Feb. 3, 1959 B. F. KELLEY 2,871,743

HYDRAULIC PIPE TONGING DEVICE

Filed Feb. 10, 1958 3 Sheets-Sheet 1

Fig. 1

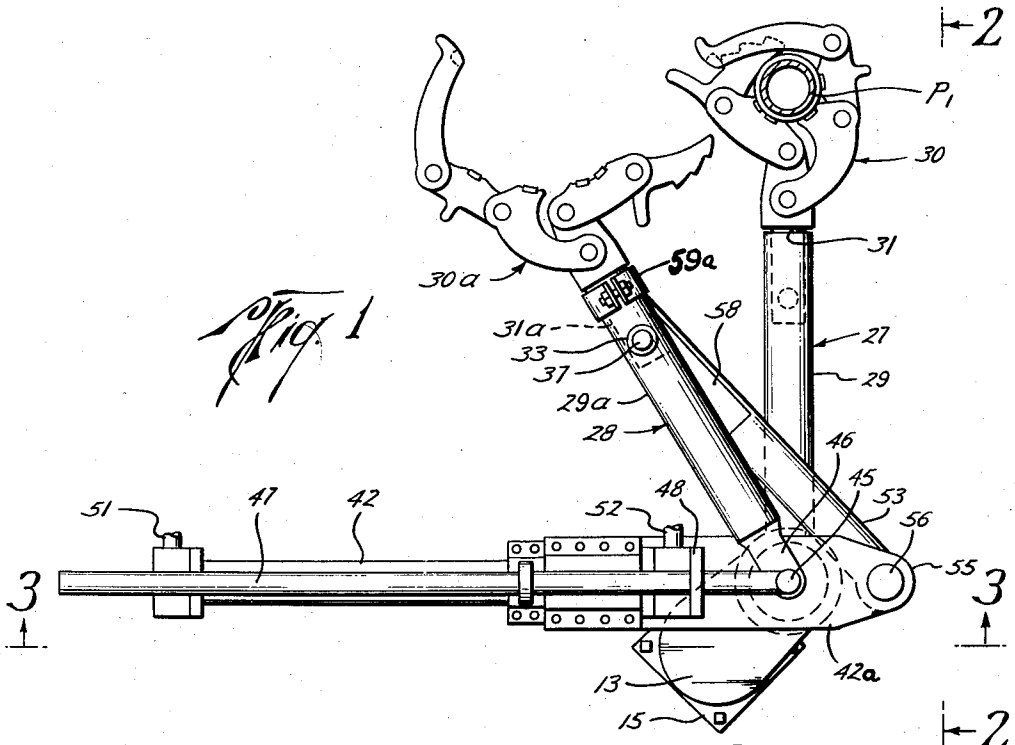
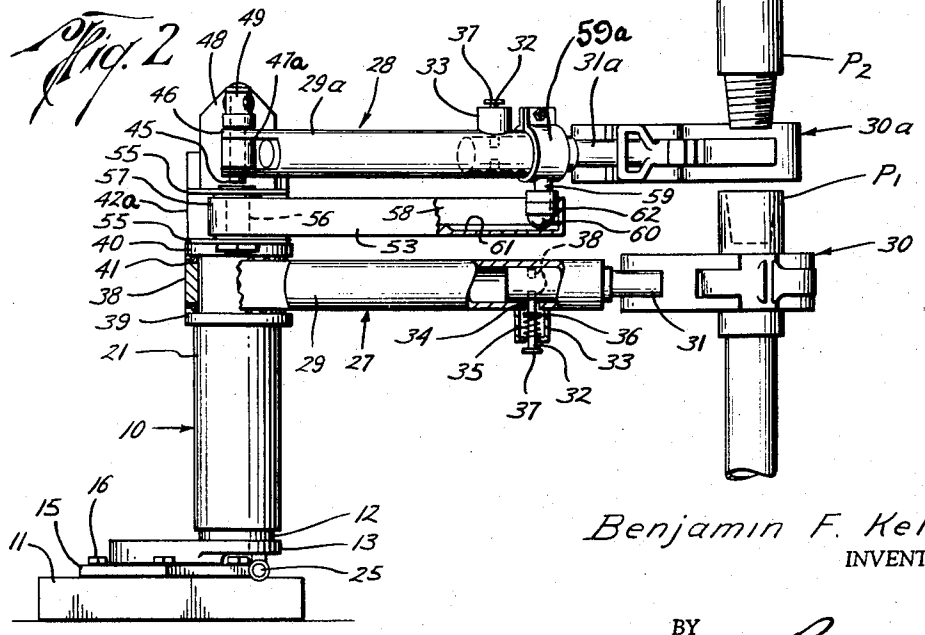


