Dec. 18, 1934. W. C. BABIN 1,984,622

COMBINATION MAKE-UP AND BREAK-OUT TONG

Original Filed April 25, 1930 2 Sheets-Sheet 1

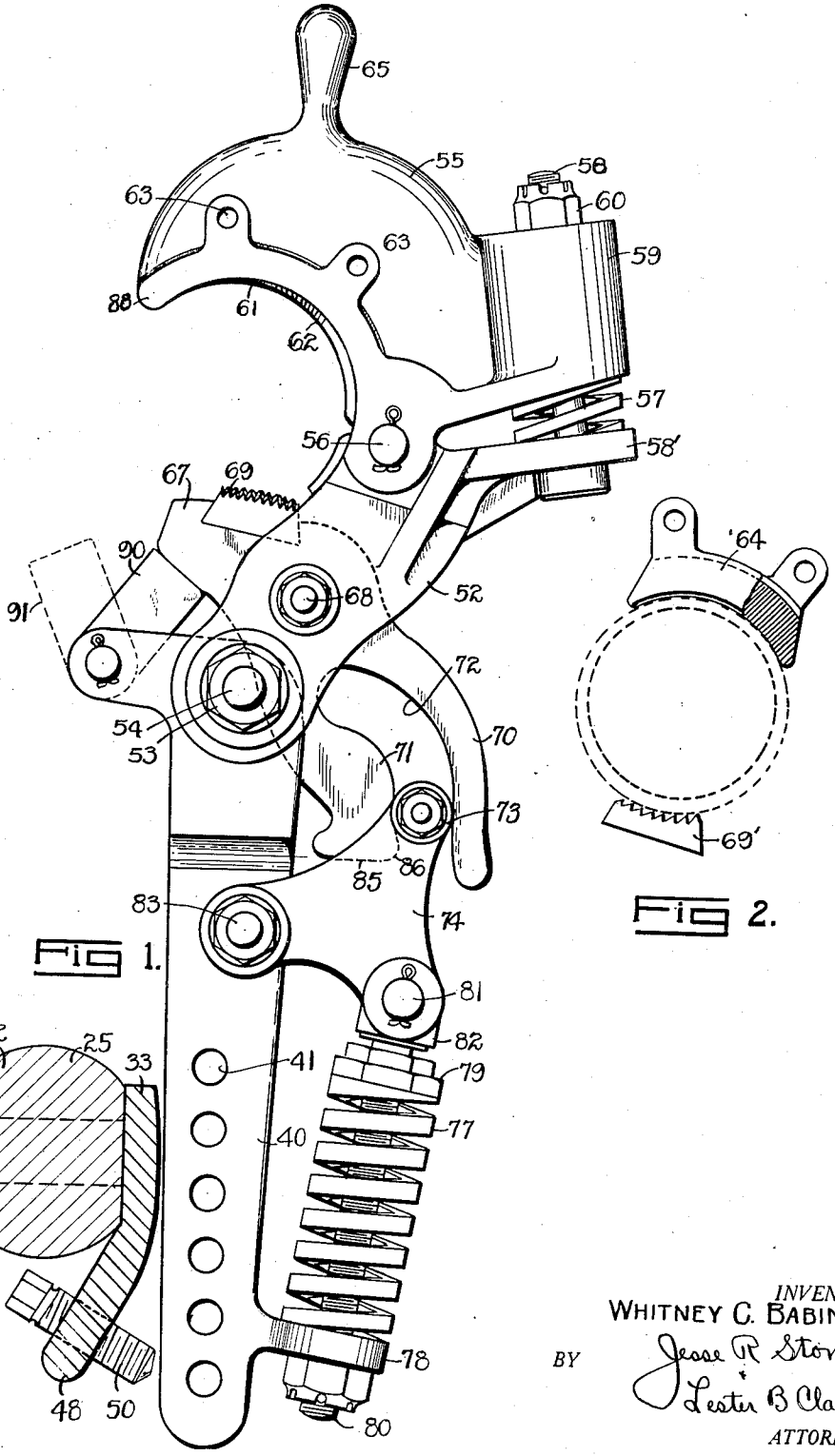

Fig 1.

Fig 2.

