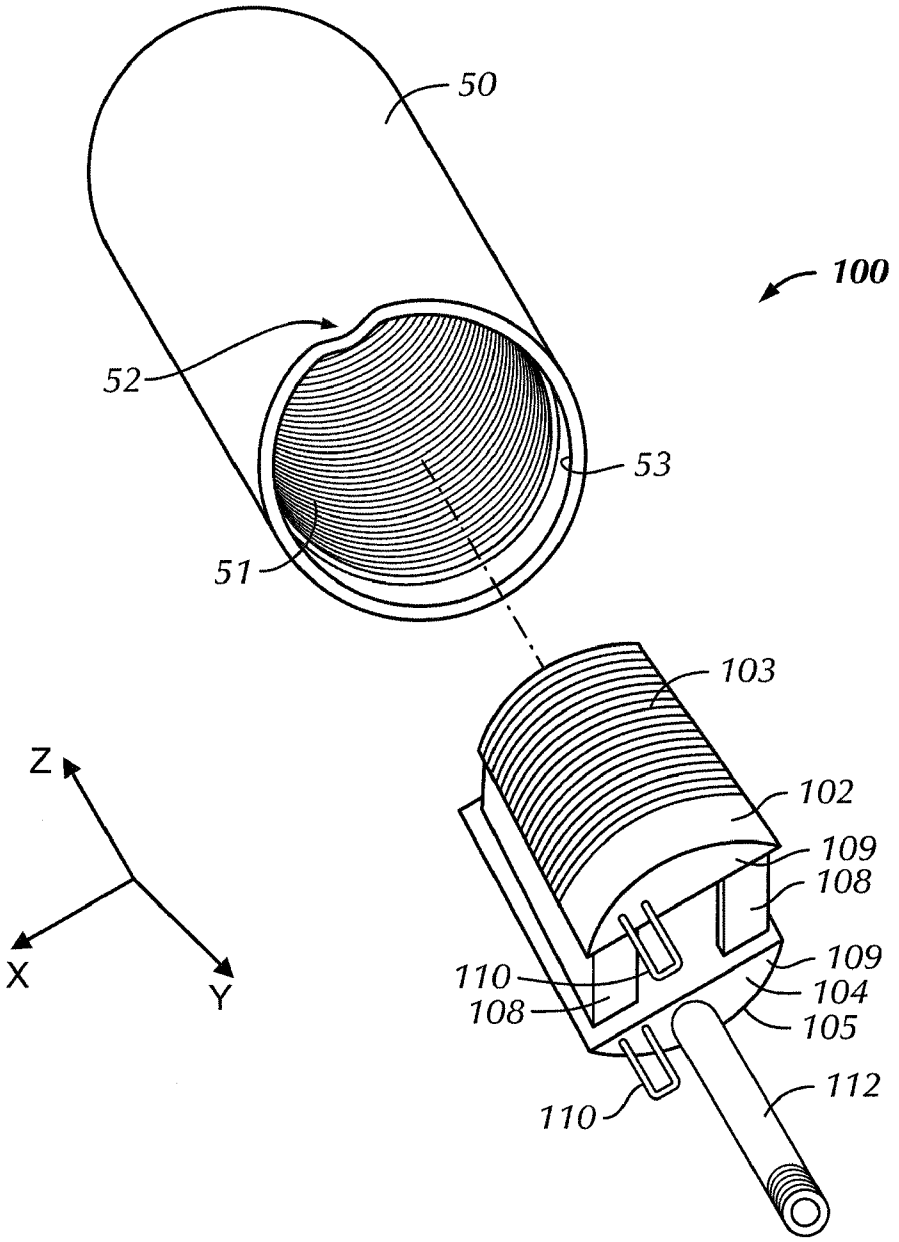
Publication Classification

(51) **Int. Cl.**
B21D 3/14 (2006.01)
B21D 39/20 (2006.01)

(52) **U.S. Cl.** **72/370.08**; 72/392

(57) **ABSTRACT**

A pipe repair tool includes at least two saddles having an actuatable cylinder disposed therebetween and configured to fit within the pipe, the at least two saddles having arcuate surfaces configured to correspond with a circumference of the pipe.