Fig. 2



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HYDRAULIC PIPE TONGING DEVICE

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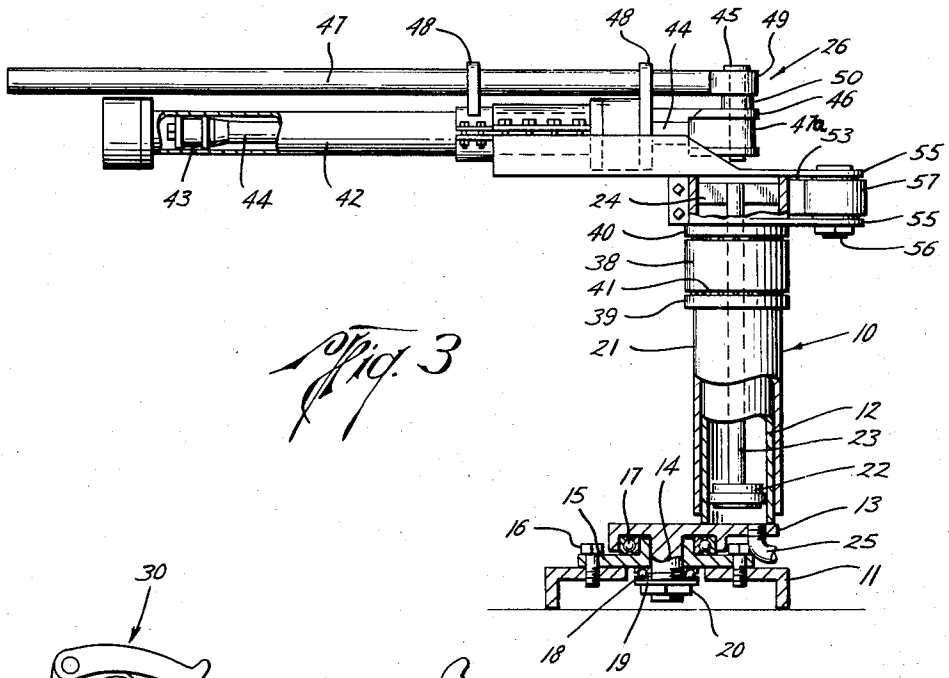

Fig. 3

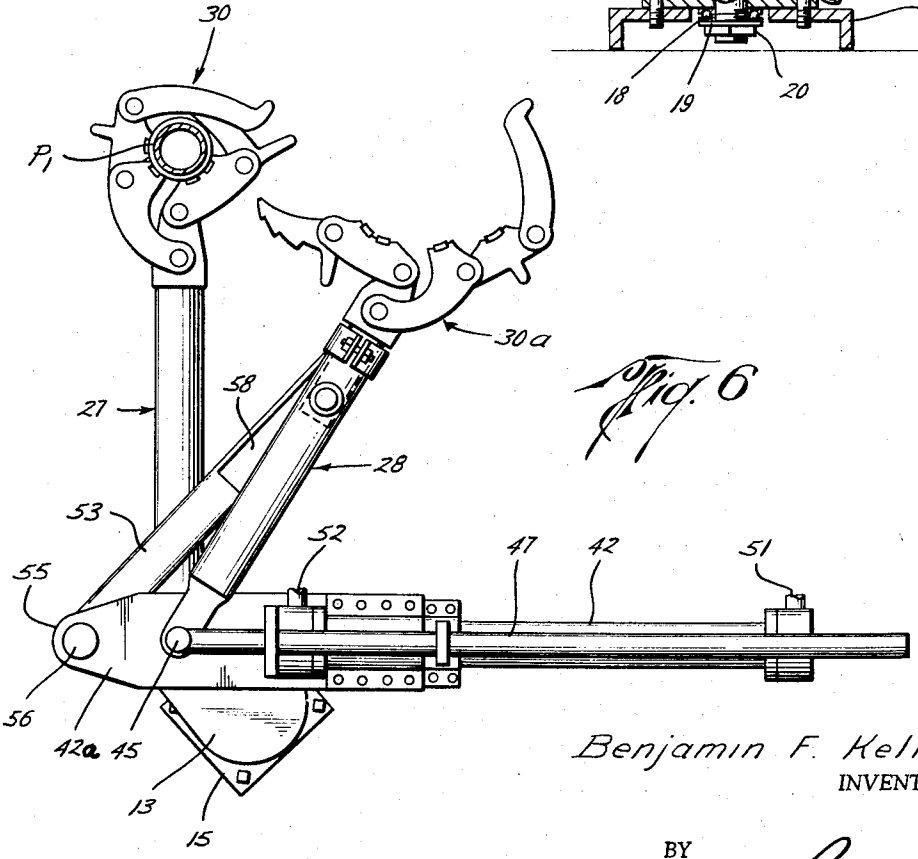

Fig. 6

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HYDRAULIC PIPE TONGING DEVICE