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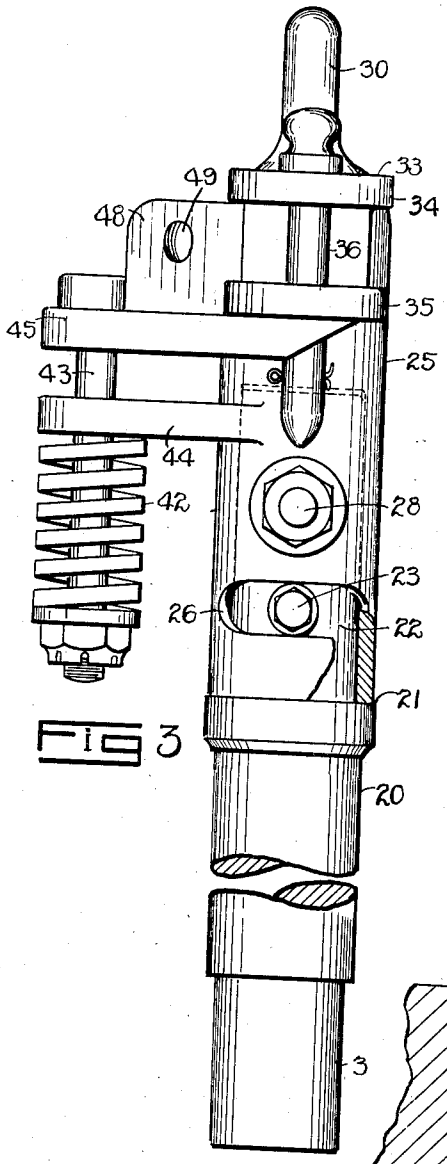

FIG 3

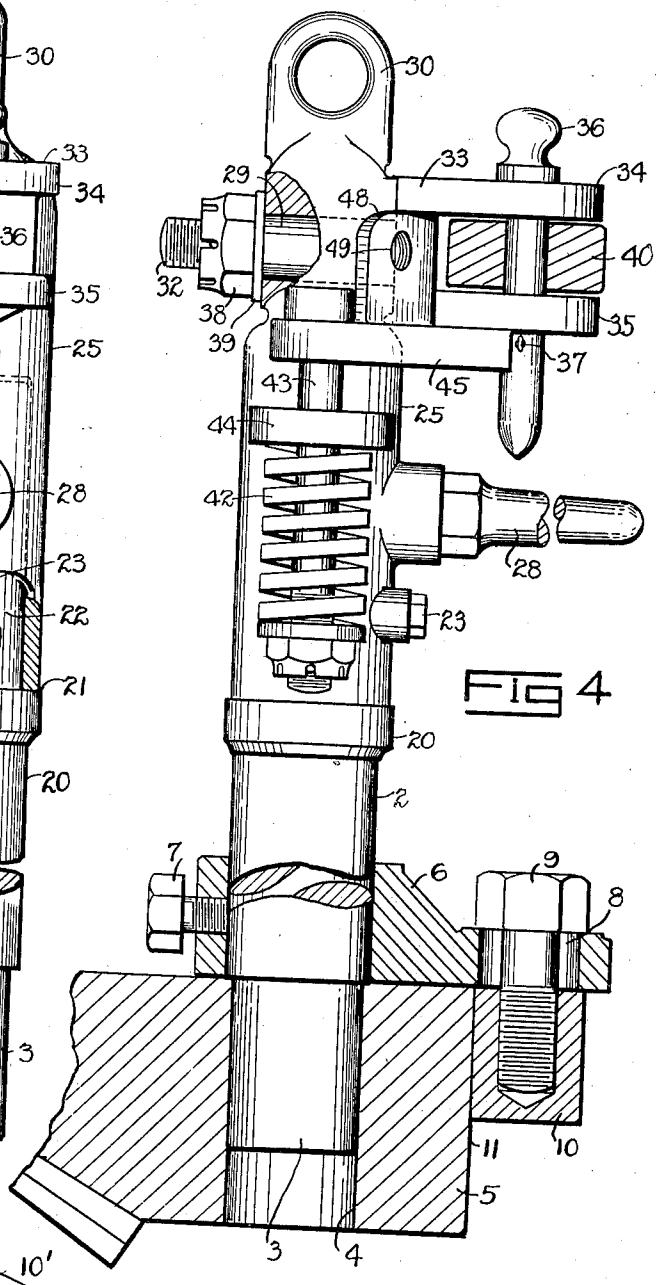

FIG 4

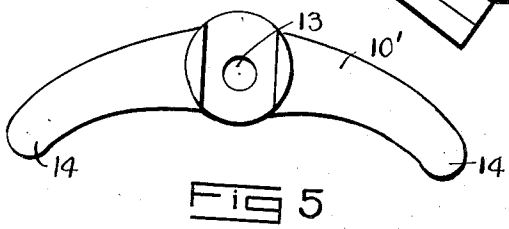

FIG 5

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UNITED STATES PATENT OFFICE

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COMBINATION MAKE-UP AND BREAK-OUT TONG

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Application April 25, 1930, Serial No. 447,118
Renewed October 29, 1934

4 Claims. (Cl. 81—91)

The invention relates to an improvement in tongs such as are used in connection with the rotary table which is power driven to make-up and break-out the tool joints or pipe couplings in connection with well drilling operations.