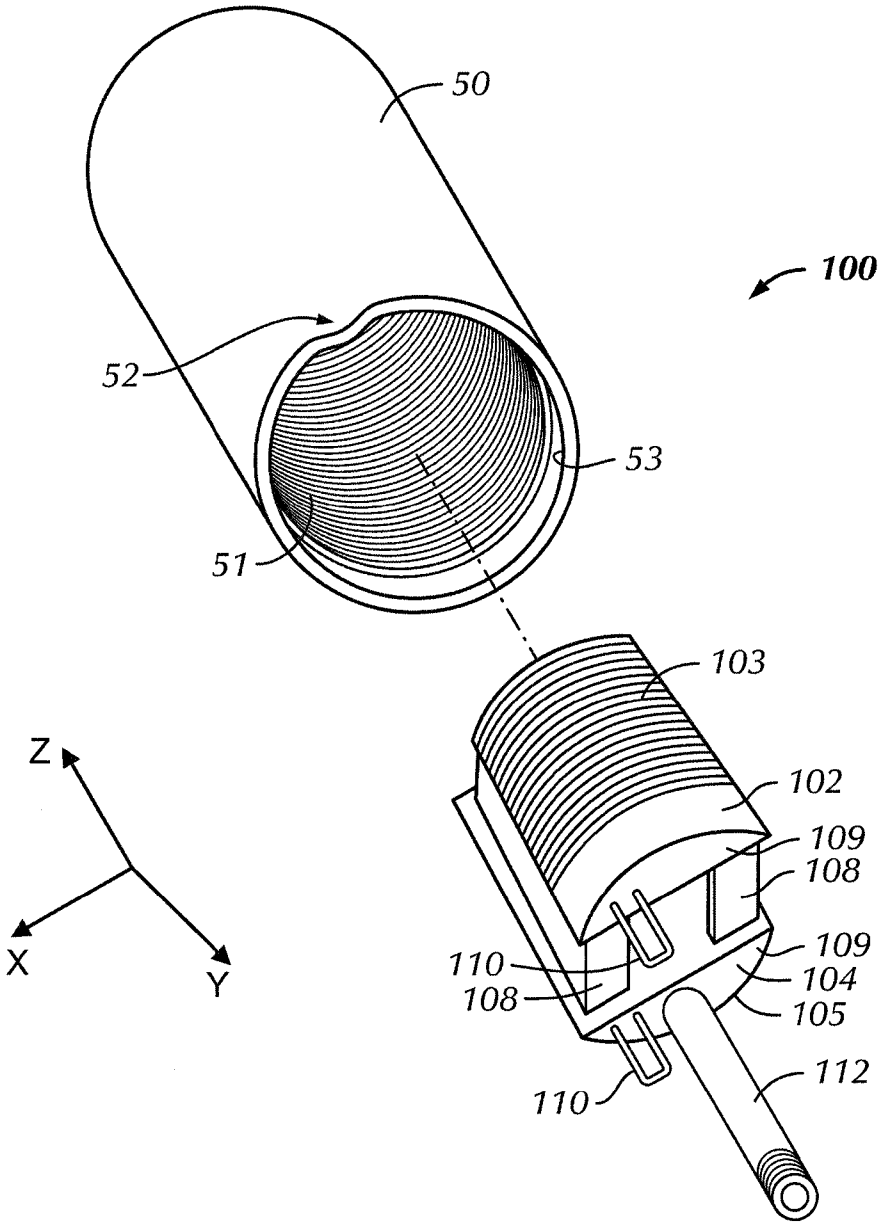


FIG. 1A

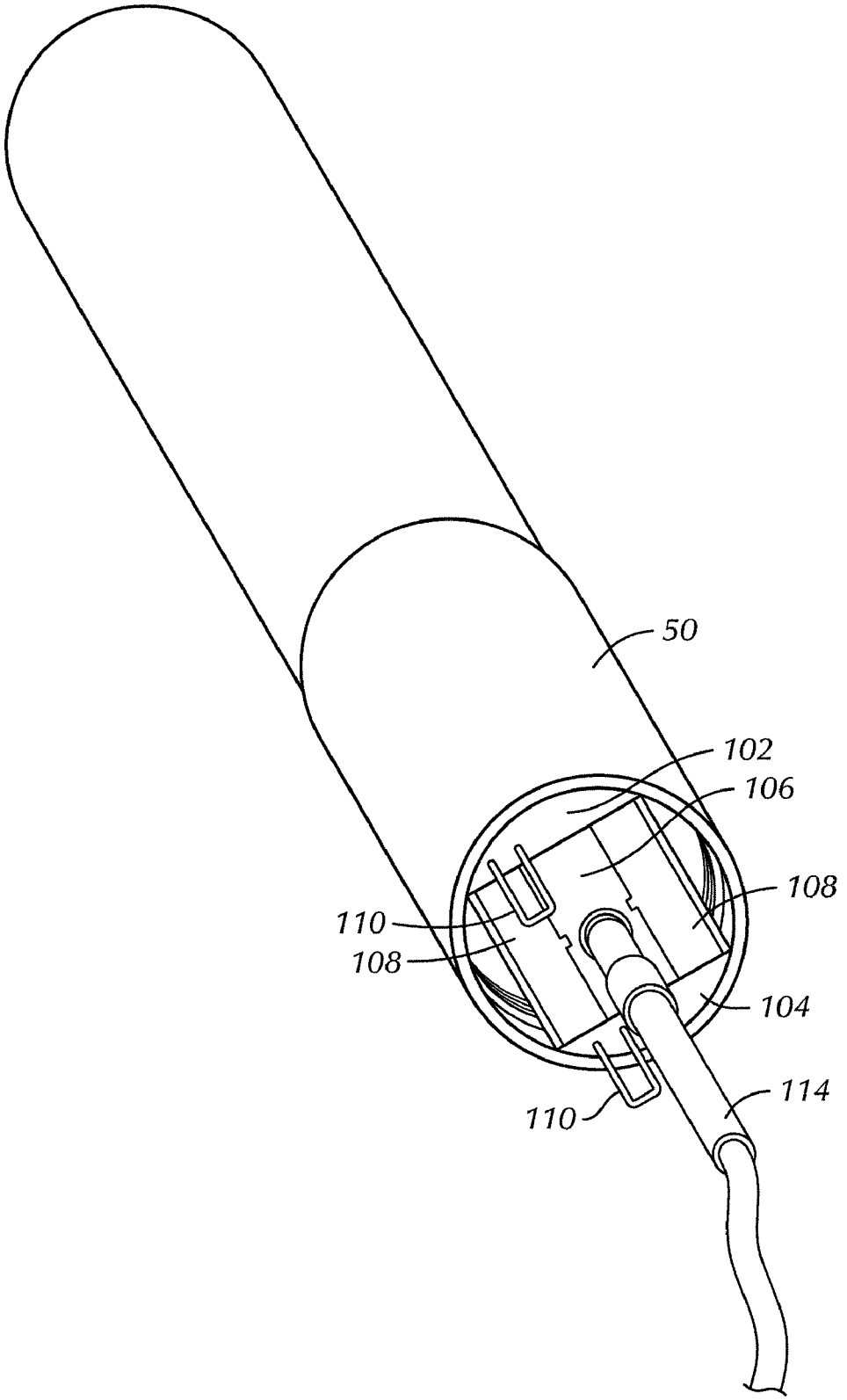


FIG. 1B

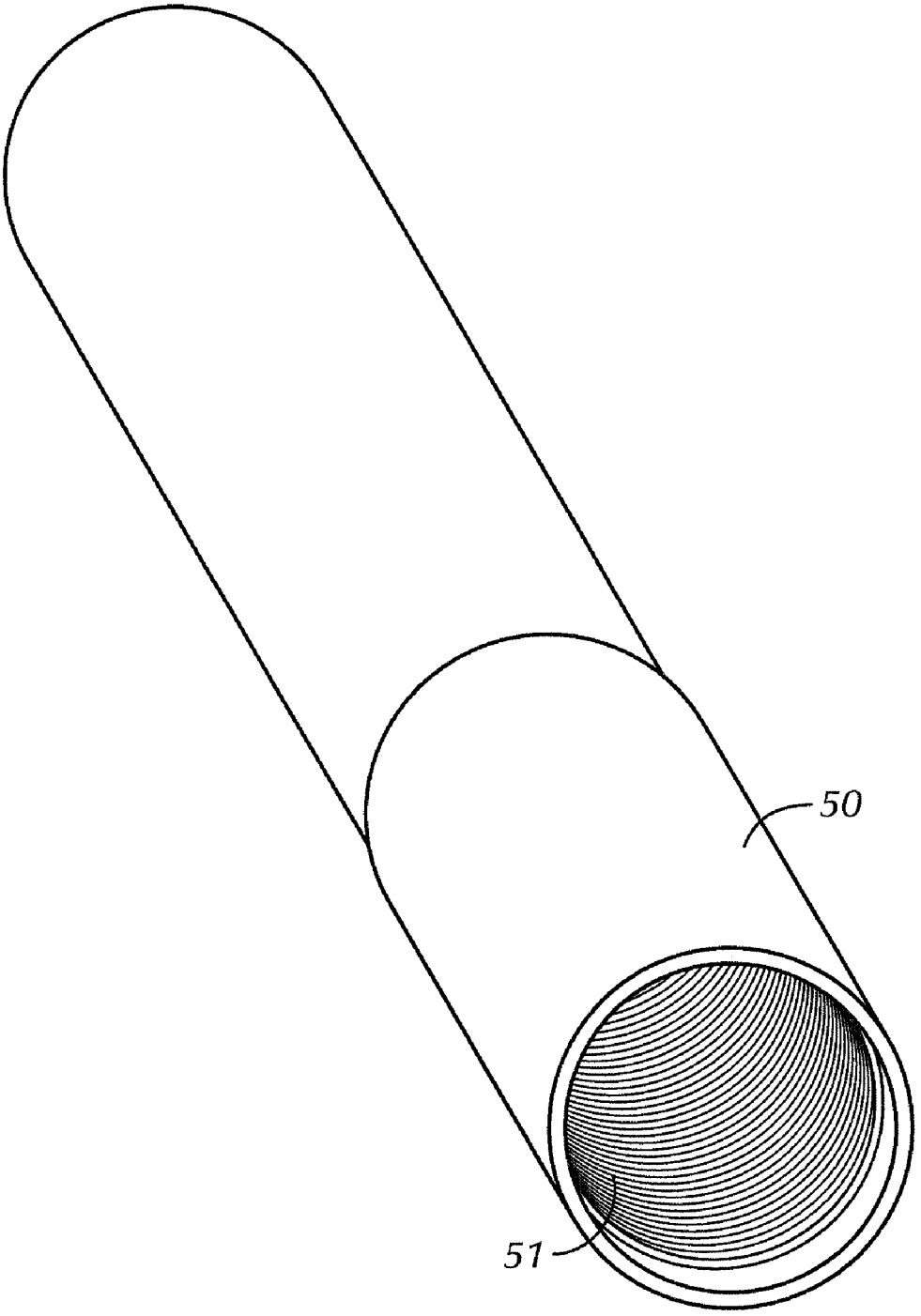


FIG. 1C

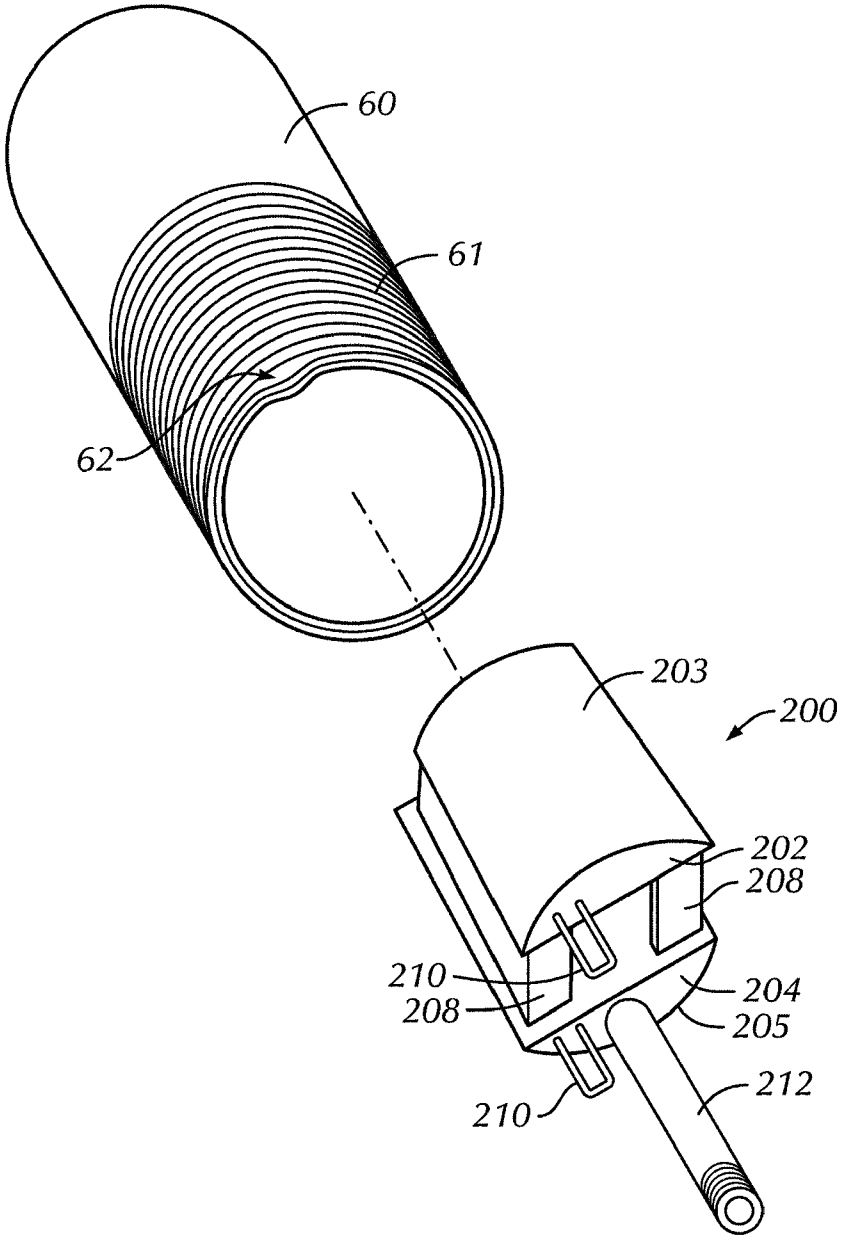


FIG. 2A

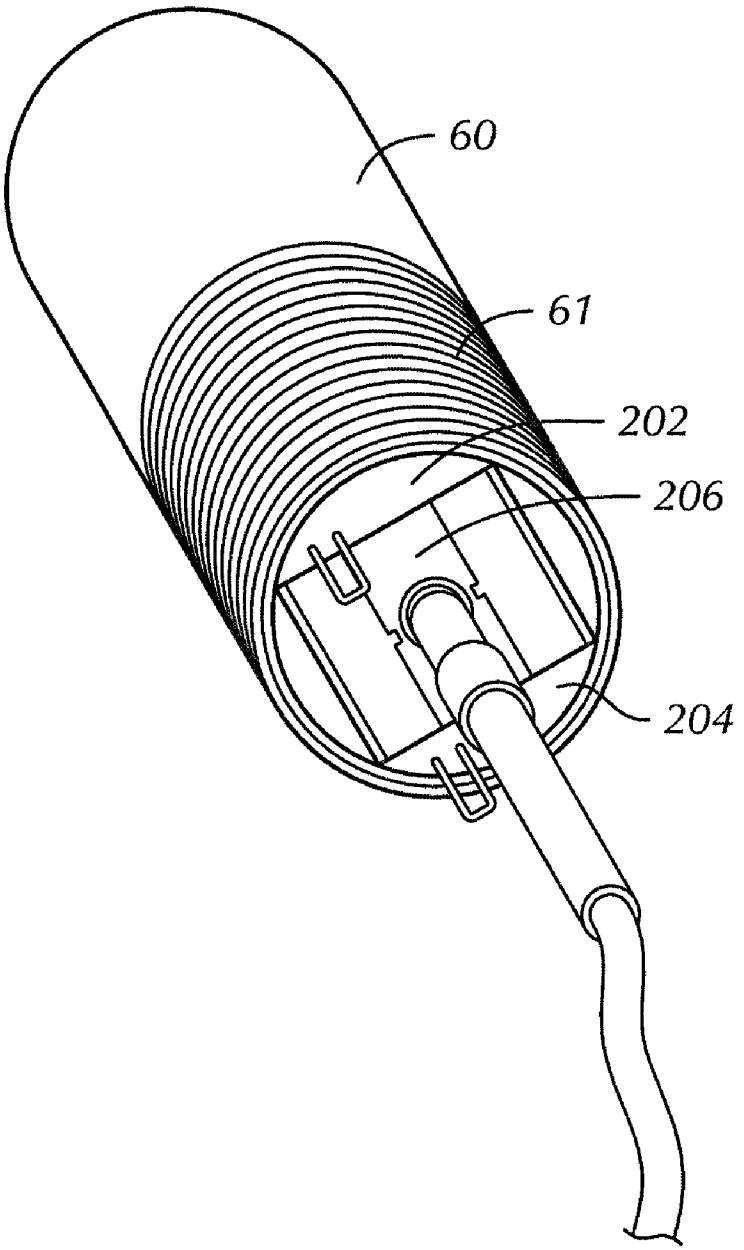


FIG. 2B

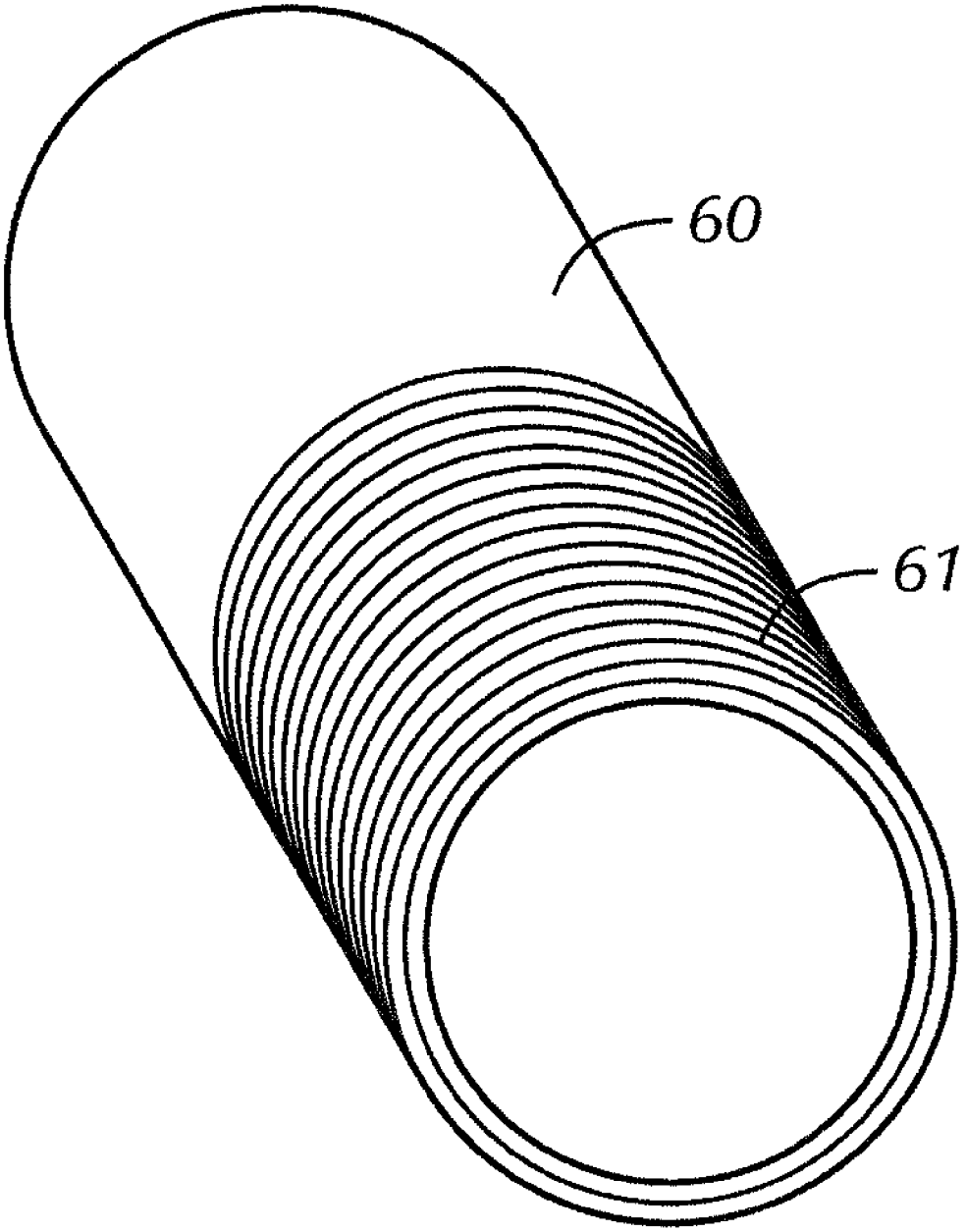


FIG. 2C

PIPE REPAIR TOOL AND RELATED METHODS

BACKGROUND

[0001] 1. Field of the Disclosure

[0002] Embodiments disclosed herein relate generally to a pipe repair tool used for general field repairs. In particular, embodiments disclosed herein relate to a pipe repair tool for repairing dented pipe ends.

[0003] 2. Background Art

[0004] Casing, tubing, joints, liners, drill pipe, drill collars, pup joints, and line pipe (collectively referred to as pipe) may be used in the oil and gas industry to retrieve and transport liquid and gas products. Pipe joints, for example, may be positioned in a wellbore to stabilize formations or transport referenced products. The pipe joints may be coupled in an end-to-end manner by threaded connections, welded connections, or other connections known in the art.

[0005] During transport of the pipe from the manufacturer's facility to a customer, the pipe may become damaged due to excessive movement. In particular, the pipe ends may be the most susceptible to damage, for example, indentations in the circumference of the pipe end. Typically, damaged pipe ends may be classified as "rejects" and must be transported to a certified threading or end prep facility whereby the pipe end is cut-off and machined to satisfy specification requirements. Thus, machining of the pipe ends at a certified facility as indicated is essentially doubled due to the fact that the threading operation was performed twice, in addition to product transportation and handling.

