ABSTRACT

A power spinning tong for rotating a well pipe has opposed pairs or rollers rotatable on lever arms which pivot about a common point on the frame. One roller of each pair is power driven. The lever arms are actuated to cause engagement of the rollers with the pipe by a wedge shiftable by a short stroke cylinder. Adjustors in each lever arm operate to adjust the tong to grip pipe of different diameters.

18 Claims, 9 Drawing Figures
ADJUSTABLE POWER SPINNING TONG

BACKGROUND OF THE INVENTION

In the making up and breaking out of joints in well pipe, such as well drilling pipe, one section of pipe is held stationary by a back up wrench or tong while the companion length of pipe is rotated, in one direction or the other. Various means have been employed to rotate the rotatable pipe at high speed during initial make up or final break out, and other devices have been employed to finally make up and initially break out the joints.

A common procedure for high speed rotation of the pipe is the use of a so-called spinning chain which is hazardous in use. Spinning tongs have been developed comprising a spinning head or drive rollers engageable with the pipe to rotate the pipe. However, the pipe may vary considerably in diameter, from time to time, requiring a pipe gripping mechanism which is operable over a range of pipe sizes.

SUMMARY OF THE INVENTION

The present invention relates to an improved power spinning tong for rotating well pipe and the like.

More particularly, the present invention involves a power spinning tong of the type having rollers which grip the pipe and some of which rollers are rotatable to drive the pipe rotatively, the rollers being revolvable on lever arms which can be opened to allow the tung to be applied to and removed from the pipe, and which can be closed to cause the rollers to tightly grip the pipe and cause it to rotate.

The rollers which grip and drive the pipe are rotatably supported on a pair of lever arms which pivot about a common pivot point under the influence of a wedge shaped actuator. This actuator is reciprocable by an actuator cylinder. Adjuster means are provided in the lever arms, so that the tung is adjustable to fit a variety of pipe sizes responsive to a uniform actuator cylinder and wedge stroke, so that the cylinder and supporting frame structure size and mass are minimized and the tung is easier to handle and occupies less rig space.

In accomplishing the foregoing, the tong has roller support lever arms which are provided with adjustable ends enabling the ends to be moved to adjusted positions towards and away from one another and with respect to expander means which actuates the lever arms towards pipe gripping positions. Specifically, the actuator means includes an expander wedge reciprocable by an actuator cylinder, and the ends of the lever arms are adjusted to move them closer or farther apart to vary the effect of the wedge on the lever arms.

In addition, a pair of the pipe spinning rollers are mounted on shafts which are adjustable towards and away from the other pair of rollers to vary the space between adjacent rollers and adapt the tong to fit a further variety of pipe sizes.

This invention possesses many other advantages, and has other purposes which may be made more clearly apparent from a consideration of the form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. They will now be described in detail for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed descriptions are not to be taken in a limiting sense.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan of a power spinning tong made in accordance with the invention, showing the gripping rollers engaged with a pipe;

FIG. 2 is a side elevation of the spinning tong of FIG. 1;

FIG. 3 is an enlarged fragmentary view illustrating the drive mechanism for the pipe spinning rollers;

FIG. 4 is a view corresponding to FIG. 1, but showing the jaws actuated to an open condition;

FIG. 5 is a fragmentary detail view in section, as taken on the line 5—5 of FIG. 1, showing the pivotal mounting of the levers on the supporting frame;

FIG. 6 is a view in section, as taken on the line 6—6 of FIG. 1, with certain parts shown in elevation and illustrating the adjustable roller mounting;

FIG. 7 is a fragmentary detail view in elevation illustrating an adjustable roller in an alternate position as compared with the position of FIG. 6;

FIG. 8 is a fragmentary detail view in section, as taken on the line 8—8 of FIG. 2, showing the lever end adjustor mechanism;

