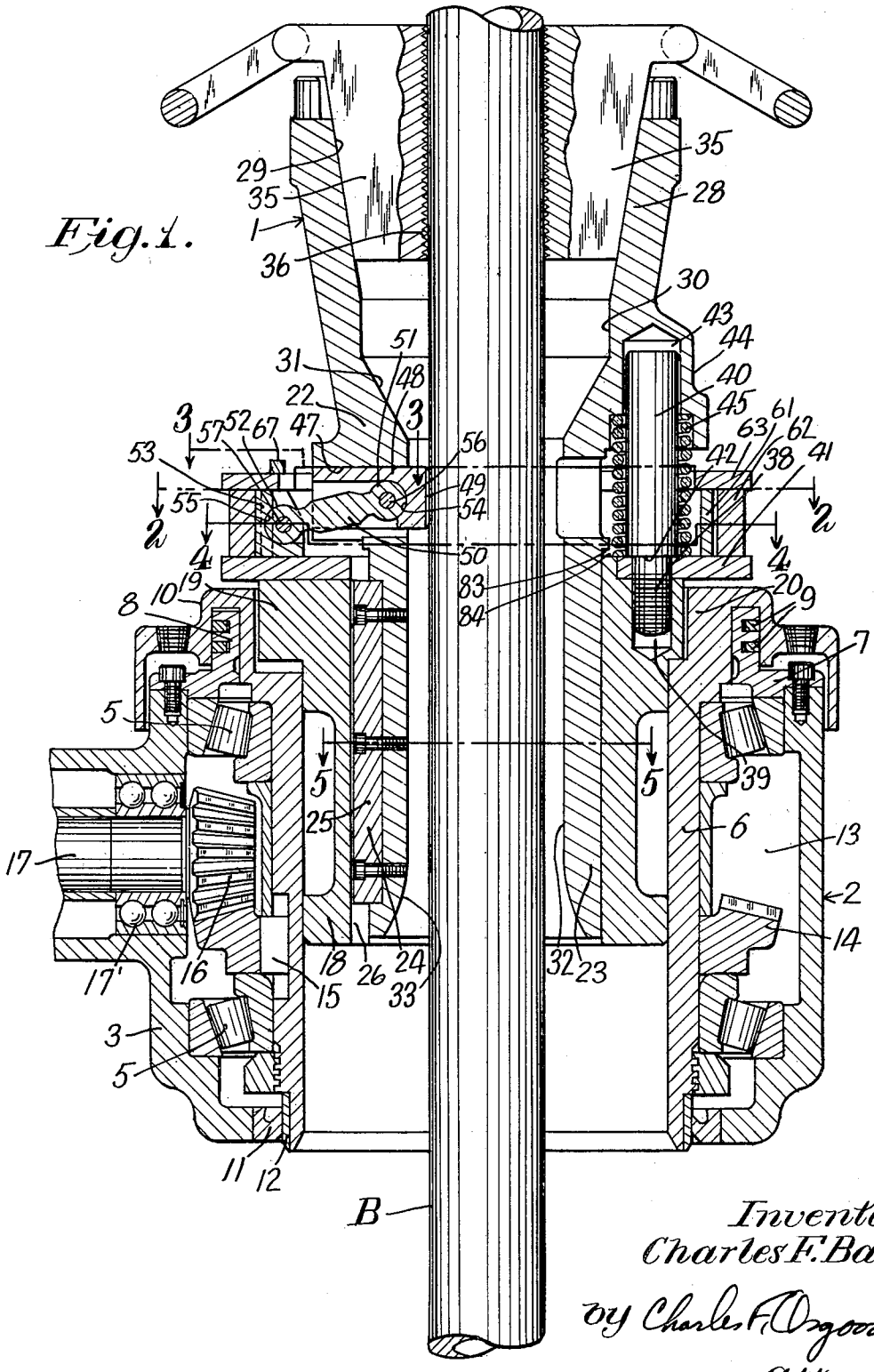
March 27, 1956 C. F. BALL 2,739,790

ROTARY OIL WELL DRILLING APPARATUS

Filed Sept. 29, 1948 4 Sheets-Sheet 1

Fig. 1.



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ROTARY OIL WELL DRILLING APPARATUS

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Fig. 2.

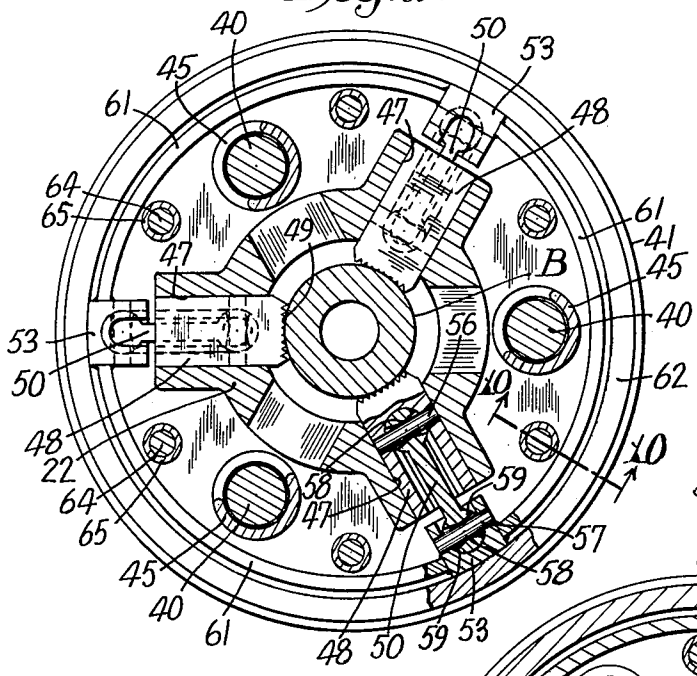


Fig. 3.