[0006] Accordingly, there exists a need for a tool capable of repairing damaged pipe ends to avoid the need for complete re-machining of the pipe ends.

SUMMARY OF THE DISCLOSURE

[0007] In one aspect, embodiments disclosed herein relate to a pipe repair tool including at least two saddles having an actuatable cylinder disposed therebetween and configured to fit within the pipe, the at least two saddles including arcuate surfaces configured to correspond with a circumference of the pipe.

[0008] In other aspects, embodiments disclosed herein relate to a method of repairing a damaged pipe end, the method including exerting a radially outward force against a section of the pipe having an indentation located in a circumference of the pipe and returning the circumference of the pipe to an original outer diameter contour.

[0009] Other aspects and advantages of the invention will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0010] FIGS. **1A-1C** show perspective views of a pipe repair tool for a pipe coupling in accordance with one or more embodiments of the present disclosure.

[0011] FIGS. **2A-2C** show perspective views of a pipe repair tool for a pipe pin end in accordance with one or more embodiments of the present disclosure.

DETAILED DESCRIPTION

[0012] In one aspect, embodiments disclosed herein relate to a pipe repair tool used in general field repairs. In particular, embodiments disclosed herein relate to a pipe repair tool that may be used for de-denting damaged pipe ends. In general, the pipe repair tool may be used with a number of different pipe sizes ranging from 2⅜ inches up to 36 inches, and larger.

[0013] Referring now to FIGS. **1A-1C**, perspective views of a pipe repair tool **100** used for repairing a coupling **50** or box type pipe end having internal threads **51** in accordance with one or more embodiments of the present disclosure are shown. The pipe repair tool **100** includes two saddles, an upper saddle **102** and a lower saddle **104**. As shown, the saddles **102**, **104** are configured in a semi-circle shape having arcuate-shaped outer surfaces **103**, **105**, respectively, which are configured to correspond to a circumference of an inner surface **51** of a pipe coupling **50**. Stated otherwise, the outer arcuate surfaces **103**, **105** of upper and lower saddles **102**, **104** may be configured to be concentric with the circumference of the inner surface **51** of the coupling **50**. The upper and lower saddles **102**, **104** may be configured having a radial thickness (measured in the z-direction) dependent upon a wall thickness of the pipe end to be repaired. In certain embodiments, the radial thickness of the upper and lower saddles **102**, **104** may be at least twice the wall thickness of the pipe end to be repaired.

[0014] Further, in certain embodiments, the upper and lower saddles **102**, **104** may be configured having threaded outer surfaces **103**, **105**, respectively, which are configured to correspond with a thread profile of the internal threads **51** of the coupling **50** (FIG. **1A**). The threaded outer surfaces **103**, **105** may be configured to correspond with any number of the various thread profiles known in the art. In addition, the upper and lower saddles **102**, **104** may be configured having a counterbore profile at an end **109** that is configured to correspond to a counterbore **53** in a distal end of the pipe coupling **50**. Those skilled in the art will appreciate a number of API standard counterbores to which the end **109** of the upper and lower saddles **102**, **104** may be matched.

[0015] The pipe repair tool **100** further includes an actuatable cylinder **106** disposed between the upper and lower saddles **102**, **104**, and which is configured to expand or extend the upper and lower saddles **102**, **104** in opposite directions. The actuatable cylinder **106** (FIG. **1B**) may be secured between the upper and lower saddles **102**, **104** in any number of ways as known to those or ordinary skill in the art. In certain embodiments, the actuatable cylinder **106** may be a hydraulic jack. As an example, a low-height, single-acting cylinder available from Enerpac®, located in Butler, Wis., may be used as the actuatable cylinder **106**. Further, an external power source such as a hydraulic pump, electric pump, manual hand pump, or hydraulic air pump, also available from Enerpac®, may be used to actuate the hydraulic jack. The actuatable cylinder **106** is disposed between the upper and lower saddles **102**, **104** such that a piston (not shown) within the actuatable cylinder **106** may be extended and force the upper saddle **102** away from the lower saddle **104**. In certain embodiments, the actuatable cylinder **106** may be rated to provide up to 10,000 psi, or greater. Alternatively, any type of actuatable cylinder known to those skilled in the art may be used in accordance with embodiments disclosed herein.

[0016] The pipe repair tool **100** may further include one or more alignment tracks **108** that are configured to maintain an alignment between the upper and lower saddles **102**, **104** in a radial direction (i.e., in the z-direction). The alignment tracks **108** provide that the upper saddle **102** and lower saddle **104** move directly away from and toward each other (i.e., in sub-

stantially 180 degree directions) as the actuatable cylinder **106** expands and retracts. The alignment tracks **108** prevent the upper and lower saddles **102**, **104** from becoming misaligned and binding. Those skilled in the art will appreciate a number of various configurations of alignment tracks that may be used in accordance with one or more embodiments disclosed herein.