FIG. 9 is a view in section, as taken on the line 9—9 of FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIGS. 1 and 2, the adjustable power spinning tong of the present invention will be seen to generally comprise a suitable frame structure 1 on which is mounted a drive motor 2, in the illustrative embodiment shown as a typical air motor. Pivotedly mounted on the frame 1 is a pair of elongated levers 3 and 4 which are pivoted about a common axis 5. The levers have elongated arms 6 extending along side the frame 1 and constituting actuating lever arms, whereby pipe gripping lever arms 7 are adapted to be moved toward and away from one another into and from gripping engagement with a pipe P. Carried by the gripping lever arms 7 are opposed drive rollers 8 and opposed idle rollers 9. As will be later described, the drive rollers 8 are adapted to be driven in either direction by the motor 2 to effect rotation of the pipe P when the pipe is gripped between the rollers 8 and 9 as seen in FIG. 1. The rollers 8 and 9 are formed of or covered by an elastomeric material which is resiliently deformable under pipe gripping pressure and provides a good friction grip of the pipe, as is well known.

The levers 3 and 4 are adapted to be actuated about the pivot 5 by actuator means, generally denoted at 10, operable to move the actuating lever arms 6 outwardly to close the gripping lever arms 7, and operable to retract the operating lever arms 6 to open the gripping lever arms 7. More particularly, the actuator means 10 includes an expander wedge or block 11 which is slidably disposed with respect to the frame 1 and connected to an actuator rod 12 which projects from an actuator cylinder 13, the cylinder 13 being fixed to the frame 1 by tie bolts 14.

Each of the levers 3 and 4 has, at the outer end of its operating arm 6, adjustable means 15 supporting a roller 16 engageable by opposing wedge surfaces 17 of the wedge block 11, whereby the lever arms are actuated in a pipe gripping direction when the actuator rod 12 is extended. Also carried by the adjustable means 15 is a lever retracting link 18 engageable with the wedge
block 11 to retract the levers from the gripping engagement with the pipe in response to longitudinal movement of the wedge block 11 when the actuator web 12 is retracted. The purpose of the adjustor means 15, which will hereinafter described in detail, is to provide an adjustable link between the respective operating lever arms 6 and the rollers 16, whereby the lateral distance between the rollers 16 can be adjusted thereby enabling the wedge block 11 to cause the gripping jaws 7 to be closed on pipes of a range of sizes in response to the uniform short stroke of the actuator rod 12. Such an adjustor structure not only enables the tong to be effectively utilized to spin pipes of a range of sizes, but also the short stroke actuator cylinder enables the overall size and mass of the spinning tong assembly to be minimized.

As previously indicated, the levers 3 and 4 are mounted on the common pivot axis 5. In this connection as best seen in FIG. 5, the lever 3 has a pair of vertically spaced webs or flanges 19 and 20 and the lever 4 has a pair of vertically spaced webs or flanges 21 and 22 which horizontally lap or interfit with the webs or flanges 19 and 20 of the lever 3. The frame 1 has a support section 23 disposed between the vertically spaced flanges 19 and 22 of the levers 3 and 4, respectively. The respective flanges 19 through 22 are all journaled on a pin or shaft 24 which extends through the support frame section 23 and downwardly into a gear case 25 which houses the drive gearing, to be later described, by which the motor 2 drives the spinning rollers 8.

The spinning rollers 8 are adapted to be rotated in either direction to cause right hand or left hand rotation of a pipe frictionally engaged between the drive rollers 8 and the idler rollers 9 by suitable drive gearing as generally illustrated in FIG. 3, such gearing being located in the previously mentioned gear case 25. The gearing includes an output gear driven by the motor 26 which is in mesh with an idler gear 27 which in turn drives a common gear 28 which is in mesh with a pair of idler gears 29, these idlers 29 respectively driving the drive gears 30 for the respective drive rollers 8. The gearing system will be seen to be such that the drive rollers 8 are driven in the same direction so that their engagement with opposite sides of the pipe will cause the pipe to be driven in a selected direction depending upon the direction that the motor 2 is driven.

Referring to FIGS. 6 and 7, it will be seen that the rollers 9 are adjustably mounted by means which enable each of the rollers 9 to be mounted either in a first position (FIG. 6) relative to the roller 8 on its gripping arm 7 or a second position (FIG. 7) closer to the roller 8, whereby to effectively cooperate with the opposing rollers to grip pipe of a range of sizes.