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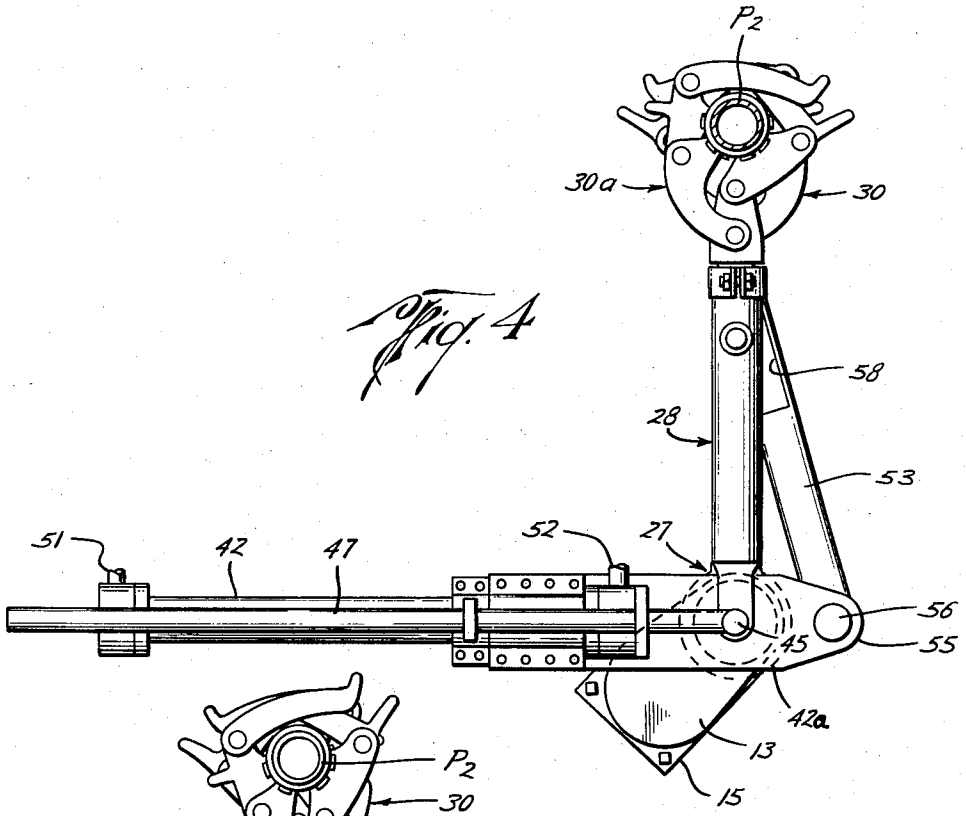

Fig. 4

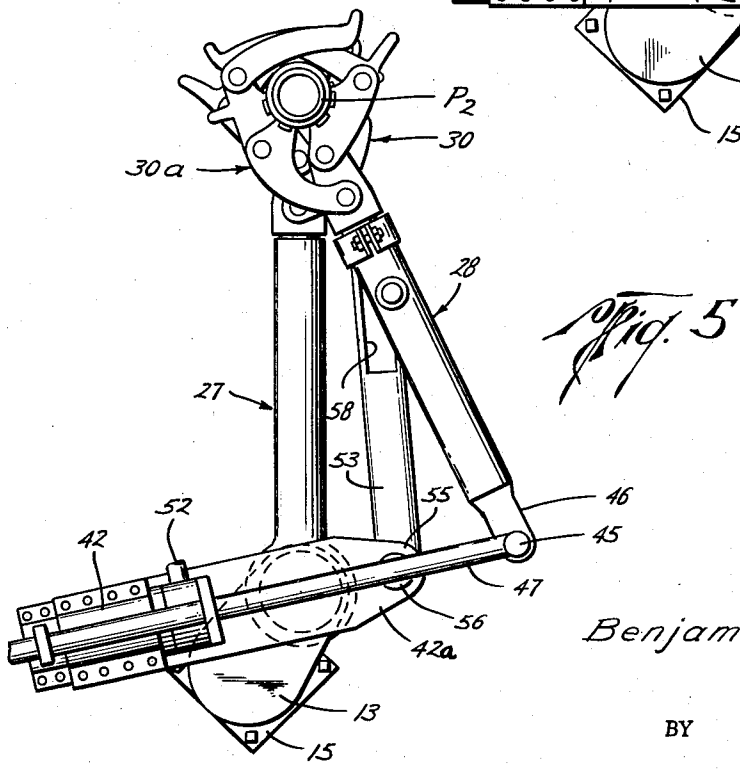

Fig. 5

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HYDRAULIC PIPE TONGING DEVICE