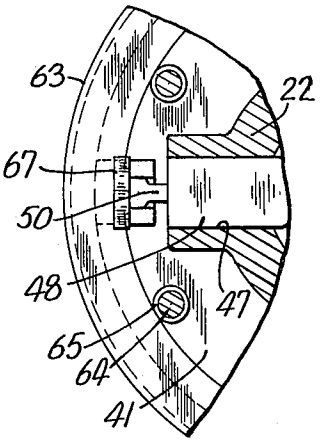


Fig. 4.

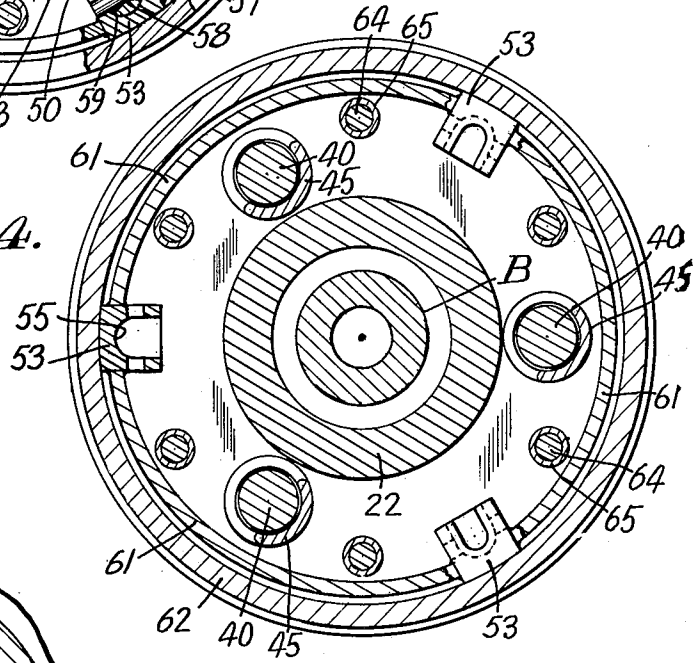
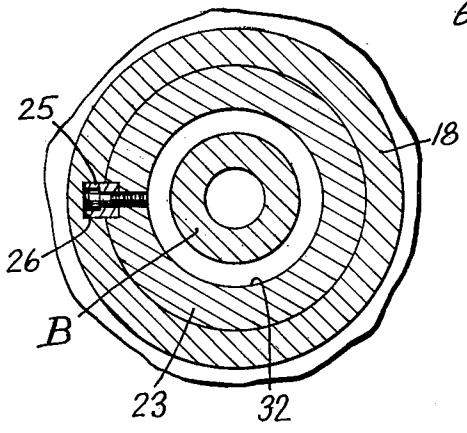


Fig. 5.



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March 27, 1956 C. F. BALL 2,739,790

ROTARY OIL WELL DRILLING APPARATUS

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Fig. 6.

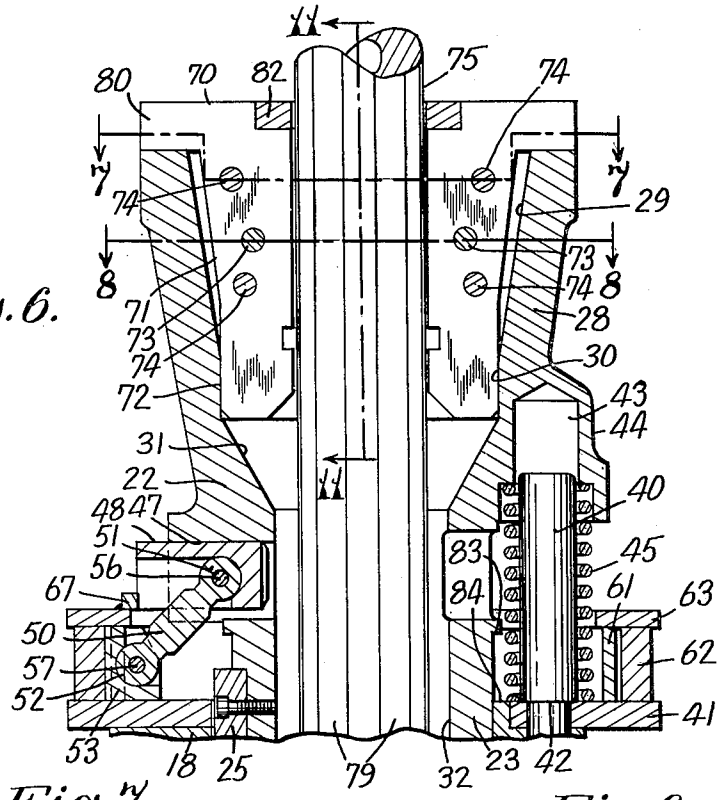


Fig. 7.