The roller 9 is suitably rotatably supported upon a pin or shaft 31 which spans upper and lower flanges 32 and 33 of the gripping arm 7. A head 34 of the pin 31 is generally rectangular in form and the pin is off center with respect to the head. The flange 32 has a rectangular seat 35 which receives the head 34.

At opposite ends of the head 34 are end projections 36 which extend into recesses 37 in the flange 32 at the ends of the seat 35. The lower flanges 33 has a bore 38 and a seat 39 to receive a bushing 40 having an off center opening 41 receiving the pin 31. A retainer 42 is employed beneath the flange 33 to retain the bushing 40 and the pin 31 in place. When the retainer 42 is removed from the pin 31, the pin can be removed from the roller and rotated 180° and the bushing 40 rotated 180°, so that upon reassembly the pin 31 is shifted towards or away from the drive roller 8.

The adjustor means 15 which support the wedge rollers 16 to vary the width between the rollers 16 comprises, in the case of each of the levers 3 and 4, the assembly best seen in FIGS. 8 and 9. The operating lever arm 6 has a slot 43 in its end, and a crank 44 is disposed in the slot 43 and pivotally mounted on a pin 45 which spans the slot 43. One arm 46 of the crank 44 is slotted at 47 to receive the roller 16 which is mounted for rotation on a pin or shaft 48 spanning the slot 47. The other arm 49 of the crank 44 is slotted at 50 to receive the head 51 of an adjustor screw 52. A quick-release pin 53 extends through the head 51 and connects the adjustor screw to the crank arm 49. The adjustor screw 52 is threaded into an adjustor link 54 which is pivotally mounted upon a pin 55 carried by the lever arm 6. When the pin 53 is pulled, the adjustor screw 52 can be rotated with respect to the link 54 to effectively increase or decrease the distance between the pins 53 and 55, thereby moving the roller 16 towards or away from the wedge block 11. Thus, with a given stroke of the wedge block 11 the levers 6 are spread more or less, depending upon the adjustment of the adjustor means 15 so that the rollers 8 and 9 will be operable to engage and spin a variety of pipe sizes.

When the wedge block 11 is retracted by the actuator cylinder 13, the links 18, previously referred to, are adapted to retract the actuating lever arms 6. The links 18 are pivotally mounted at 18a on the shafts or pins 48 which support the wedge rollers 16. At their free ends, the retractors links 18 have roller 18b disposed in recesses 18c in the wedge block 11 and shaped to pull the links 18 to the positions of FIG. 4 from the positions of FIG. 1, upon retraction of the wedge block 11, thereby pulling ends of the actuating arms 6 towards one another and expanding the gripping arms 7.

I claim:

1. A powered pipe spinning tong comprising: a frame structure, a pair of elongated levers, pivot means pivotally mounting said levers on said frame structure with said levers extending in opposed laterally spaced relation, said levers having opposed actuating arms at one side of said pivot means and opposed pipe gripping arms at the other side of said pivot means, pipe gripping roller means carried by said gripping arms for actuation into gripping engagement with a pipe upon spreading of said actuating arms, actuator means for spreading said actuating arms, drive means for rotation of said pipe gripping roller means and a pipe gripped thereby, and adjustor means for adjusting said actuating arms relative to said actuator means to enable said pipe gripping roller means to grip and rotate pipe of a range of sizes.

2. A powered pipe spinning tong as defined in claim 1, wherein said pipe gripping roller means comprises a pair of rollers carried by each of said pipe gripping arms and in opposing relation to the rollers on the other pipe gripping arm.

3. A powered pipe spinning tong as defined in claim 1, wherein said pipe gripping roller means comprises a pair of rollers carried by each of said pipe gripping arms and in opposing relation to the rollers on the other pipe gripping arm, said drive means driving one of the rollers of each pair.
4. A powered pipe spinning tong as defined in claim 1, wherein said pipe gripping roller means comprises a pair of rollers carried by each of said pipe gripping arms and in opposing relation to the rollers on the other pipe gripping arm, said pivot means comprising a supporting portion of said frame, and common means pivotally mounting said levers on said supporting portion.

5. A powered pipe spinning tong as defined in claim 1, wherein said pipe gripping roller means comprises a pair of rollers carried by each of said pipe gripping arms and in opposing relation to the rollers on the other pipe gripping arm, said pivot means comprising a supporting portion of said frame, a pivot shaft extending through said supporting portions, and interfitting portions on said levers pivotally connected to said supporting portion and said pivot shaft.