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Application February 10, 1958, Serial No. 714,366

14 Claims. (Cl. 81—53)

This invention relates to a wrench or tonging device of the type ordinarily used in handling oil well drill pipe and casing and is directed more particularly to a hydraulic arrangement for supporting and operating the tongs in making-up and breaking-out well pipe strings.

The more conventional pipe tongs employed for breaking-out and making-up the joints of drill pipe or casing in oil well operations usually comprise separate tongs, one serving as a back-up wrench and the other serving as a drive wrench, which are independently applied to the joint elements of a pipe connection. Ordinarily, the drive wrench employed to make-up or break-out the pipe joint is suspended on a cable or cat line from a well derrick and is swung into position about the upper element of a pipe joint by the operator, generally after the back-up tong has been put in place about the lower section of the pipe. In addition to the manual effort and hazards sometimes attendant upon the handling of the tongs in this conventional arrangement, the force applied to the drive tong ordinarily will introduce a bending moment into the pipe string at the joint, which is damaging to the pipe and its connection to the joint or coupling elements. Moreover, the force applied in making-up joints is ordinarily not subject to any positive control, with the result that the joints are often made up too tightly which is also damaging to the connection elements of the pipe strings.

It is a primary object of the present invention to provide an improved tonging device in which both the back-up tong and the drive tong form elements of an integrated device which obviates the disadvantages of existing tonging arrangements, such as are described above.

An important object is to provide a tonging device in which both tongs form elements of an integrated structure in which the positioning of the tongs at the operating level and the actuation of the drive tong are hydraulically performed.

A further object is to provide a hydraulically actuated tonging device in which both tongs are mounted on a single supporting structure and interconnected to obviate application of bending moment to the pipe string by the operation of the tong elements.

A more specific object is the provision of a hydraulically actuated tonging device in which both the back-up and drive tongs are pivotally supported on a common pedestal which is adapted to be vertically adjusted to accord with the vertical position of a joint to be engaged by the tongs.

Still another object is to provide a tonging device of the character described in which the pipe-gripping heads are rotatable through angles of 180° in their respective handle elements, whereby the tongs may be used for either making-up or breaking-out pipe sections, as may be required.

A further object is the provision of a tonging device of the general character described in which the drive tong is provided with an auxiliary pivoted support with which the tong is slidably engaged during swinging movement of the tong.

Other and more specific objects and advantages of this invention will become more fully apparent from the following detailed description when read in conjunction with the accompanying drawings which illustrate a useful embodiment in accordance with this invention.

In the drawing:

Fig. 1 is a plan view of the tonging device, showing the tongs in the breaking-out position with the back-up tong engaged with a pipe section and the drive tong in open position removed from the pipe;

Fig. 2 is an end elevational view of the device viewed from line 2—2 of Fig. 1, some of the parts being broken away for purposes of illustration;

Fig. 3 is a side elevational view, partly in section, of the device viewed from line 3—3 of Fig. 1;

Figs. 4 and 5 are views similar to Fig. 1, showing both tongs in engagement about the pipe in two breaking-out positions; and

Fig. 6 is a view similar to Fig. 1, showing the back-up tong in the making-up position, and the drive tong head open and in the breaking-out position but swung away from the pipe.

Referring to the drawings, there is shown a pedestal structure, designated generally by the numeral 10, vertically supported on a base member 11, which is of any suitable form by which the pedestal structure may be securely attached to a foundation, such as a well derrick floor, or the like. Pedestal structure 10 includes a cylinder 12 having its lower end secured near one end of an elongated base plate 13. Near its opposite end, base plate 13 is provided with a depending pivot pin 14 which is journalled in a bearing plate 15 which is supported on base member 11 and secured thereto by means of cap screws 16. Anti-friction bearings, such as roller bearings 17, are positioned between bearing plate 15 and base plate 13 surrounding pivot pin 14, and a second anti-friction bearing 18 is disposed about pivot pin 14 between bearing plate 15 and a washer 19 underlying bearing 18 and secured by a nut 20 threadedly mounted on the lower end of pivot pin 14. With the pedestal support arrangement just described, it will be seen that pedestal structure 10 may swing freely in a horizontal plane about pivot pin 14.