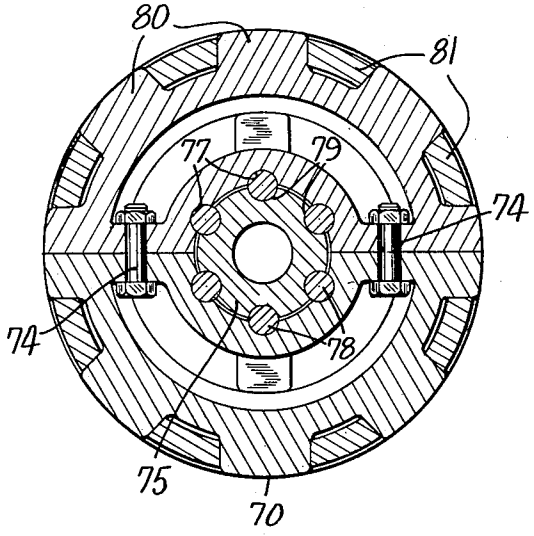
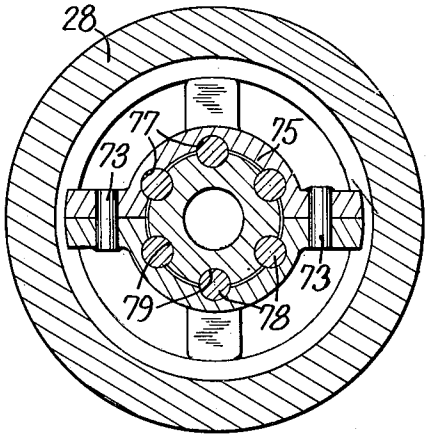


Fig. 8.



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March 27, 1956 C. F. BALL 2,739,790

ROTARY OIL WELL DRILLING APPARATUS

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Fig. 9.

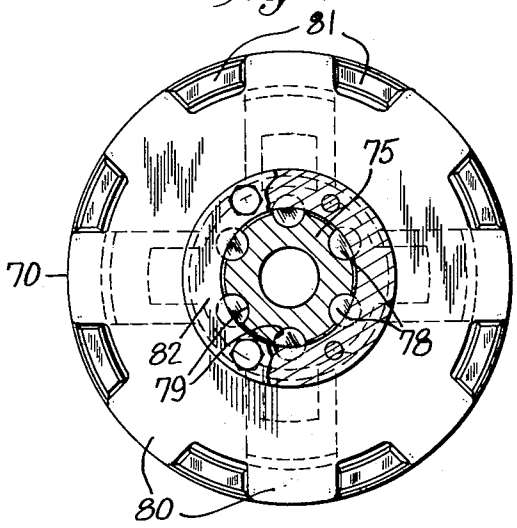


Fig. 10.

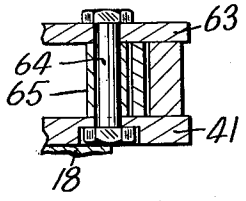


Fig. 11.

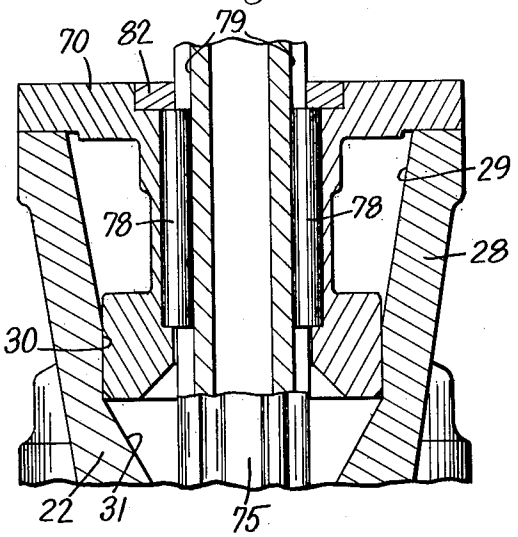
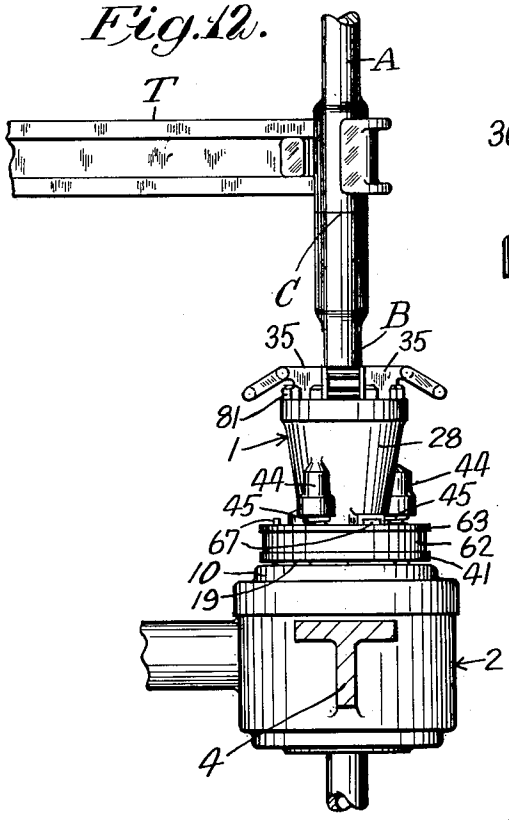


Fig. 12.



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United States Patent Office 2,739,790 Patented Mar. 27, 1956

2,739,790

ROTARY OIL WELL DRILLING APPARATUS

Charles F. Ball, Franklin, Pa., assignor to Joy Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application September 29, 1948, Serial No. 51,813

12 Claims. (Cl. 255—23)

This invention relates to rotary oil well drilling apparatus and more particularly to improved means for rotating the drill pipe line and for breaking and uncoupling the pipe joints of such an apparatus.