6. A powered pipe spinning tong as defined in claim 1, wherein said actuator means comprises means carried by said actuating arms and adjustable relative to said actuator arms.

7. A powered pipe spinning tong as defined in claim 1, wherein said actuator means comprises a crank pivotally mounted on each actuating arm, each crank having a crank arm cooperating with said actuator means for spreading said actuating arms and another crank arm, and an adjustable connection between said actuating arm and said another crank arm.

8. A powered pipe spinning tong as defined in claim 1, wherein said actuator means comprises a crank pivotally mounted on each actuating arm, each crank having a crank arm cooperating with said actuator means for spreading said actuating arms and another crank arm, and an adjustable connection between said actuating arm and said another crank arm, said adjustable connection including adjustable screw means carried by said actuating arm and said another crank arm.

9. A powered pipe spinning tong as defined in claim 1, wherein said actuator means comprises a crank pivotally mounted on each actuating arm, each crank having a crank arm cooperating with said actuator means for spreading said actuating arms and another crank arm, and an adjustable connection between said actuating arm and said another crank arm, said adjustable connection including adjustable screw means carried by said actuating arm and said another crank arm, and means releasably connecting said adjustable screw means to one of said actuating arm and another crank arm for enabling adjustment of said adjustable screw means.

10. A powered pipe spinning tong as defined in claim 1, wherein said pipe gripping roller means comprises a pair of rollers carried by each of said pipe gripping arms and in opposing relation to the rollers on the other pipe gripping arm, said drive means driving two of the opposing rollers, and including means supporting the other two opposing rollers to idle.

11. A powered pipe spinning tong as defined in claim 1, wherein said pipe gripping roller means comprises a pair of rollers carried by each of said pipe gripping arms and in opposing relation to the rollers on the other pipe gripping arm, said drive means driving two of the opposing rollers, and including means adjustably supporting the other two opposing rollers for idling and for movement to positions relative to the driven rollers for engaging pipe of different diameters.

12. A powered pipe spinning tong as defined in claim 1, wherein said pipe gripping roller means comprises a pair of rollers carried by each of said pipe gripping arms and in opposing relation to the rollers on the other pipe gripping arm, said drive means driving two of the opposing rollers, and including means adjustably supporting the other two opposing rollers for idling and for movement to positions relative to the driven rollers for engaging pipe of different diameters, the last mentioned means including shafts rotatably supporting the respective idling rollers, and means for adjusting the shafts towards and away from the driven rollers.

13. A powered pipe spinning tong comprising: a frame structure, a pair of elongated levers, pivot means pivotally mounting said levers on said frame structure with said levers extending in opposed laterally spaced relation, said levers having opposed actuating arms at one side of said pivot means and opposed pipe gripping arms at the other side of said pivot means, pipe gripping roller means actuable into gripping engagement with a pipe upon spreading of said actuating arms, actuator means for spreading said actuating arms, drive means for rotating said pipe gripping roller means and a pipe gripped thereby, said pivot means comprising a supporting portion of said frame, and common means pivotally mounting said levers on said supporting portion.

14. A powered pipe spinning tong as defined in claim 13, wherein said pipe gripping roller means comprise a pair of rollers carried by each of said pipe gripping arms and in opposing relation to the rollers on the other pipe gripping arm.

15. A powered pipe spinning tong as defined in claim 13, wherein said pipe gripping roller means comprises a pair of rollers carried by each of said pipe gripping arms and in opposing relation to the rollers on the other pipe gripping arm, said drive means driving one of the rollers of each pair.

16. A powered pipe spinning tong as defined in claim 13, including adjustable means for adjusting said tong to grip pipe of a range of diameters.

17. A powered pipe spinning tong as defined in claim 13, including adjustable means for adjusting said tong to grip pipe of a range of diameters, said adjustable means adjusting said actuator arms relative to said actuator means.

18. A powered pipe spinning tong as defined in claim 13, including adjustable means for adjusting said tong to grip pipe of a range of diameters, said adjustable means adjusting said pipe gripping roller means.