Slidably mounted about the exterior of cylinder 12 is an elevating sleeve 21, which is free to move vertically along cylinder 12. A piston 22 is slidably positioned in cylinder 12 and is secured to a piston rod 23 which extends upwardly through cylinder 12 and has its upper end secured to sleeve 21 as by means of a spider 24, or the like. With this arrangement, it will be seen that reciprocation of piston 22 in cylinder 12 will correspondingly reciprocate sleeve 21 along the exterior of cylinder 12. A pipe 25 communicates through base plate 13 with the interior of cylinder 12 below piston 22. By means of pipe 25, hydraulic fluid may be admitted into cylinder 12 below piston 22 to elevate the latter and thereby elevate sleeve 21. By releasing fluid from beneath piston 22 through pipe 25, piston 22 is allowed to descend, thereby permitting sleeve 21 to descend correspondingly. The tonging device, designated generally by the numeral 26, is supported on sleeve 21 and may, therefore, be raised or lowered by the raising and lowering of sleeve 21 through operation of piston 22, as previously described.

Tonging device 26 includes a lower tong, designated generally by the numeral 27, which is designated as the back-up tong, and an upper tong, designated generally by the numeral 28, which is designated the drive tong. The vertical spacing between the tongs is such as will permit the tongs to be effectively applied to the respective upper and lower elements of any conventional threaded point or coupling employed to connect sections of a pipe

string together. Back-up tong 27 includes a tubular arm 29 and a pipe-gripping head 30, of any conventional type commonly employed in oil field pipe tongs of the general character here described, and it will be understood that the present invention is not directed to the specific character or form of the pipe-gripping heads, as such. The head 30 is rotatably connected to arm 29 by means of a cylindrical shaft 31 which extends into the bore of one end of arm 29 and is rotatable therein. Arm 29 carries a spring latch for securing head 30 in a selected position. This spring latch comprises a latch pin 32 which extends radially through a housing 33 which surrounds an opening 34 in arm 29 through which the inner end of latch pin 32 projects. A coil spring 35 surrounds latch pin 32 and has one end bearing against the interior of housing 33 and the other end against an abutment 36 mounted on the latch pin, so as to normally bias the inner end of the latch pin toward the interior of arm 29. The outer end of latch pin 32 carries a head 37 by which the latch pin may be gripped to pull it outwardly against the resistance of coil spring 35. Shaft 31 is provided at diametrically opposite points with recesses 38 registering with opening 34 and adapted to receive the inner end of latch pin 32. Thus when latch pin 32 engages one of the recesses 38, head 30 will be locked in the back-up position, which may be the breaking-out position, and when latch pin 32 is engaged in the other recess 38, head 30 will have been rotated 180° from its previous position to be in the back-up position for the make-up of pipe sections.

The several elements comprising upper tong 28 are in all respects identical with those comprising tong 27 and include the tubular arm 29*a*, head 30*a*, connecting shaft 31*a*, and identical latch elements for locking the head in either the make-up or break-out positions.

At the end opposite head 30, lower arm 29 is mounted on sleeve 21 for rotation in a horizontal plane, being provided with a journal 38 surrounding sleeve 21 and supported on a flange 39 mounted on sleeve 21 and secured in place by a second flange 40 mounted on sleeve 21 above journal 38. Anti-friction bearings 41, of any suitable type, are positioned between journal 38 and flanges 39 and 40 to permit free swinging movement of arm 29 about sleeve 21.

A horizontally disposed support bracket 42*a* is pivotally supported on the upper end of sleeve 21 and supports on its upper surface a horizontally disposed hydraulic cylinder 42 in which is slidably mounted a piston 43 (Fig. 3) carried on a piston rod 44, which projects through the end of cylinder 42 and is pivotally secured to the end of arm 29*a* of drive tong 28 by means of a wrist pin 45 which projects through the bifurcated end 46 (Figs. 2 and 3) of arm 29*a* and through a journal 47*a* carried by the outer end of piston rod 44. A guide rod 47, to stiffen piston rod 44 during its reciprocatory movement, is positioned above cylinder 42 and parallel thereto, slidably mounted in bearings 48—48 secured to cylinder 42. The end of guide rod 47, adjacent the outer end of piston rod 44, is provided with a journal 49 registering with journal 47*a*, and wrist pin 45 extends through journal 49, spacer 50, bifurcated end 46 and journal 47*a*, so that arm 29*a* will be pivotally connected to both the end of piston rod 44 and guide rod 47.

