Oct. 25, 1955 W. C. KLITZKE 2,721,491

IMPACT MEANS FOR POWER-OPERATED PIPE WRENCH

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Fig. 1.

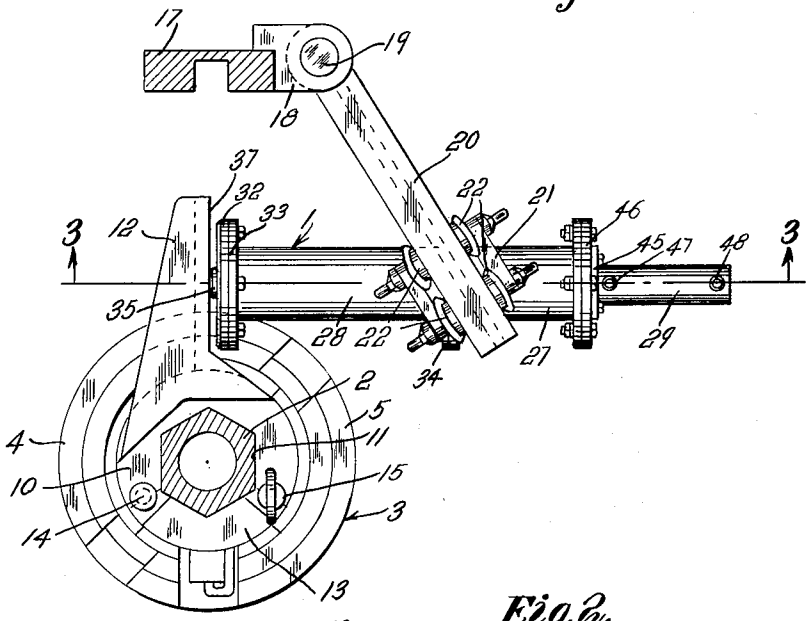
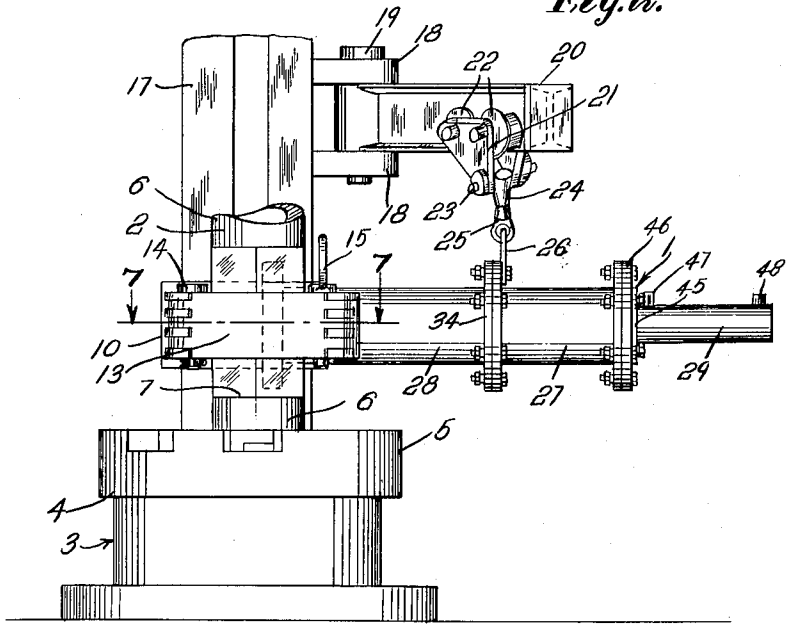


Fig. 2.



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Fig. 3.