In a rotary oil well drilling apparatus the drill pipe line or drill string is usually hoisted and fed by the cable of the hoisting mechanism of the drilling apparatus and is usually rotated during the drilling operation by a rotary table having a driver provided with splines engaging splineways on a kelly or drill stem attached to the upper end of the pipe line. As the kelly or stem slides downwardly through the table opening it is rotated by the driver of the table. The hoisting cable permits gravity feed of a drill bit attached to the lower end of the pipe line at a controlled rate as it is rotated by the rotary table and in deep hole drilling the hoisting cable is used to remove some of the weight of the pipe line from the drill bit. The hoisting cable is also utilized to hoist the pipe line from the drill hole. When it is desired to add additional pipe sections as the hole deepens or to remove pipe sections during raising of the pipe line from the hole, the kelly or stem is detached from the upper end of the pipe line, and tongs suspended from the derrick are usually employed to break the pipe joints. Pipe slips or wedges mounted in the table-bowl are adapted to grip the drill pipe to hold the pipe line against downward movement through the rotary table during uncoupling of the pipe joints but such slips are incapable of connecting the pipe line to the rotary table for rotation therewith. The rotary table is usually mounted in a stationary position on the derrick floor or on the base of a mobile drill rig. The present invention contemplates improvements over known types of drill pipe rotating and pipe joint breaking means in that such means are combined with the rotary table so that the table not only rotates the pipe line but also may serve to break and uncouple the pipe joints, thereby eliminating the conventional lower tong. The improved joint breaking means of the present invention embodies pipe gripping devices mounted on and rotatable with the rotary table and which, when the pipe slips are set, are held in gripping relation with the drill pipe by the weight of the pipe line so that drill pipe is effectively gripped to connect the same to the table for rotation thereby. When the weight of the pipe line is removed by the hoisting cable from the pipe slips, springs are provided to effect release of the gripping device. By the simple interchange of pipe slips and a driver bushing, common parts mounted on the rotary table may be employed to rotate the pipe line both during drilling and the breaking and uncoupling of pipe joints.

An object of the present invention is to provide an improved rotary oil well drill apparatus. Another object is to provide an improved combined drill pipe rotating and pipe joint breaking means associated with the rotary table of a rotary drilling apparatus. A further object is to provide an improved device for gripping and rotating the pipe line to effect breaking and uncoupling of the pipe joint. Yet another object is to provide an improved

rotary table having an improved driver head associated therewith for engaging the splined kelly or drill stem for rotating the drill pipe line. A still further object is to provide an improved pipe joint breaking device for the joints of a drill pipe line whereby the removal of pipe sections during hoisting of pipe line from the drill hole is facilitated and greatly expedited. Another object is to provide an improved joint breaking device for breaking and uncoupling the joints of a drill pipe line and having gripping jaws actuated by the weight of the pipe line and embodying means for preventing the application of excessive gripping pressures to the drill pipe, eliminating the possibility of crushing the drill pipe as a result of subjecting the jaws to excessive pipe line weight. A further object is to provide an improved gripping jaw structure for a drill pipe gripping device whereby the drill pipe is effectively gripped even when the drill pipe is slightly off center or eccentrically disposed in the rotary table due to faulty positioning of the pipe slips in the table bowl. Still another object is to provide an improved combined drill pipe rotating and pipe joint breaking device whereby by a simple interchange of parts the pipe line may be rotated during drilling or the pipe joints may be uncoupled during hoisting of the pipe line. A still further object is to provide an improved drill pipe joint breaking device which is associated with the driver of the rotary table of a rotary drill apparatus whereby the rotary table may be employed to effect breaking and uncoupling of the pipe joints, eliminating the conventional lower tong. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these accompanying drawings:

Fig. 1 is a view in central longitudinal vertical section through a rotary table with which an illustrative embodiment of the invention is associated.

Fig. 2 is a cross sectional view taken substantially on line 2—2 of Fig. 1, with one of the toggle links and its associated parts broken away in section.

Fig. 3 is a fragmentary horizontal sectional view taken on line 3—3 of Fig. 1, illustrating details of the gripping jaws.

Fig. 4 is a detail cross sectional view taken substantially on line 4—4 of Fig. 1, with the toggle links omitted and showing the spring ring.

Fig. 5 is a cross sectional view taken substantially on line 5—5 of Fig. 1.

Fig. 6 is a fragmentary sectional view taken on the plane of Fig. 1, with the jaws in released position and with the driver bushing substituted for the pipe slips.

Fig. 7 is a cross sectional view taken substantially on line 7—7 of Fig. 6.

Fig. 8 is a cross sectional view taken substantially on line 8—8 of Fig. 6.

Fig. 9 is a cross sectional view taken through the kelly and looking down on the top of the driver head.

Fig. 10 is a detail vertical sectional view taken on line 10—10 of Fig. 2.

Fig. 11 is a detail vertical sectional view taken substantially on line 11—11 of Fig. 6, showing the driver splines.

Fig. 12 is a somewhat diagrammatic view showing the improved joint breaking devices and the upper holding tong in operative joint breaking relation with the drill pipe line.

In this illustrative construction, as shown in the drawings, the improved combined drill pipe driver and pipe joint breaking device is generally designated 1 and, for illustrative purposes, is shown associated with a rotary table generally designated 2 of a conventional rotary oil

well drilling apparatus. The drilling apparatus may be either of a stationary type with the rotary table mounted on the derrick floor or of the mobile type with the rotary table carried by the base of a mobile rig. Evidently, features of the invention may be associated with other forms of rotating mechanisms and other types of drilling equipment.