Conduits 51 and 52, for introducing and discharging hydraulic fluid from cylinder 42 for reciprocating piston 43, are shown connected to opposite ends of cylinder 42. It will be understood that by introducing hydraulic fluid into cylinder 42 on one side of piston 43, the latter will be caused to push or drive the free end of tong 28 in one direction while introduction of hydraulic fluid into the opposite end of cylinder 42 will act against the piston to reverse the direction of movement imparted to the end of drive tong 28. A pivoted cantilever support arm 53 is horizontally positioned between upper and lower tongs 28 and 27, respectively. At one end support arm 53 is pivotally supported between bearing or hinge plates 55—55 carried by the end of bracket 42*a* and projecting to one side of the vertical axis of pedestal 10. A hinge pin 56 extends through the hinge plates 55 and a journal 57 in the end of support arm 53. The pivot point for arm 53 formed by hinge pin 56 is thus laterally offset with respect to the pivot point for back-up tong 27. At its opposite or outboard end support arm 53 is provided with an upwardly opening longitudinal guide recess 58 for slidably receiving a pivot pin 59 which is secured, intermediate the ends of drive tong 28, being conveniently secured to the forward end of arm 29*a* by means of a removable collar 59*a* and arranged thereon to project downwardly into recess 58. The lower end of pivot pin 59 is provided with a rounded head 60 adapted to slide smoothly in an arcuate groove 61 formed longitudinally in the bottom of recess 58, and ring-shaped bearings 62 are rotatably mounted about the pivot pin 59 above head 60 to provide anti-friction bearings engageable with the side walls of recess 58 to prevent binding of the pivot pin in recess 58.

With the arrangement just described, it will be seen that support arm 53 provides a sliding pivoted support for drive tong 28, while acting also as a guide for the drive tong as the latter is swung to and fro by the reciprocation of piston rod 44.

The above-described tonging device is operated in the following manner: Referring particularly to Figs. 4 and 5, the device is shown at two positions in the breaking-out operation. Back-up arm 27 is secured to the lower element P_1 of a screw coupling connecting sections of a pipe string (Fig. 2) with head 30 in the back-up position, to prevent counter-clockwise rotation of the lower pipe section. Drive tong 28 is secured about the upper coupling element P_2 with its head 30*a* in the breaking-out position; that is, a position in which it will grip the pipe when turned in the counter-clockwise direction. With the tongs thus in place fluid pressure will be exerted by hydraulic fluid introduced alternately through connections 51 and 52 to reciprocate piston rod 44, whereby to oscillate drive tong 28, which will unscrew upper coupling element P_2 from lower coupling element P_1.

Fig. 4 shows the position of the drive tong at the point where it is about to begin an unscrewing stroke on the pipe, and Fig. 5 illustrates the position of the drive tong at the completion of a break-out or counter-clockwise stroke. As the drive tong is oscillated by the action of the piston rod, guide pin 59 will slide longitudinally in recess 58 and the free end of support arm 53 will swing in accordance with the oscillatory movement of the drive tong, at the same time providing support for the drive tong in its movements. By reason of the pivoted connections between support arm 53 and support bracket 42*a*, together with the inter-relationships of the latter with back-up tong 27 and drive tong 28, the action engaged in by the drive tong with support arm 53 will be a sort of scissoring movement which will also serve to limit or absorb the horizontal thrust of the drive tong relative to the back-up tong, so as to obviate the application of any substantial bending moment to the pipe string during operation of the tongs.

To employ the tonging device for making-up joints of the pipe, heads 30 and 30*a* will be rotated 180° from the positions illustrated in Figs. 1, 2, 4 and 5, the rotation being effected by pulling out latch pins 32 and turning the heads 180° in the respective arms 29 and 29*a* and re-inserting the latch pins in the appropriate recesses in the shafts 31 and 31*a*.

Fig. 6 illustrates the positions of the heads in the make-up position, and the operation of swinging the drive tong will be the same as previously described, but the reversed heads will cause the pipe section gripped by the pipe tong to be driven in the make-up direction in this case. In making-up joints, the extent to which the joint is made-up may be regulated by controlling the application of hydraulic fluid to the drive tong cylinder by generally con-

ventional means, such as pressure relief valves (not shown) which will open upon attainment of a pre-determined pressure in the system, and thereby limit the magnitude of the make-up force applied to the tong.