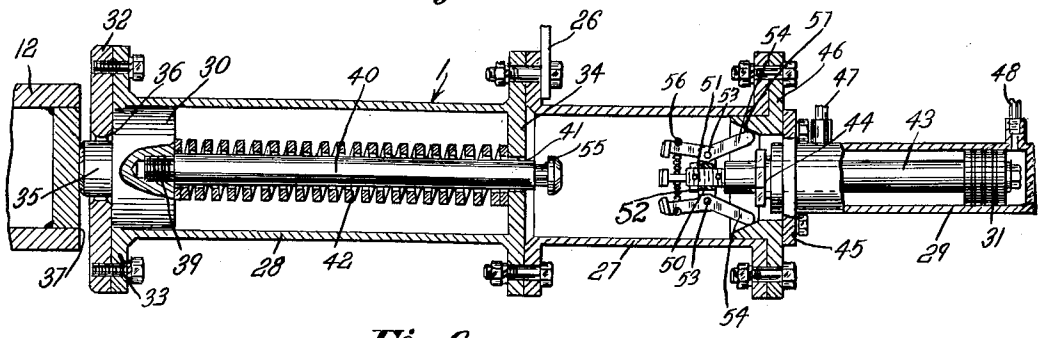


Fig. 4.

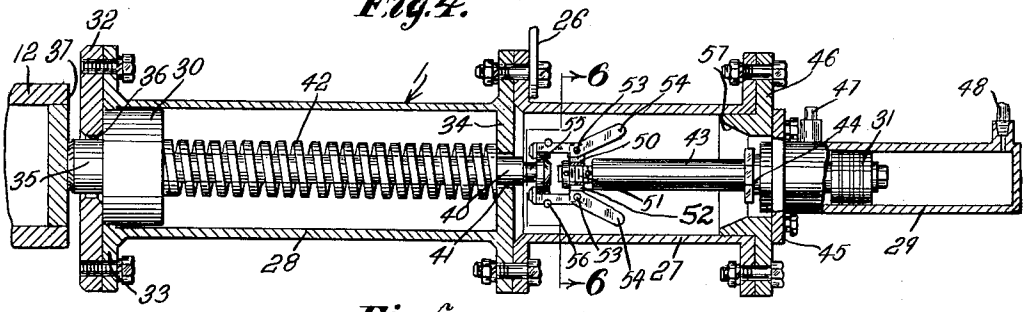


Fig. 5.

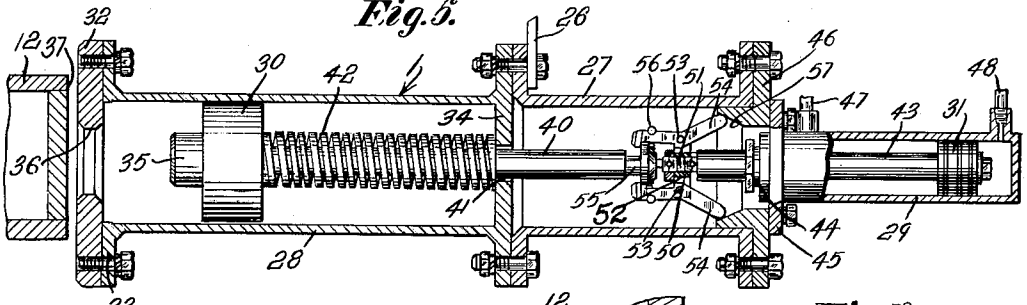


Fig. 6.

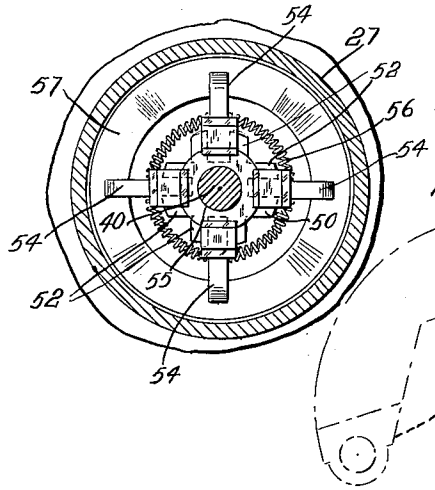
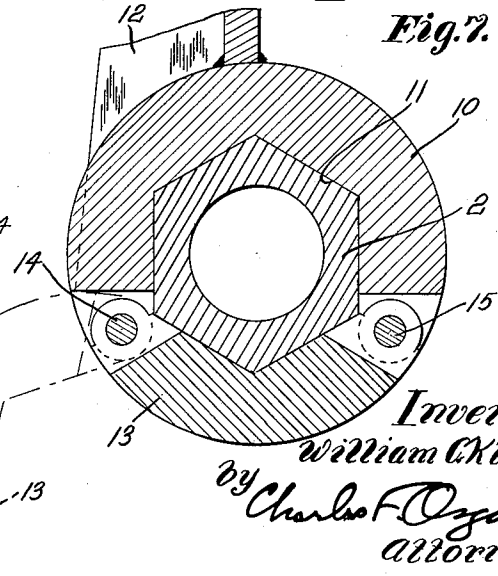


