Oct. 28, 1952 A. L. STONE 2,615,682

POWER-OPERATED SLIDABLE JAW PIPE TONG

Filed March 24, 1951

FIG. 1.

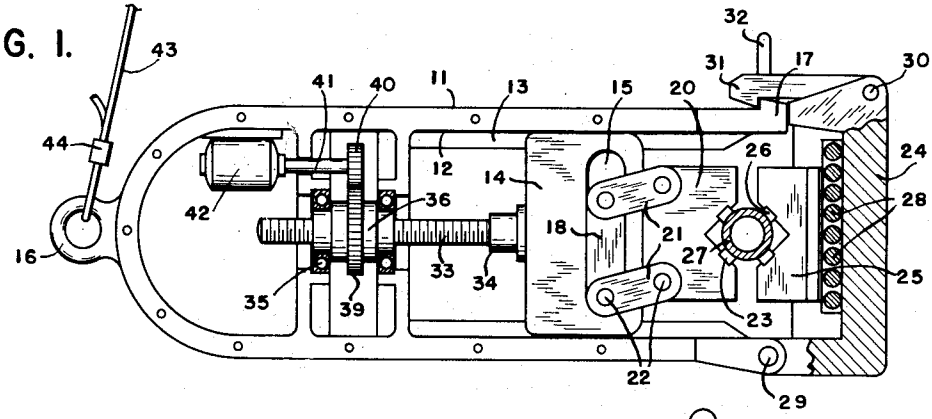


FIG. 2.

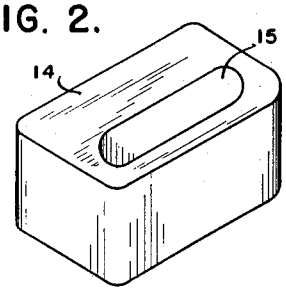


FIG. 4.

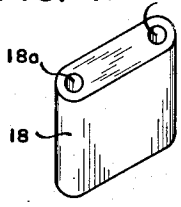


FIG. 3.

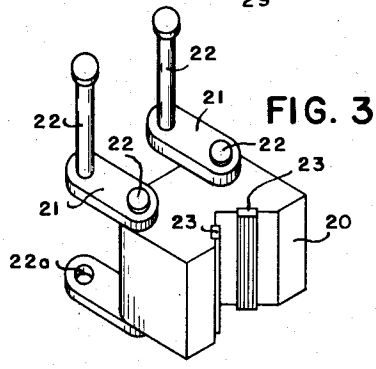
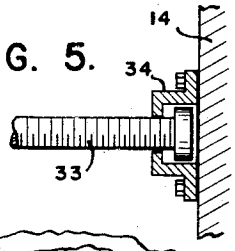


FIG. 5.



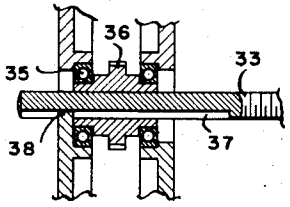


FIG. 6.

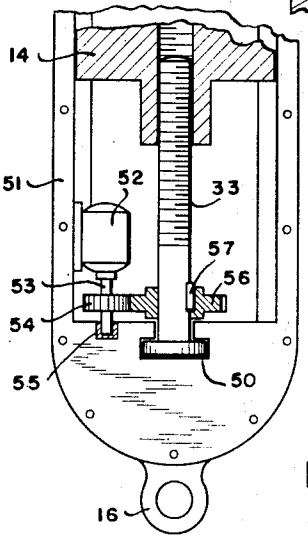
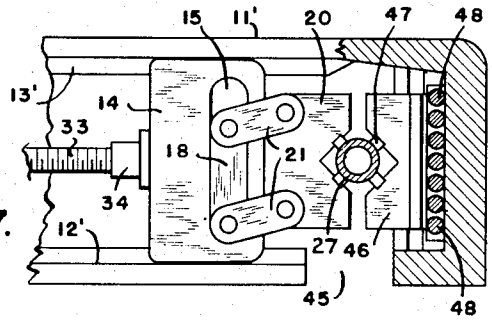


FIG. 8.

FIG. 7.



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Patented Oct. 28, 1952 2,615,682

UNITED STATES PATENT OFFICE

2,615,682

POWER-OPERATED SLIDABLE JAW PIPE TONG

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Application March 24, 1951, Serial No. 217,366

9 Claims. (Cl. 255—35)

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The present invention is directed to a device adapted for making up and releasing a section of pipe. More particularly, the invention is directed to a device adapted for unscrewing and for making up lengths of pipe employed in oil well drilling operations.