The rotary table 2, in this instance, comprises a stationary casing 3 supported as by lateral bracket arms 4 (Fig. 12) on the base of a drilling apparatus. The casing has journaled therein as by combined radial and axial thrust bearings 5 for rotation about a vertical axis, a central driving sleeve 6. A cap ring 7 secured as by screws to the top of the casing has an upstanding annular flange 8 which carries sealing rings 9 sealingly engaging the outer vertical walls of an annular recess formed within an annular portion 10 integral with the upper end of the rotatable sleeve 6. A sealing ring 11 carried at the bottom of the casing sealingly engages the cylindrical exterior periphery of a sleeve 12 fitted on the lower portion of the driving sleeve 6 as shown in Fig. 1. The casing and inner sleeve 6 cooperate to provide an annular chamber 13 containing a large bevel gear 14 having its hub keyed at 15 to the driving sleeve 6. A bevel pinion 16 secured to a suitable motor driven shaft 17 meshes with and drives the bevel gear 14 thereby to effect rotation of the driving sleeve 6. The shaft 17 is journaled in bearings 17' supported within the casing. The casing chamber 13 contains a suitable lubricant for the driving gears and bearings and the sealing rings 9 and 11 prevent leakage of lubricant from the chamber between the relatively rotating parts. A rotatable member or driver herein in the form of a driver bushing or sleeve 18 is fitted within the sleeve bore and has upper lugs 19 interlocked with lugs 20 on the driving sleeve so that the sleeve and bushing rotate in unison as the table is driven. The driver bushing 18 is suitably secured in position on the driving sleeve, in any suitable manner, as by a cap screw (not shown), and may be readily detached when desired. Since the specific structure of the rotary table does not per se enter into the present invention other than its particular manner of association therewith further description thereof is herein unnecessary.

Now referring to the improved combined drill pipe driver and pipe joint breaking device 1, it will be noted that mounted on the rotary table is a rotatable casing 22 having an integral sleevelike portion 23 fitted in the bore of the rotatable driver or driver bushing 18 and slidingly keyed or splined to the latter at 24 for permitting axial sliding movement of the casing 22 relative to the driver bushing, for a purpose to be later explained, while the casing 22 and driver bushing rotate in unison with the rotary table. To provide the sliding key or spline connection a key 25 is secured as by screws to the sleevelike portion 23 of the casing and slidingly engages a keyway 26 in the driver bushing 18. The rotatable casing 22 has an upper enlarged portion or bowl 28 which has a tapered upper recess 29 and a coaxial lower bore 30, the latter connected at its bottom by a tapered portion 31 with the bore 32 of the sleevelike portion 23. The bottom portion of the bore 32 is flared outwardly at 33 and the tapered portion 31 and the flared portion 33 facilitate axial movement of the drill pipe line through the rotatable casing. The tapered recess 29 in the casing bowl 28 is adapted to receive conventional pipe slips or pipe gripping wedges 35 having horizontal teeth or serrations 36 for gripping the drill pipe to hold the latter against downward axial movement through the rotary table. In this improved construction, secured as by screw threaded portions 38 received in threaded openings 39 in the driver bushing 18 and formed on vertical spring guide pins 40, is a circular plate 41. The spring guide pins 40 are herein desirably three in number and each has a shoulder 42 engaging the top of the plate as shown in Fig. 1. These guide pins extend upwardly loosely into bores 43 formed in bosslike enlargements 44 on the casing-bowl and coil springs 45 surrounding the pins and arranged between the plate 41 and the bowl-enlargements 44 constantly urge the rotatable casing 22 in an upward axial direction relative to the driver bushing 18. The rotatable casing 22 has a plurality of radial recesses 47, herein desirably three in number, formed therein in which pipe gripping jaws 48 are slidably guided. These gripping jaws have vertical teeth or serrations 49 adapted to grip the exterior periphery of the drill pipe for connecting the latter to the rotatable casing for rotation therewith. Toggle links 50 having spherical ends 51 and 52 are pivotally connected to the jaws 48 and to blocks 53, the latter resting on the top surface of the plate 41. The upper spherical ends 51 of the toggle links are fitted in spherical-shaped sockets 54 in the gripping jaws and the lower spherical ends 52 of the links are fitted in similar sockets 55 in the blocks 53. Parallel pivot pins 56 and 57 respectively secured to the jaws and blocks pivotally secure the toggle-ends in their respective sockets. The spherical toggle-ends have transverse bores 58 receiving the pivot pins and these bores have outwardly and oppositely tapered portions 59 to permit limited lateral swing of the toggle links relative to the jaws and blocks thereby to permit proper gripping of the drill pipe even in the event the latter is arranged slightly off center or eccentrically disposed with respect to the rotatable casing. The blocks 53 are rigidly secured as by welding and held in equally spaced relation by arcuate segments 61 and these segments cooperate with the blocks to provide a ring-like structure. A spring ring 62 surrounds the block-ring and is loosely positioned between the top surface of the plate 41 and the lower surface of an upper plate 63, and the blocks of the block-ring abut the inner surface of the spring ring. The upper plate 63 is rigidly secured to the bottom plate 41 as by bolts 64 and held in proper spaced relation by spacing sleeves 65 (see Fig. 10) surrounding the bolts and secured by the bolts between the upper and lower plates. The ring 62 is free to center itself with respect to the drill pipe in the event the latter is slightly off center or eccentrically disposed with respect to the rotatable casing, so that the pipe may at all times be firmly gripped by the jaws. Suitable stops 67 welded to the upper plate 63 are engaged by the outer ends of the gripping jaws 48 when the rotatable casing 22 is moved to its uppermost position by the springs 45 and with the jaws fully released. When the gripping jaws are fully retracted against the stops their inner ends are located completely outside of the peripheral walls of the bore 32 thereby avoiding any projections which might interfere with axial movement of the drill pipe through the casing 22.