Fig. 7.



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IMPACT MEANS FOR POWER-OPERATED PIPE WRENCH

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Application March 30, 1954, Serial No. 419,658

10 Claims. (Cl. 81—52.3)

This invention relates to a hammer breakout and more particularly to an impact wrench device for breaking the tool joints of an oil well drill pipe line.

In a drill pipe line, such as is employed with an oil well drilling apparatus, the threaded tool joints often become so tightly screwed together that it is exceedingly difficult to break them loose. Heretofore, various forms of impact devices have been devised to effect loosening of a tight joint, and the present invention contemplates improvements over such known devices in that the joint may be broken in an efficient and rapid manner and without undue effort upon the part of the operator.

A principal object of the present invention is to provide novel means for imparting powerful impact blows to a conventional drill pipe to assist in breaking loose the tool joints which couple the pipe sections. Another object is to provide an improved impact wrench having novel impact imparting or hammering mechanism. Yet another object is to provide an improved hammer breakout for a tool joint. A further object is to provide improved resilient means in which energy is stored during retraction of the hammer and for imparting rapid forward motion to the hammer when the latter assumes its retracted position. Still another object is to provide an improved impact wrench of the fluid operated type and having embodied therein improved trigger mechanism for effecting release of the hammer when the latter assumes its retracted position. A still further object is to provide an improved wrench member. Further objects and advantages reside in the detailed construction of the wrench structure, which is designed for simplicity, economy and efficiency. These and other objects will hereinafter become apparent from the following description.

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

In these drawings:

Fig. 1 is a plan view of an illustrative form of the improved hammer breakout with the latter shown in association with a drill pipe line of a conventional rotary oil well drilling apparatus.

Fig. 2 is a side view of the hammer breakout and drilling apparatus shown in Fig. 1.

Fig. 3 is an enlarged longitudinal vertical section taken on line 3—3 of Fig. 1, illustrating structural details of the hammer breakout and showing the hammer in forward blow-striking position.

Figs. 4 and 5 are vertical sections similar to Fig. 3, showing moving parts in different positions.

Fig. 6 is an enlarged cross section taken on line 6—6 of Fig. 4.

Fig. 7 is an enlarged horizontal section taken on line 7—7 of Fig. 2, showing details of the wrench.

In this illustrative embodiment of the invention, as shown in the drawings, the improved hammer breakout or impact wrench device is generally designated 1 and is shown associated with a drill pipe line 2 of a conventional oil well drilling apparatus, generally designated

3. The drilling apparatus may assume various forms and herein includes a rotary table 4 provided with a conventional slip bowl 5 having slips for holding the pipe line suspended in a well during the joint breaking operation. The drill pipe line includes pipe sections 6 coupled together at 7 by usual threaded tool joints. The hammer breakout or wrench device 1 may engage an upper pipe section above the tool joint in adjacency to the latter, as shown in Fig. 2, and the pipe line below this tool joint is held suspended and against rotation by the slips of the slip bowl of the rotary table, in a well-known manner. Evidently the hammer breakout may be used in breaking joints of other types of equipment.