Since, in making-up or breaking-out well pipe strings, the joints will not always be at the same level above the derrick floor, the tonging device may be raised or lowered, as may be required, to align it with the position of the pipe joint to be worked upon. This is accomplished simply by introducing pressure fluid into cylinder **12** below piston **22**, in order to raise the tonging device and by releasing fluid from beneath piston **22**, the tonging device will be lowered, as may be desired or necessary.

It will be understood that the several hydraulic fluid conduits connected to connections **25**, **51** and **52** may lead to a control stand (not shown) of generally conventional design fitted with the usual control valves, gages, pressure relief valves and the like, where the operator may manipulate the various hydraulic control elements for directing hydraulic fluid to and from cylinders **12** and **42**, as may be required for raising and lowering the tongs and for driving the drive tong when the latter has been engaged with a pipe section.

By means of the hydraulically-operated tonging device above-described, the disadvantages inherent in more conventional pipe handling arrangements will be obviated or eliminated; the operation of making-up and breaking-out the pipe strings will be greatly speeded up, and the forces applied to the joints in making-up will be controlled and limited as desired and as noted previously. Bending moment will be eliminated for all practical purposes.

The pivoted connections between the pedestal structure, the tongs and support arm **53** provide a large measure of flexibility in adjusting the tongs to the pipe and any danger of binding of the parts in the operation of the structure is avoided. The off-set position of the pedestal on its pivoted base elements provides an additional freedom of movement and adjustability for the device with respect to the pipe string when the apparatus has been secured to the foundation on which it is mounted.

It will be understood that numerous changes and modifications may be made in the details of the illustrative embodiment within the scope of the appended claims but without departing from the spirit of this invention.

What I claim and desire to secure by Letters Patent is:

1. A pipe tong device, comprising, a vertically disposed pedestal member, a pair of pipe tongs supported in horizontal vertically spaced positions from said pedestal member, the lower one of said tongs having one end pivotally connected to the pedestal member, a horizontally extending support arm disposed between said tongs and pivotally connected at one end to said pedestal member to swing in a horizontal plane, means forming a longitudinally slidable pivoted connection between the free end portion of the support arm and an intermediate point on the upper one of said tongs, and means mounted on the pedestal and connected to the free end of said upper tong for oscillating the same in a horizontal plane about said pivoted connection.

2. A pipe tong device according to claim 1 wherein each of said pipe tongs comprises an elongate handle member, a pipe-gripping head rotatably connected to said handle member, and releasable latch means for locking said head to said handle member in a selected angular position relative thereto.

3. A pipe tong device, comprising, a vertically disposed pedestal member, a pair of pipe tongs supported in horizontal vertically spaced positions from said pedestal member, the lower one of said tongs having one end pivotally connected to the pedestal member, a horizontally extending support arm disposed between said tongs and pivotally connected at one end to said pedestal member to swing in a horizontal plane, means forming a longitudinally slidable pivoted connection between the free end portion of the support arm and an intermediate point on the upper one of said tongs, and pressure fluid-actuated means connected to the free end of said upper tong for oscillating the same in a horizontal plane about said pivoted connection.

4. A pipe tong device according to claim 3 wherein said pressure fluid-actuated means comprises a horizontally disposed cylinder mounted on the pedestal member, a piston reciprocable in the cylinder, a piston rod connected to the piston and projecting from the cylinder and pivotally connected to said free end of said upper tong, and means for conducting pressure fluid to said cylinder for actuating said piston.

5. A pipe tong device, comprising, pedestal means including a vertically reciprocable pedestal member, a pair of pipe tongs supported in horizontal vertically spaced positions from said pedestal member, the lower one of said tongs having one end pivotally connected to the pedestal member, a horizontally extending support arm disposed between said tongs and pivotally connected at one end to said pedestal member to swing in a horizontal plane, means forming a longitudinally slidable pivoted connection between the free end portion of the support arm and an intermediate point on the upper one of said tongs, pressure fluid-actuated means mounted on the pedestal member and connected to the free end of said upper tong for oscillating the same in a horizontal plane about said pivoted connection, and pressure fluid-actuated means in said pedestal means for reciprocating said pedestal member.

6. A pipe tong device according to claim 5 wherein said last-mentioned pressure fluid-actuated means includes an upright cylinder slidably supporting said pedestal member, a piston reciprocable in said cylinder and connected to said pedestal member, and means for conducting pressure fluid to said cylinder for actuating said piston.