Interchangeable with the pipe slips 35 in the casing-bowl 28 is a driver bushing 70 having a tapered body 71 fitting the tapered recess 29 and having a cylindrical lower portion 72 fitting the lower axial bore 30. As shown in Figures 6 to 9, inclusive, and Figure 11 this driver bushing is of the split type and is composed of two identical parts maintained in proper relation as by dowel pins 73 and rigidly secured together as by bolts 74. By splitting the bushing the latter may be placed around a kelly or drill stem 75 attached to the upper end of the pipe line thereby eliminating the need of removing the kelly or stem from the casing each time it is desired to insert the driver bushing within the casing-bowl. The kelly and drill pipe are hollow to permit the passage of drilling fluid therethrough to the bottom of the drill hole, in the manner well known to those skilled in the art. The driver bushing 70 has a series of longitudinally extending concave recesses 77 which receive cylindrical splines 78 which engage splineways 79 on the kelly or stem in a well known manner. The driver bushing has upper lugs 80 which interlockingly engage lugs 81 on the upper end of the casing-bowl 28 so that the bushing

and casing may rotate in unison. A cover plate 82 secured as by screws to the driver bushing 70 serves to hold the splines 78 in place.

The mode of use of the combined pipe line driver and pipe joint breaking device is as follows: During the joint breaking operation the upper pipe section, designated A in Fig. 12, is held against rotation by a conventional upper tong shown at T in Fig. 12. The pipe slips 35 are placed within the casing-bowl 28 and when the pipe line is lowered by the hoisting cable of the drilling apparatus these pipe slips grip the next lower pipe section, designated B in Fig. 12, so that the weight of the pipe line or drill string is transferred from the hoisting cable to the casing 22 causing the latter to move downwardly a slight distance, compressing the springs 45 until the pipe line is entirely suspended from the pipe slips on the casing. As the casing 22 slides downwardly within the drive bushing, the gripping jaws are moved, through the action of the toggle links 50, inwardly into gripping relation with the drill pipe section B. The gripping load transmitted to the drill pipe by the gripping jaws is limited in a predetermined manner by the spring ring 62 which may expand slightly as the jaws are applied. A shoulder 83 on the casing 22 engages a surface 84 on the driver bushing 18 to limit positively when the load becomes excessive the gripping pressure on the drill pipe to prevent crushing of the drill pipe. When the drill pipe line is firmly gripped by the gripping jaws and the rotary table is driven the drill pipe section B is rotated relative to the upper pipe section A, which is held against rotation by the tong T, thereby breaking the joint C between the adjacent pipe sections and after the joint is broken the pipe section B is rapidly rotated relative to the pipe section A completely to uncouple the joint. The rotatable casing and gripping jaws may also be employed to make and couple joints and, in that event, the gripping jaws hold the lower pipe section B against rotation while the upper pipe section A is rotated by the tong T. If desired, the rotary table may be made reversible to effect rotation of the pipe section B while the pipe section A is held against rotation by the tong T to make and couple the joints. During the drilling operation the driver bushing 70 is interchanged for the pipe slips 35 and the kelly 75 is attached to the upper end of the pipe line and the rotary table may be rotated to rotate the pipe line through the splines 78 and splineways 79 in a well known manner. During the drilling operation the gripping jaws 48 are held fully released by the springs 45 which hold the casing 22 in its uppermost position as shown in Fig. 6.

As a result of this invention an improved rotary oil well drill apparatus is provided wherein the rotary table effects rotation of the drill pipe line or drill string both during the drilling operation and during the breaking and uncoupling of the drill pipe joints. By mounting the rotatable casing of the gripping device on springs carried by the rotary table the gripping jaws are actuated through the pipe slips by the weight of the drill pipe line and the springs effect release of the gripping jaws when the weight of the pipe line is removed from the slips. By the provision of the spring ring associated with the toggle links for actuating the gripping jaws, which spring ring yields upon actuation of the jaws into gripping position, a predetermined gripping pressure on the drill pipe is provided. The positive engagement of the casing of the gripping device with the drive bushing, prevents crushing of the drill pipe as the result of excessive gripping pressures on the pipe. The particular toggle link and sliding ring connections not only effect powerful gripping of the drill pipe but also, due to the limited lateral movement of the links and ring, permit proper gripping of the drill pipe even when the latter is arranged slightly eccentrically in the rotatable casing, as the result of improper setting of the pipe slips within the casing-bowl. By slidingly interlocking the driving casing with the table bushing the casing may be rotated irrespective of the axial position thereof, both during pipe line rotation and during breaking of pipe joints. By the provision of interchangeable pipe slips and driver bushing the pipe slips may be quickly detached from the casing-bowl and the driver bushing substituted therfor thereby enabling the driving casing to remain on the rotary table and to serve as at rotating member for the driver bushing during the drilling operation. The device is relatively rugged and foolproof and may be readily attached to a conventional rotary table with a minimum of change. Other advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

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

1. In combination, a rotary table having a rotary drive bushing through which a drill pipe is adapted to extend, a casing arranged centrally of said table and splined to said bushing for rotation therewith and for limited axial sliding movement with respect thereto, said casing having a bore and surrounding the pipe line, means for yielding urging said casing upwardly axially relative to said table, means for limiting the said axial movement of said casing relative to said table, pipe gripping and rotating jaws guided on said casing for connecting the pipe line for rotation with said table, means operatively connected between said bushing and said jaws and engaging the latter for actuating said jaws by said casing upon downward axial movement of said casing relative to said bushing to effect gripping of the drill pipe, and pipe slips carried by said casing for gripping the drill pipe upon downward axial movement of the latter for holding the pipe against downward movement relative to said casing to suspend the entire weight of the pipe line from said casing, the weight of the pipe line effecting such downward axial movement of said casing relative to the table in opposition to said yielding urging means thereby to effect actuation of said jaw actuating means to cause said jaws to grip and rotate the pipe.