The hammer breakout or wrench device 1 comprises a wrench member 10 having a polygonal opening 11 through which the drill pipe line extends and the pipe sections are polygonal in cross section substantially to fit the wrench opening (Figs. 1 and 7). The wrench body has a lateral lever arm 12 and a swingable jaw or gate 13 is pivoted at 14 on the wrench body and is held in closed position by a releasable pin 15. The lever arm desirably projects laterally from the wrench body at the side thereof opposite from the gate. This jaw or gate enables ready attachment of the wrench to the upper pipe section above the tool joint and as the wrench is rotated or turned the walls of the polygonal opening 11 may grip the polygonal surface of the drill pipe to rotate the latter therewith.

Mounted in a suitable manner at one side of the rotary table of the drilling apparatus is an upright support 17 (Figs. 1 and 2) to which vertically spaced brackets 18 are secured, and these brackets support a vertical pivot pin 19. Pivotally mounted on this pivot pin between the brackets is a horizontal arm or arm-like support 20 desirably in the form of an I-beam and a trolley 21 has rollers 22 which may roll along the upper surface of the bottom flanges of the arm longitudinally to the latter. This trolley carries a horizontal pin or pivot rod 23 on which a swivel member 24 is pivotally mounted to swing laterally and rotatively suspended from this swivel member on an upright axis is a swiveled eye 25. This eye is connectible to a hook 26 on the body 27 of the hammer breakout or wrench device so that the latter is held flexibly suspended from the trolley and is movable with the latter, thus to permit proper positioning of the wrench with respect to the drill pipe. If desired, the support 17 may be vertically adjustable to vary the elevation of the wrench device.

The hammer breakout or wrench device has secured to its body 27 aligned horizontal cylinders 28 and 29, the former being a hammer cylinder and containing a hammer or striking plunger 30 and the latter cylinder being a fluid cylinder and containing a reciprocable piston 31. The inner or front cylinder 28 has a front head plate 32 secured, as by screws, to a flange 33 on the forward portion of the cylinder 28 and the latter has a rear head 34. The hammer 30 has a reduced striking bar portion 35 which passes through an axial opening 36 in the front cylinder head plate 32 into contact with a vertical impact surface 37 on the arm 12 of the wrench member (Figs. 1 and 3). Threadedly secured at 39 to the hammer 30 (Fig. 3) is a rearwardly extending coaxial retracting rod or bar 40 which extends rearwardly through an axial opening 41 in the rear cylinder head 34 and a suitable resilient energy storing mechanism may be employed to drive the hammer forwardly which herein desirably comprises a resilient means in the form of a coil spring 42 surrounding the retracting rod 40 between the hammer 30 and the rear cylinder head 34.

The retracting mechanism for the hammer for mov-

ing the latter rearwardly in opposition to the resilient mechanism may assume various forms and herein desirably comprises a piston rod 43 secured to the piston 31 and extending forwardly through a suitable packing or gland 44 carried by a front head 45 of the cylinder 29, this head being secured, as by screws, to a rear plate 46 in turn secured, as by screws, to the body 27 of the hammer breakout. Fluid conduits 47 and 48 are connected to the opposite ends of the cylinder 29 at opposite sides of the piston 31 and through which pressure fluid, desirably a liquid under pressure, may be supplied for effecting reciprocation of the piston. Any suitable valve means may be provided for controlling fluid flow in these conduits.

The piston rod 43 carries at its forward end a suitable trigger mechanism which herein desirably comprises a spider or yoke 50 threadedly secured at 51 to the forward end of the piston rod and this spider has four equally-spaced bifurcated radial arms 52, the furcations of which carry pivot pins 53 on which fingers or lever-like latches 54 are pivotally mounted. These latches are movable at their forward ends into an annular groove 55 at the rearward end portion of the retracting bar 40 and are yieldingly held in grasping relation with respect to the bar in contact with the rear wall of the groove by an expansible spring ring 56 which engages the forward portions of the latches in the manner shown. The rear plate 46 on the body 27 has a conical opening 57 and when the hammer 30 and the piston 31 approach their retracted positions, as shown in Fig. 5, the fingers or latches at their rearward ends engage the tapered walls of this conical opening so that as the piston 31 continues to move rearwardly the forward portions of the arms are swung apart to release the retracting bar 40 from their grasp, and the resilient energy storing mechanism embodying the coil spring 42 then drives the hammer 30 rapidly forwardly in the cylinder 28 to deliver a sharp blow to the lever arm 12 of the wrench member, thereby to break or loosen the tool joint. In the event one blow does not loosen the joint, the hammer may be quickly retracted and then again released to strike an additional blow, in an obvious manner.