7. A pipe tong device, comprising, a vertically disposed pedestal member, a pair of pipe tongs supported in horizontal vertically spaced positions from said pedestal member, the lower one of said tongs having one end pivotally connected to the pedestal member, a horizontally extending support arm disposed between said tongs and having one end pivotally connected to said pedestal member at a point spaced laterally from the vertical axis thereof to swing in a horizontal plane, means forming a longitudinally slidable pivoted connection between the free end portion of the support arm and an intermediate point on the upper one of said tongs, said last mentioned means comprising an upwardly opening longitudinal slot in the free end of said arm member and a pivot pin secured to said upper tong and projecting downwardly into said slot, and means connected to the free end of said upper tong for oscillating the same in a horizontal plane about said pivoted connection.

8. A pipe tong device according to claim 7 wherein said last-mentioned means comprises pressure fluid-actuated piston means mounted on the pedestal member.

9. A pipe tong device, comprising, pedestal means including a vertically reciprocable pedestal member, a pair of pipe tongs supported in horizontal vertically spaced positions from said pedestal member, the lower one of said tongs having one end pivotally connected to the pedestal member, a horizontally disposed bracket member mounted on the pedestal member between the tongs, a horizontally extending support arm having one end pivotally connected to the bracket member at a point spaced laterally from the vertical axis of said pedestal member to swing in a horizontal plane, means forming a longitudinally slidable pivoted connection between the free end portion of the support arm and an intermediate point on the upper one of said tongs, and fluid pressure-actuated means mounted on the bracket member and connected to the free end of the upper tong for oscillat-

ing the same in a horizontal plane about said pivoted connection.

10. A pipe tong device according to claim 9 wherein said fluid pressure-actuated means comprises a horizontally disposed cylinder mounted on the bracket member, a piston reciprocable in the cylinder, a piston rod connected to the piston and projecting from the cylinder, a guide rod slidably mounted on the exterior of said cylinder parallel to said piston rod, the projecting end of said piston rod and the adjacent end of the guide rod having a common pivoted connection to the free end of the upper tong, and means for conducting pressure fluid to said cylinder for actuating said piston.

11. A pipe tong device, comprising, a vertically disposed rotatable pedestal means, a vertically reciprocable sleeve member mounted on the pedestal means, a pair of pipe tongs supported in horizontal vertically spaced positions from said sleeve member, the lower one of said tongs having one end pivotally connected to the sleeve member, a horizontally extending support arm pivotally secured at one end to said sleeve member at a point laterally spaced from the vertical axis of the sleeve member, means forming a longitudinally slidable pivoted connection between the free end portion of the support arm and an intermediate point on the upper one of said tongs, and means mounted on the sleeve member and connected to the free end of said upper tong for oscillating the same in a horizontal plane about said pivoted connection.

12. A pipe tong device according to claim 11 wherein each of said pipe tongs comprises an elongate handle member, a pipe-gripping head rotatably connected to said handle member, and releasable latch means for locking said head to the handle member in a selected angular position relative thereto.

13. In a pipe tong device of the character described, a pipe tong, comprising, an elongate tubular handle, a pipe-gripping head, a cylindrical shaft having one end connected to said head and its other end rotatably inserted into the bore of said handle, an opening in the wall of said handle opposite the inserted portion of the shaft, a latch pin retractibly projectible through said opening from the exterior of the handle, a pair of recesses at diametrically opposite points on said inserted portion of the shaft adapted to receive the inner end of said latch pin when positioned in registration with said opening to lock the head to the handle, and means resiliently biasing the latch pin inwardly of said opening.

14. A pipe tong device, comprising, a base member attachable to a supporting foundation, a tubular cylinder rotatably mounted in upright position on said base member, a sleeve member slidably enclosing said cylinder and vertically reciprocable relative thereto, a support bracket mounted on the upper end of the sleeve member and having a portion projecting laterally to one side of the vertical axis of the sleeve member, upper and lower pipe tongs each comprising a pipe-gripping head and an elongate handle, the lower pipe tong being disposed below said bracket and having its handle end journalled about the sleeve member to swing in a horizontal plane relative thereto, a laterally extending support arm having one end journalled in the laterally projecting portion of said bracket to swing in a horizontal plane above the lower pipe tong, said upper pipe tong being horizontally disposed above and supported by said support arm, means forming a longitudinally slidable pivoted connection between said support arm and said upper pipe tong, said means comprising an upwardly opening longitudinal guide slot in the free end portion of the support arm and a pivot pin secured to a point on the upper pipe tong intermediate the ends of its handle and projecting downwardly therefrom into said guide slot, pressure fluid-actuated means connected to the handle of said upper pipe tong to oscillate the tong about said pivoted connection, and fluid pressure-actuated means mounted in said cylinder and connected to said sleeve member for reciprocating the latter.

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