2. In combination, a rotary table having a rotatable driving bushing through which a pipe line is adapted to extend, a hollow casing arranged centrally of said table and splined to said bushing for rotation therewith and for limited axial sliding movement with respect thereto, said casing surrounding the pipe line, spring means supported by said bushing and arranged between said bushing and said casing for urging the latter axially toward its uppermost position, means for limiting the axial movement of said casing relative to said bushing, pipe gripping and rotating jaws guided on said casing, for connecting the pipe line for rotation with said table, means operatively connected between said bushing and said jaws and engaging the latter for actuating said jaws by said casing upon downward axial movement of said casing relative to said bushing to effect gripping of the drill pipe, and pipe slips carried by said casing for gripping the drill pipe upon downward axial movement of the latter for holding the pipe against downward movement relative to said casing to subject said casing to the entire weight of the pipe line to effect such downward movement of said casing against the action of said spring means thereby to effect actuation of said jaw actuating means to move said jaws to grip and rotate the pipe, and said spring means moving said casing upwardly axially relative to said bushing to operate said jaw actuating means to effect release of said jaws from said pipe when the weight of the pipe line is removed from said casing.

3. In combination, a rotary driver having a rotatable drive sleeve provided with a bore and through which a drill pipe is adapted to extend, a casing mounted for rotation with said driver and arranged centrally in said bore and movable axially relative to said drive sleeve, means for yieldingly urging said casing axially upwardly relative to said sleeve, chuck jaws guided for radial movement on said casing for gripping the drill pipe to connect the pipe line for rotation with said driver, means operated by the axial downward movement of said casing relative to said drive sleeve for moving said jaws radially into gripping engagement with the drill pipe, said operating means including toggle links pivotally connected at their inner ends to said jaws, a member carried by said drive sleeve and to which the outer ends of said toggle links are pivotally connected, said links being inclined upwardly with respect to a horizontal plane, and means carried by said casing and engaging the drill pipe for holding the pipe line against downward movement relative to said casing to subject the latter to the entire weight of the pipe line thereby to effect downward axial movement of said casing relative to said drive sleeve in opposition to said yielding urging means to effect operation of said jaw actuating means, said toggle links swinging downwardly about their pivots toward said horizontal plane as said casing moves axially downwardly to cause said jaws to grip the pipe.

4. In a rotary drilling apparatus, the combination comprising a rotary table through which a drill pipe line is adapted to extend, and a pipe joint breaking device carried by and rotatable with said table and comprising a casing arranged centrally in said table and having a central bore and surrounding the drill pipe, means for securing said casing to said table for rotation therewith and for limited axial movement relative thereto, means for yieldingly urging said casing upwardly axially relative to said table, means for limiting the axial movement of said casing downwardly relative to said table, pipe gripping and rotating jaws radially guided on said casing for gripping the drill pipe to connect the latter for rotation with said table, and means carried by said table and operatively connected to said jaws and actuated by downward axial movement of said casing relative to said table against the action of said yielding urging means for moving said jaws into gripping relation with the drill pipe.

5. In a rotary drilling apparatus, the combination comprising a rotary table through which a drill pipe line is adapted to extend, and a pipe joint breaking device carried by and rotatable with said table and comprising a casing arranged centrally in said table and having a central bore and surrounding the drill pipe, means for securing said casing to said table for rotation therewith and for limited axial movement relative thereto, means for yieldingly urging said casing upwardly axially relative to said table, means for limiting the axial movement of said casing downwardly relative to said table, pipe gripping and rotating jaws guided for radial movement on said casing for gripping the drill pipe to connect the pipe line for rotation with said table, and means carried by said table and operatively connected to said jaws and actuated by downward axial movement of said casing relative to said table against the action of said yielding urging means for moving said jaws into gripping relation with the drill pipe, and auxiliary gripping means carried by said casing and adapted to grip the drill pipe to subject said casing to the weight of the pipe line to effect such axial movement of said casing downwardly relative to said table.

6. In a rotary drilling apparatus, the combination comprising a rotary table through which a drill pipe line is adapted to extend, and pipe joint breaking device carried by and rotatable with said table and arranged centrally therein and surrounding the pipe line, said device comprising a casing slidingly interlocked with said table for rotation therewith and for limited axial movement with respect thereto, spring means supported by said table and arranged between said table and said casing for constantly urging said casing toward its uppermost axial position, means for limiting the axial movement of said casing downwardly relative to said table, pipe slips carried by said casing for gripping the drill pipe to suspend the entire weight of the pipe line from said casing to effect downward axial movement thereof against the action of said spring means, pipe gripping and rotating jaws guided for radial movement on said casing for gripping the drill pipe to connect the pipe line for rotation with said table, and means carried by said table and operatively connected to said jaws for actuating the latter by axial movement of said casing to move said jaws into gripping relation with the drill pipe when said casing is lowered, whereby said jaws are held in gripping relation with the drill pipe by the weight of the pipe line.