In oil well drilling operations and the like it is common to employ pipe stands which usually comprise three lengths of pipe known as a tribble. In coming out of the hole, it is conventional practice to release a stand from the pipe in the hole by exerting torque on the tool joint by means of tongs and then spinning out the length to be released. The elevators then bring up another stand which is tonged and then the stand is released by a suitable spinning device which may be the rotary table or other devices which are becoming known in the art.

Conventional tongs are maintained with self-energizing jaws operated in such a manner that an increase in torque increases the pressure of the tong dies on a tool joint. These jaws wrap around the tool joint in such a manner that it is impractical to use them as power operated tongs, nor is it practical to do any lifting with a tong of this design.

Hydraulically powered tongs have become known to the oil industry recently. In these devices hydraulic power is employed to apply pressure on the jaws and thus permit the application of the necessary torque to release the tool joint. It is impractical to combine hydraulic power and mechanical self-energizing features in the same device for releasing the stands of pipe at the tool joint since in such devices the fluid pressure necessary to move the body of the tong into a grasping position must hold it in this position while torque is applied. Thus, if a self-energizing feature is added, the pressure against the fluid system is increased by the amount of the mechanical leverage. Since the system must maintain this high pressure, it has been considered necessary to apply the high pressure directly, thus eliminating any self-energizing feature. This system makes it necessary to grasp all tool joints with the same intensity. Thus, the prior art devices employing hydraulic power have limitations in that the tong required a high powered hydraulic system, whereas only a portion of the power in such tong devices is needed to provide the required torque.

It is, therefore, the main object of the present invention to provide a mechanical tong in which power to the tong jaws is supplied through a system of mechanical linkages which hold the jaws in engagement with the outer periphery of the pipe to be grasped while applying torque thereto.

Another object of the present invention is to provide a device for making up and releasing a

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section or stands of pipe embodying a mechanical self-energizing feature in which the pipe is grasped and torque applied thereto in a rapid and efficient manner.

The device of the present invention embodies a frame member, a cross head member, a first jaw connected by a link arrangement to the cross head member, a door member defining a second jaw, and a power operated screw connected to the first jaw and adapted to move the latter in a forward and backward direction.

Other objects of the present invention will become apparent by reference to the drawing in which—

Fig. 1 is a partial sectional view looking downward on the device of the present invention;

Fig. 2 is a perspective view of the cross head of Fig. 1;

Fig. 3 is a perspective view of the movable jaw and linkages of the device of Fig. 1;

Fig. 4 is a perspective of the sliding member of Fig. 1;

Fig. 5 is a cross section showing a detail of the power screw and its attachment to the cross head of Fig. 1;

Fig. 6 is a cross section showing a detail of the power operated screw and the bearing assembly therefor;

Fig. 7 is a partial sectional view looking downward on a modified embodiment of Fig. 1 in which the frame member is provided with a side opening; and

Fig. 8 is a view looking downward on a modification of the embodiment of Fig. 1 in which another means is shown for moving the cross head forward and backward.

In the several figures of the drawing, identical numerals have been employed to designate identical parts.

Referring now to the drawing and particularly to Fig. 1, numeral 11 designates a tong frame member defining a recessed inner surface 12 and a shoulder 13 in which is slidably arranged a cross head member 14 which defines a slot 15. Frame member 11 defines with its exterior surface an eye member 16 and an exterior shoulder 17. Slidably arranged in slot 15 is a slide member 18. Slide member 18 is adapted to move from one side of center to the other of slot 15 and is attached to a first jaw member 20 by means of parallel links 21. Parallel links 21 are connected, respectively, to jaw member 20 and slide 18 by pins 22 which fit into holes 22a in links 21 and holes 18a in slide 18. Jaw member 20 is provided with insert dies 23 which are adapted to engage with the outer periphery of a stand of pipe or a tool joint. Pivotably mounted on the open end of frame member 11 is a door member 24 which encloses a second jaw member 25 and similar to jaw member 20 is provided with dies 26.

First jaw member 20 and second jaw member 25 cooperate to form jaws which are adapted to encircle a stand of pipe or a tool joint which is indicated by numeral 27. Jaw member 25 is slidably mounted on rollers 28 to decrease friction and allow relative movement of first and second jaw members 20 and 25 when force is applied to the device as will be described. The relative movements of the two jaw members may be described as a combination of lateral and arcuate movements; the lateral movement is a function of the linkage which prevents the jaw member 20 from turning to face the pipe as it moves while the arcuate movement is a function of torque exerted on the device. Door member 24 is designed to be opened and closed and is pivotably mounted on frame member 11 by pin 29. Door member 24 is provided with a second pin 30 to mount pivotably a latch member 31 provided with a handle 32 for operation thereof which engages with shoulder 17 of frame 11 to latch the door 24 and to close frame member 11.