Evidently the hammer breakout or wrench device may be supported in various conventional manners other than that disclosed, and the hammer may be retracted against a resilient opposing pressure by various other means, either manual or automatic. Under certain conditions, compressed air, a resilient rubber-like mass or other equivalent compressible means may be employed in the cylinder 28 in lieu of the spring 42 so that the expansive action of the air pressure or other resilient means may drive the hammer forwardly, when the trigger mechanism is released, to strike its blow. While the wrench member 10 is shown separate from the body of the impact device, it is obvious that the wrench may be loosely supported from or otherwise connected to the impact device in any suitable manner.

The general mode of use of the improved hammer breakout or wrench device will be clearly apparent from the description given but to summarize, the hammer breakout may be suitably positioned by adjusting movements of the swinging arm 20 and the trolley 21 properly to locate the striking bar of the hammer with respect to the wrench lever 12 after the wrench member has been moved into place, as shown in Figs. 1 and 2, and the gate 13 is closed and locked by the pin 15. The wrench member 10 engages the upper drill pipe section just above the tool joint 7 and the lower portion of the pipe line is held suspended and against rotation by the slips of the slip bowl 5, in a well-known manner. Fluid under pressure may then be supplied to the front end of the cylinder 29 to effect movement of the piston 31 rearwardly from the position shown in Fig. 4, and the trigger mechanism which grasps the retracting bar 40 moves the hammer 30 rearwardly against the action of the energy storing spring 42, further highly compressing the latter. When the piston 31 reaches the position shown in Fig. 5 the latches 54 engage the tapered walls of the bore 57 and as the piston continues to move rearwardly the latches are released from their grasp on the retracting bar and the then freed hammer is rapidly driven forwardly in the cylinder 28 to impart a powerful blow to the lever arm 12 of the wrench member 10, thereby imparting a powerful rotative force to the upper pipe section to effect breaking or loosening of the tool joint. After the blow has been delivered to the wrench member, fluid under pressure may be supplied to the rear end of the cylinder 29 to move the piston 31 forwardly and when the trigger mechanism reaches the position shown in Fig. 4 the retracting bar 40 is again grasped by the latches 54. When the piston 31 is again moved rearwardly the hammer 30 is retracted and, if desired, an additional blow or blows may be imparted to the wrench to break or loosen a stubborn joint.

As a result of this invention an improved hammer breakout or impact wrench device is provided whereby a powerful impact blow may be transmitted to the upper pipe section above the tool joint thereby to impart a powerful rotative force to the upper pipe section to break or loosen the joint. By the provision of the resilient energy storing mechanism for driving the hammer forwardly and the power operated retracting mechanism for retracting the hammer the latter may be quickly retracted and then when freed from the retracting mechanism suddenly driven forwardly with a tremendous impact force. The improved trigger mechanism associated with the hammer and the piston of the power cylinder enables efficient retraction of the hammer and quick release of the hammer when the latter assumes its fully retracted position. The device is not only simple and rugged in design but it is also efficient and reliable in operation, well adapted for its intended purpose. These and 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 an impact wrench device, a support, a hammer mechanism carried by said support and including a movable hammer for imparting an impact blow to a wrench member to be rotated, a power device carried by said support at the rear end thereof for retracting said hammer, resilient means for suddenly driving said hammer forwardly when said hammer reaches its retracted position and is freed from said power device, a trigger mechanism operated by said power device for connecting said hammer to the latter for retraction thereby, and means actuated by rearward movement of said hammer for releasing said trigger mechanism when said hammer assumes its retracted position to free said hammer for forward movement, said power device having a power actuated element extending axially forwardly and said trigger mechanism comprising a releasable latch carried at the front end of said power actuated element.