7. In a rotary drilling apparatus, the combination comprising a rotary table through which a drill pipe line is adapted to extend, and pipe joint breaking device carried by and rotatable with said table and arranged centrally therein and surrounding the pipe line, said device comprising a casing slidingly interlocked with said table for rotation therewith and for limited axial movement with respect thereto, spring means supported by said table and arranged between said table and said casing for constantly urging said casing toward its uppermost axial position, means for limiting the axial movement of said casing downwardly relative to said table, pipe slips carried by said casing for gripping the drill pipe to hold the latter against downward movement relative to said casing to suspend the entire weight of the pipe line from said casing to effect downward axial movement thereof against the action of said spring means, pipe gripping and rotating jaws guided for radial movement on said casing for gripping the drill pipe to effect rotation of the pipe line with said table, and means carried by said table and operatively connected to said jaws for actuating the latter by axial movement of said casing to move said jaws into gripping relation with the drill pipe when said casing is lowered to hold said jaws in gripping relation with the drill pipe by the weight of the pipe line, and means associated with said jaw actuating means and upon which said actuating means acts for yieldingly limiting the radial gripping pressure applied by said jaws to the drill pipe.

8. In combination, a rotary table having a rotatable driver provided with a central opening through which a drill pipe is adapted to extend, a rotatable hollow casing surrounding the drill pipe and slidingly interlocked with said driver for rotation therewith and for limited axial movement relative thereto, said casing projecting upwardly above said table and having an upper slip-bowl, means for limiting the downward axial movement of said casing relative to said driver, pipe slips received in said bowl for gripping the drill pipe to hold the pipe line against downward movement relative to said casing to suspend the pipe line from said slips on said casing, pipe gripping and rotating means carried by said casing and movable radially with respect thereto, actuating means for said gripping and rotating means operatively connected to said driver and actuated by said casing upon downward axial movement of said casing relative to said driver to hold said gripping means in radial gripping relation with the drill pipe by the weight of the pipe line thereby to connect the latter for rotation with said table, and means associated with said actuating means and upon which said actuating means acts for predeterminedly limiting the radial gripping pressure applied by said gripping means to the drill pipe to prevent crushing of the latter.

9. In combination, a rotary driving member having a rotatable driver provided with a central opening through which a drill pipe is adapted to extend, a rotatable hollow casing surrounding the drill pipe and slidingly interlocked with said driver for rotation therewith and for limited axial movement relative thereto, said casing projecting

upwardly above said member and having an upper slip-bowl, pipe slips received in said bowl for gripping the drill pipe for holding the pipe line against downward movement relative to said casing to suspend the entire weight of the pipe line from said slips on said casing, pipe gripping and rotating means carried by said casing and movable radially with respect thereto, actuating means for said gripping means operatively connected to said driver and actuated by downward axial movement of said casing relative to said driver to hold said gripping means in radial gripping relation with the drill pipe by the weight of the pipe line thereby to connect the latter for rotation with said table, yieldable means associated with said actuating means and yieldable upon overload for predeterminedly limiting the radial gripping pressure applied by said gripping means to the drill pipe, and abutment means on said driver and said casing for positively limiting the downward axial movement of said casing relative to said driver to prevent crushing of the drill pipe by said jaws due to overload.

10. In combination, a rotary driving member having a tubular driver bushing rotatable therewith and through which a drill pipe is adapted to extend, a hollow casing surrounding the drill pipe and splined to said rotatable bushing for rotation therewith and for limited axial movement relative thereto, means for limiting the axial movement of said casing relative to said rotatable bushing in a downward direction, a spring ring carried by said bushing, pipe gripping and rotating jaws guided for radial movement on said casing, means including toggle links arranged between said spring ring and said jaws and engaging the latter for operating said jaws, said casing upon axial downward movement actuating said toggle links of said jaw operating means to effect movement of said jaws radially into gripping relation with the drill pipe to connect the latter for rotation with said table, and said spring ring upon actuation of said jaws yieldable when a predetermined loading pressure is applied thereto through said toggle links thereby to maintain a predetermined maximum radial gripping pressure on the drill pipe.

11. In a drill pipe gripping device, a rotatable drive member, a hollow casing rotatable with said member and having limited axial movement with respect thereto, means for yieldingly urging said casing axially upwardly relative to said rotatable drive member, means for limiting axial movement of casing relative to said rotatable drive member, pipe gripping and rotating jaws guided for radial movement on said casing for gripping a drill pipe extending through said casing for connecting the pipe line for rotation with said drive member, and means for radially actuating said jaws by said casing upon axial movement of said casing relative to said member in opposition to said yielding urging means including jaw actuating elements and mounting means for said elements carried by said member and having limited lateral movement with respect to said member for automatically centering itself with respect to the drill pipe in the event the latter is slightly off center with respect to said casing to cause said jaws properly to radially grip and rotate the off-centered pipe.

12. In a drill pipe gripping device, a rotatable drive member, a hollow casing rotatable with said member and having limited axial movement with respect thereto, pipe gripping and rotating jaws guided for radial movement on said casing for gripping a drill pipe extending through said casing for connecting the pipe line for rotation with said drive member, and means for radially actuating said jaws by said casing upon downward axial movement of said casing relative to said drive member including jaw actuating elements and mounting means for said elements carried by said member and having limited lateral movement with respect to said member and shiftable laterally with respect to said member automatically to center itself with respect to the drill pipe in the event the latter is slightly off-center with respect to said casing, whereby said jaws may properly radially grip and rotate the off-centered pipe, said jaw actuating elements comprising toggle links and said mounting means including a laterally shiftable annular element carried by said rotatable member and surrounding said casing, said toggle links at their inner ends being pivotally connected to said jaws and at their outer ends being pivotally connected to said annular element, and said casing as it moves axially downwardly relative to said member effecting swinging of said toggle links to cause movement of said jaws into gripping engagement with the pipe.

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