[0017] Still further, the upper and lower saddles **102**, **104** may include attachment points **110** where a linkage (not shown) may be connected to secure the upper and lower saddles **102**, **104** together. For example, the linkage may include, but is not limited to, a flexible linkage such as a chain, flexible strap, or other flexible linkages known to those skilled in the art. Further, the pipe repair tool **100** may include an extension arm **112** that protrudes axially (i.e., in the y-direction) from the pipe repair tool **100**. As shown, the extension are **112** may be attached to the lower saddle **104**, however, alternatively the extension arm **112** may be attached at any convenient location on the pipe repair tool **100**. The extension arm **112** allows the pipe repair tool to be inserted into a pipe up to a greater distance axially into the pipe length, rather than merely at the pipe end.

[0018] Referring briefly to FIG. **2**A, a perspective view of pipe repair tool **200** used for repairing a pin end **60** of a pipe having external threads **61** in accordance with one or more embodiments of the present disclosure is shown. The pipe repair tool **200** includes an upper saddle **202**, a lower saddle **204**, and an actuatable cylinder **206** (FIG. **2**B) disposed therebetween. In this embodiment, the outer arcuate surfaces **203**, **205** of the upper and lower saddles **202**, **204**, respectively, are smooth (i.e., no threaded surface) to correspond with the smooth inner surface of the pin end **60** (due to the pin end **60** having external threads **61**). The pipe repair tool **200** further includes alignment tracks **208**, attachment points **210**, and an extension arm **212** similar to the previous embodiment described above.

[0019] Referring now to FIGS. **1**A-**1**C and **2**A-**2**C together, methods of using the pipe repair tools **100**, **200** in accordance with one or more embodiments disclosed herein are as follows. As shown in FIGS. **1**A and **2**A, often a damaged pipe end **50**, **60** will have an indentation **52**, **62** that protrudes in a radially inward direction. A damaged pipe end **50**, **60** with such an indentation **52**, **62** is often classified as a reject and may not be used unless costly remanufacturing steps are undertaken (i.e., cutting the damaged end and rethreading). Using a pipe repair tool in accordance with methods disclosed herein, the damaged pipe end may be repaired such that the pipe length may be used.

[0020] The pipe end is first inspected to determine whether the pipe end is salvageable and if use of the pipe repair tool may be sufficient to repair the damage to the pipe end. For a damaged pipe coupling **50** (with internal threads **51**), if the indentation area **52** (FIG. **1**A) exceeds the first two threads axially inward from the coupling end, or if the internal threads **51** are detected to have encountered any tears, cut, grinds, shoulders, steps, or any other imperfections and/or damage that breaks the thread continuity in the indented area, or if any coupling face damage with raised metal is detected, the coupling **50** may likely remain in the reject category (i.e., the coupling is beyond repair). Likewise, for a damaged pin end **60** (with external threads **61**), if the indentation area **62** (FIG. **2**A) exceeds the second full crested thread from the pin nose face, or if the external threads **61** are detected to have encountered any tears, cuts, grinds, shoulders, steps, or any other imperfections and/or damage that breaks the thread continuity in the indented area, or if any pin end damage with raised metal is detected, the pin end **60** may likely remain in the reject category (i.e., the pin end is beyond repair).

[0021] Still further, for damaged plain end casing (not shown), if the indentation exceeds API Specification 5CT requirements for outer diameter ("OD") dimensional requirements, the damaged plain end casing may remain in the reject category. Further, for damaged plain end line pipe, if the indentation exceeds API Specification 5L requirements, which state that pipe shall contain no indentations greater than ¼ inch (0.250 inch) measured as the distance between the lowest point of the indentation (i.e., the furthest point radially inward) and a prolongation of the original contour of the pipe, the damaged line pipe may remain in the reject category. If the damaged pipe end is determined to be repairable, the repairs may be commenced as follows.

[0022] To repair the damaged pipe end, the pipe may be rotated until the damaged area **52** (FIG. **1**A) is located at approximately a 12 o'clock position (i.e., the indentation is on top). Next, the pipe repair tool **100** may be inserted into the pipe end as shown in FIG. **1**B. The upper saddle **102** may be aligned with the indentation **52** such that the indentation **52** is positioned in approximately the center of the upper saddle **102**. The lower saddle **104** is configured to engage a lower half of the pipe end circumference to provide a stable base during repair. The lower saddle **104** may be configured to have an arcuate outer surface **105** length of up to approximately ½ of the circumference of the pipe end. In general, the greater the length of the arcuate outer surface **105**, the better stability the lower saddle **104** is able to provide during repair of the pipe end. Further, during repair of a pipe coupling having internal threads, the threaded outer surface **105** of the lower saddle **104** is matched to correspond with the internal threads **51** of the pipe coupling **50**. The threaded outer surface **105** of the lower saddle **104** is matched with the internal threads **51** to avoid deforming the internal threads during repair.

[0023] Likewise, referring briefly to FIGS. **2**A-**2**C, to repair a pin end **60** of a pipe the pipe repair tool **200** may be inserted into the pin end **60** and oriented such that the upper saddle **202** is approximately centered on the indentation **62**. Because the pin end **60** has external threads **61**, the upper and lower saddles **202**, **204** have outer surfaces **203**, **205** that are smooth and configured to correspond with the smooth inner surface of the pin end **60**. Further, in certain embodiments, a shim (not shown) may be inserted between the upper and lower saddles **202**, **204** and an inner surface of the pin end **60** to avoid direct contact between the outer surfaces **203**, **205** of the upper and lower saddles **202**, **204** and the inner surface of the pin end **60**. The shim may be relatively thin and is intended to prevent any marring or deforming of the inner surface of the pin end **60**.