Cross head member 14 is attached to a screw member 33 by a head piece 34 as shown in detail in Fig. 5. Screw member 33 is mounted within frame member 11 in bearings 35. Mounted on screw member 33 is a power nut 36, the inner surfaces of which define an internal screw thread which cooperates with the screw member 33 to cause a backward or forward motion of screw member 33, depending on the direction of rotation of the power nut 36. Screw member 33 defines a key way 37 which is adapted to receive key 38 as shown in Fig. 6 and thus prevents rotation of the screw 33 and allows it to travel in a forward or backward direction. By attaching screw 33 to member 14, for example, by welding, key way 37 and key 38 may be omitted. Power nut 36 is actuated by a gear train comprising gears 39 and 40. Gear 40 is mounted on a shaft 41 which is connected to a motor or power means 42 which is mounted within frame member 11. Torque is applied to pipe grasped by the device by means of a cable or a rope 43 which passes through eye member 16 and is clamped by clamp 44. The tong may be supported on the derrick floor by well known means similar to those employed on conventional power tongs.

Referring now to Fig. 7, it will be seen that corresponding parts in Figs. 1 to 6 have been designated by corresponding numerals. In this embodiment of the invention frame member 11' defines a side opening 45 adapted to allow the tong assembly to receive a stand of pipe. Frame member 11' encloses a second jaw member 46 which is provided with dies 47 and cooperates with jaw member 20 and is adapted to encircle a stand of pipe or a tool joint indicated by numeral 27. It will be seen that jaw member 46 like jaw member 25 of Fig. 1 is slidably mounted on rollers 48 to allow relative movement of first jaw member 20 and second jaw member 46 when force is applied to the device. The device of Fig. 7 functions identically to the device of Fig. 1 as will be described.

Frame member 11' defines a recessed inner surface 12' and a shoulder 13' in which is slidably arranged cross head member 14 which defines a slot 15 as described in Figs. 1 to 6 inclusive. The remaining parts of the device of Fig. 7 are similar to the device of Figs. 1 to 6 and further description thereof need not be given here.

Referring now to Fig. 8, it will be seen that screw 33 is threaded into cross head member 14, the external threads of screw 33 cooperating with internal threads of cross head member 14 to allow longitudinal movement thereof as will be described. Screw 33 rotates in a recess 50 defined by frame 51. Mounted on frame 51 is a motor 52 provided with a shaft which carries a gear 54. Shaft 53 rotates in bearing 55 defined by frame 51 and actuates through gear 54 a second gear 56 which defines with its inner surface a key 57 which cooperates with screw 33 to allow rotational movement thereof as the gears 54 and 56 are rotated by the motor 52. Thus rotation of the screw 33 in this embodiment of my invention allows forward and backward movement of cross head 14.

The device of the present invention may be operated as follows with reference to the apparatus of Figs. 1 to 6: Frame member 11 is placed around the tool joint as shown in Fig. 1 with the door member 24 being closed and latched. By causing the motor 42 to operate, the back jaw 20 is moved rapidly forward to grasp the tool joint encircled by the jaws 20 and 24. The screw, through motor 42 will produce sufficient power to permit supporting the weight of a stand of drill pipe which may be as much as a ton or more; enough torsional power is provided to assure that no slippage occurs while the links are applying the added power necessary to apply the maximum torque. By application of power, through gear 39 the link members 21 require the jaw member 20 to move toward the center, thus tightening the grip on the tool joint as torque is applied and causing it to be broken loose from the drill stand.

The operation of the device of Fig. 7 is similar to that of Figs. 1 to 6 with the exception that the manual operation of closing the door member is dispensed with. Frame member 11' comprising the tong assembly is placed around the tool joint 26 by means of opening 45 with the joint 26 in position in jaw 46 as shown in the drawing. Motor 42 is caused to operate and the back jaw 20 is moved rapidly forward to grasp the tool joint between jaws 20 and 46. The screw 33 produces sufficient power to support the weight of a stand of drill pipe while torsional power is provided through links 21 to apply the necessary torque to break out the tool joint.

The device of Fig. 8 operates similarly to the embodiments of Figs. 1 to 7 with the exception that the screw 33 rotates and by means of being threaded into cross head 14 causes longitudinal movement thereof in forward and backward motion by operation of motor 52 which supplies power through shaft 53 to gears 54 and 56 and thence to screw 33.