2. In an impact wrench device, the combination comprising a support, a wrench member engageable with an element to be rotated and having a lever arm, and an impact mechanism for delivering a powerful blow to said lever arm to impart a rotative force to said wrench member comprising a freely moving hammer, guiding means for said hammer carried by said support, power operated means carried by said support for retracting said hammer, and means in which energy is stored as a result of such retraction of said hammer by said power

operated means for imparting a sudden forward driving force to said hammer when the latter is freed from said power operated means.

3. An impact wrench device as set forth in claim 2 wherein said energy storing means comprises compressible resilient means which is highly compressed during retraction of said hammer by said power operated means, and means is provided for suddenly freeing said hammer when the latter assumes its retracted position to cause said compressed resilient means to drive said hammer forwardly.

4. An impact wrench device as set forth in claim 2 wherein a trigger mechanism is provided for connecting said hammer to said power operated means, and means is provided for releasing said trigger mechanism to free said hammer from said power operated means when said hammer assumes its retracted position.

5. A blow-striking device for imparting a rotative blow to an element to be rotated comprising a hammer, a power operated means, releasable means for connecting said hammer to said power operated means to enable the latter to retract said hammer, means for releasing said connecting means to free said hammer from said power operated means when said hammer assumes its retracted position, and means for driving said hammer forwardly when said connecting means is released as aforesaid, said power operated means being located rearwardly of said hammer driving means and including a forwardly extending element at the front end of which said releasing means is carried.

6. A device as set forth in claim 5 wherein said hammer-driving means comprises a mechanism in which energy is stored as said hammer is retracted by said power operated means, and said energy storing mechanism drives said hammer forwardly when the latter is freed by said releasable connecting means from said power operated means.

7. An impact wrench device comprising a wrench member engageable with an element to be rotated, and means for delivering a powerful impact blow to said wrench member comprising a reciprocable hammer, means for guiding said hammer during its reciprocable movement, compressible resilient means for opposing rearward movement of said hammer, means for retracting said hammer against the action of said resilient means, said resilient means when said hammer assumes its retracted position driving said hammer forwardly by its expansive action to cause said hammer to impart a powerful blow to said wrench member, a trigger mechanism operatively associated with said retracting means for connecting the latter to said hammer, and means actuated by rearward movement of said hammer for releasing said trigger mechanism when said hammer assumes its retracted position to free said hammer from said retracting means, said retracting means located rearwardly of said hammer guiding means and including a rod extending forwardly, said trigger mechanism including a releasable latch carried at the front end of said rod.

8. An impact wrench device as set forth in claim 7 wherein said retracting means also comprises a cylinder coaxial with said guiding means rearwardly of the latter and a fluid actuated piston reciprocable in said cylinder, said forwardly extending rod being the rod of said piston.

9. In a device of the character disclosed, a wrench member having a body provided with an opening through which an element to be rotated is adapted to extend, said body upon turning of the wrench member engaging the element to be rotated for rotating the latter therewith, said body having a lever arm projecting laterally from one side thereof and adapted to receive the rotative forces for turning the wrench member, said lever arm having a plane impact-receiving surface, and impact-imparting means disposed with its longitudinal axis at substantially right angles to said impact-receiving surface for delivering an impact blow to said surface to turn said lever arm thereby to effect turning of said wrench member.

10. In an impact wrench device, a support, a hammer mechanism carried by said support and including a movable hammer for imparting an impact blow to a wrench member to be rotated, a power device carried by said support for retracting said hammer, resilient means for suddenly driving said hammer forwardly when said hammer reaches its retracted position and is freed from said power device, said power device comprising relatively reciprocable coacting cylinder and piston elements arranged coaxially with said hammer at the rear end of said support, releasable means carried by one of said elements at the forward end thereof for connecting said hammer for movement with a reciprocable one of said elements into its rearmost position and releasable to free said hammer from said power device to permit said resilient means to drive said hammer forwardly as aforesaid, and means for supplying an operating medium to said cylinder element to effect relative reciprocation of said elements.

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