[0024] After the pipe repair tool is properly positioned in the pipe end, the actuatable cylinder may be actuated and a piston within the actuatable cylinder expanded to urge the upper saddle into contact with an inner surface of the damaged section of the pipe end. In the embodiment shown in FIGS. **1**A-**1**C, similar to the lower saddle **104**, the upper saddle **102** is configured having a threaded outer surface **103** configured to correspond with the internal threads **51** of the pipe coupling **50**. The upper saddle **102** is expanded to contact the damaged surface **52**. The outward radial force from the expanding upper saddle **102** forces the indentation **52** of the damaged section radially outward and restores the pipe cou-

pling **50** to its original outer diameter. Once the damaged section of the pipe coupling **50** reaches the original diameter contour, the pressure to the actuatable cylinder is released to allow the upper saddle **102** to retract away from the inner surface of the pipe end **50**.

[0025] Still further, in certain embodiments, prior to relieving pressure in the actuatable cylinder and retracting the upper saddle, the upper saddle may remain in contact with the inner surface of the pipe end and the repaired pipe end may be work-hardened or strain-hardened. The repaired pipe end may be work-hardened to ensure that the repaired outer diameter contour is permanent and that the damaged section (i.e., the indentation) does not return to the damaged state whatsoever (i.e., that the indentation does not return). Any type of cold-working or work-hardening process may be used to induce slight permanent deformation of the metal and exact the shape change (i.e., return the pipe end to its original outer diameter contour). For example, repetitively struck blows from a large hammer on an outer surface of the repaired pipe end may effectively cold-work the pipe end.

[0026] Following repairs to the pipe end, an inspection of the repaired pipe end may be conducted to ensure that the repaired pipe end has been repaired to proper dimensions and within proper tolerances. A thread element and/or pipe end dimensional inspection may be performed to ensure compliance with respective API Specifications (e.g., API Specifications 5CT, 5B, 5L and 5A5) in addition to any customer specification requirements, as will be known and understood by one of ordinary skill in the art. For example, a ring gauge or plug gauge may be employed to confirm that the repaired pipe end meets API specification requirements. Those skilled in the art will understand the use of a ring or plug gauge to do so.

[0027] Advantageously, embodiments of the present disclosure provide a pipe repair tool capable of returning a damaged pipe end to original specifications as allowed by API specification standards. Particularly, embodiments disclosed herein eliminate the need to cut and rethread the pipe end due to minor repairable damage of the pipe end. Thus, the pipe repair tool may save repair costs of damaged pipe ends as well as decrease the time required to make the repair itself.

[0028] While the present disclosure has been described with respect to a limited number of embodiments, those skilled in the art, having benefit of this disclosure, will appreciate that other embodiments may be devised which do not depart from the scope of the disclosure as described herein. Accordingly, the scope of the disclosure should be limited only by the attached claims.

What is claimed is:

1. A pipe repair tool comprising:

at least two saddles having an actuatable cylinder disposed therebetween and configured to fit within the pipe, the at least two saddles comprising arcuate surfaces configured to correspond with a circumference of the pipe.

2. The pipe repair tool of claim **1**, wherein the actuatable cylinder is configured to expand the at least two saddles in opposite directions.

3. The pipe repair tool of claim **1**, wherein the arcuate surfaces of the at least two saddles are configured to be substantially concentric with the circumference of the pipe.

4. The pipe repair tool of claim **1**, wherein an arc length of the arcuate surfaces is approximately one-half or less of the circumference of the pipe.

5. The pipe repair tool of claim **1**, wherein the actuatable cylinder is a hydraulic cylinder.

6. The pipe repair tool of claim **1**, further comprising an external power source in fluid communication with the actuatable cylinder.

7. The pipe repair tool of claim **1**, further comprising at least one alignment member configured to maintain a radial alignment between the at least two saddles.

8. The pipe repair tool of claim **1**, wherein a radial thickness of the at least two saddles is at least twice the wall thickness of the tubular.

9. The pipe repair tool of claim **1**, further comprising at least one linkage between the at least two saddles.

10. The pipe repair tool of claim **1**, wherein the actuatable cylinder is configured to provide a pressure of up to 10,000 psi.

11. The pipe repair tool of claim **1**, wherein a profile of the at least two saddles is configured to correspond to a standard counter bore of the pipe.

12. The pipe repair tool of claim **1**, further comprising at least one shim configured to be inserted between the at least two saddles and an inner surface of the pipe.

13. A method of repairing a damaged pipe end, the method comprising:

exerting a radially outward force against a section of the pipe having an indentation located in a circumference of the pipe; and

returning the circumference of the pipe to an original outer diameter contour.

14. The method of claim **13**, further comprising work-hardening the section of the pipe having the indentation after returning the circumference of the pipe to the original outer diameter contour.

15. The method of claim **13**, further comprising dimensionally inspecting the threaded pipe.

16. The method of claim **13**, further comprising providing a pipe repair tool having at least two saddles and expanding the at least two saddles to exert a radially outward force on the indentation.

17. The method of claim **16**, further comprising inserting a shim between an outer surface of the at least two saddles and an inner surface of the section of the pipe having the indentation.

18. The method of claim **16**, further comprising providing threaded outer surfaces on the at least two saddles to correspond with an internal thread of the pipe end.

19. The method of claim **16**, further comprising providing smooth outer surfaces on the at least two saddles to correspond with a smooth inner surface of the pipe end.

20. The method of claim **13**, further comprising repairing the indentation according to API specification requirements.

* * * * *