It will be apparent that screw 33 rather than be threaded into cross head member 14 like in Fig. 8 or anchored to the cross head 14 and powered by a nut 36 as in the embodiments of Figs. 1 to 7, inclusive, may be rotatably attached to the cross head member 14 and threaded into the frame 51, thus moving the cross head 14 by rotation and longitudinal movement of the screw 33. This latter embodiment is not shown in the drawing since it will be apparent to the skilled workman.

The screw may be provided such that it will have a very rapid motion forward and backward when energized by a very small motor, thus allowing the jaw 20 to be retracted sufficiently to permit the improved tong device to accom-

modate a wide variety of pipe sizes without loss of time.

The screw thread permits the use of a high speed motor attached to the power nut through a single set of gears.

The motor employed in the practice of the present invention may be a fluidly operated motor such as one operated pneumatically or hydraulically, or the motor may be an electric motor. The amount of horsepower required to operate the improved device should be in the range from about one-half horsepower up to about five horsepower.

The device of the present invention may be suspended from a cable adapted to be mounted within a derrick, or it may be mounted on a suitable post on the derrick floor which will allow it to be swiveled into or out of position as desired. Whatever type of supporting means is used, it should be of sufficient strength to support a stand of pipe weighing a ton or more.

The nature and objects of the present invention having been completely described and illustrated, what I wish to claim as new and useful and to secure by Letters Patent is:

1. A device adapted for making up and releasing a stand of pipe which comprises a frame member defining a longitudinally extending slide surface, said frame member being open at one end and closed at the other, a cross head member arranged within said frame member and adapted to slide on the surface defined by said frame member, a first jaw member movably connected to said cross head member and adapted to engage with the outer periphery of a stand of pipe, a screw member arranged in said frame member and connected to said cross head member, power means arranged within said frame member operably connected to said screw member and adapted to move said screw member and said first jaw member forward to and backward from said open end, and a latchable door member on said frame member defining a second jaw cooperating with said first jaw to encircle the outer periphery of a stand of pipe and arranged to close the open end of said frame member.

2. A device adapted for making up and releasing a stand of pipe which comprises a frame member defining a longitudinally extending slide surface and a shoulder adapted to receive a slidable member, said frame member being open at one end and closed at the other, a cross head member arranged within said frame member and adapted to slide on said surface, a first jaw movably connected with said cross head member and adapted for forward and backward motion, a pair of parallel link members movably connected to said first jaw member and said cross head member, a screw member arranged on said frame member and connected to said cross head member, power means arranged within said frame member, a gear train operably connecting said power means and said screw member, a door member pivotally mounted on said frame member mounting a second jaw cooperating with said first jaw to encircle the outer periphery of a stand of pipe and adapted to close the open end of said frame member, and a latch member pivotally mounted on said door member adapted to engage with an exterior shoulder defined by said frame member.

3. A device in accordance with claim 2 in which said second jaw is slidably mounted in said door member in perpendicular relationship to the movement of said first jaw member.

4. A device adapted for making up and releasing a stand of pipe which comprises a frame member defining a longitudinally extending slide surface and a side opening in said frame member parallel to the longitudinal axis thereof adapted to permit said frame member to embrace a stand of pipe and a first jaw member adjacent said side opening, a cross head member arranged within said frame member and adapted to slide on the surface defined by said frame member, a second jaw member connected to said cross head member and adapted to engage with the outer periphery of a stand of pipe and adapted to cooperate with said first jaw member in embracing a stand of pipe, a screw member arranged in said frame member and connected to said cross head member, and power means arranged within said frame member operably connected to said screw member and adapted to move said screw member and said second jaw member forward to and backward from said first jaw member.

5. A pipe tong comprising, in combination, a frame member provided with means to receive a pipe and having a longitudinally extending slide surface, a first pipe gripping jaw member carried by said frame member, a cross head member arranged within said frame member to slide on the longitudinally extending slide surface, a second pipe gripping jaw member movably connected to said cross head member, a screw member arranged in said frame assembly operably connected to said cross head member, and power means mounted in said frame member operably connected to said screw member to move said second jaw member forward to and backward from said first jaw member.

6. A pipe tong in accordance with claim 5 in which said first jaw member is slidably mounted in said frame member in perpendicular relationship to the movement of said second jaw member.

7. A pipe tong in accordance with claim 5 in which the means to receive the pipe is an open end of said frame member provided with a pivotally mounted latchable door member and in which the first pipe gripping jaw member is carried by said door member.

8. A pipe tong in accordance with claim 5 in which the means to receive the pipe is a side opening in the frame member parallel to the longitudinal axis of the frame member and adjacent the first jaw member.

9. A device in accordance with claim 4 in which the first jaw member is slidably mounted in the frame member adjacent said side opening in perpendicular relationship to the movement of said second jaw member.

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