It is one of the objects of the invention to provide a tong which will be automatically releasable when the joint has been made up under a predetermined torque.

Another object of the invention is to provide a tong which is capable of limited restrained vertical pivoting.

Another object of the invention is to provide a tong which is automatically releasable when a predetermined torque is exerted upon the tong.

A still further object of the invention is to provide a tong having a jaw which is adapted to be released by a hammer blow after a predetermined torque has been exerted.

It is also an object of the invention to arrange a tong having a head which is resiliently mounted.

Still another object of the invention is to provide a pipe tong whose pipe-engaging surfaces are crowned so that the tong may be rocked both horizontally and vertically with respect to the pipe and still retain its grip thereon.

A still further object of the invention is to provide a pipe tong with an automatically releasable jaw which is adjustable to release at any desired predetermined torque.

It is also an object of the invention to arrange a tong mounted upon a post on the rotary table in such a manner that it may be pivoted to operative or inoperative position.

It seems apparent that various other objects of the invention will be readily understood when the following description is considered in connection with the accompanying drawings wherein

Fig. 1 is a top plan view of the tong showing the handle thereof mounted adjacent the make-up post.

Fig. 2 is a detail showing the arrangement of the die and adapter which are arranged to engage the pipe.

Figs. 3 and 4 are elevations of the make-up post taken at right angles to each other and showing the detailed arrangement of the structure.

Fig. 5 shows another form of a subpost which may be used.

The present invention is in the nature of an improvement over my prior co-pending application Serial No. 364,635, for a make-up tongue, filed May 20, 1929.

In well drilling operations carried on by the rotary method of drilling a drill bit is passed into the earth and is rotated by means of a string of pipe known as the drill stem. This stem is made up of a plurality of sections which are coupled together as the drilling operation proceeds. In order that these sections may be firmly and securely screwed together without undue loss of time it is usual to provide a tong which is mounted on the rotary table. This table is arranged to be rotated by power and is used to impart rotation to the drill stem during the drilling operation. When a tong is mounted on the rotary table the portion of the drill stem already in the bore is held immovable. The tong then grasps the section which is to be coupled onto the drill stem and the rotary table is turned until the two sections of the drill stem have been coupled together. However, when the coupling is entirely made up the torque or rotation of the tong should cease in order to prevent stripping the threads on the tool joint coupling.

Various types of tongs have been provided with the idea of releasing either the tong or the rotary when the joint is made up. These prior devices, however, have not proven entirely satisfactory due to the fact that they do not automatically release at the proper time and are not mounted in a manner which will allow vertical flexibility of the tong as the threads are made up. The same tong is used in uncoupling or breaking out the tool joints when the drill stem is being withdrawn from the well.

The present invention is directed to the production of a tong and supporting post which will allow flexibility and ready manipulation of the tongs and at the same time insure positive operation and release of the tongs at all times. Fig. 4 shows a side elevation of the make-up post 2. This post is provided with a stud 3 arranged to be received in a socket 4 adjacent the periphery of the rotary table 5. A lug 6 is arranged to be adjusted on the post 2 by means of a set screw 7. This lug has a slot 8 formed therein which is adapted to receive the bolt 9, which in turn retains the subpost 10 in position. This subpost 10 may be a square piece of metal which is adapted to bear against the periphery 11 of the rotary table. In this manner when the set screw 7 is adjusted the post 2 is limited as to rotation with respect to the table 5. The subpost 10 may be adjusted radially by means of the slot 8 and the bolt 9 to accommodate its use to various sizes and types of rotaries now manufactured. If desired, however, the subpost 10 may be replaced by a subpost 10' illustrated in plan view in Fig. 5. This

subpost 10' has considerable length and is provided with an opening 13 to receive the bolt 9 and is formed with the fingers 14 which are adapted to engage against the side 11 of the rotary. In this manner the post 2 will be firmly held in position and the stress on the periphery of the rotary will be suitably distributed so that considerable torque may be placed upon the post 2.

The post 2, as seen in Figs. 3 and 4, is made up of two parts. The base 20 which carries the stud 3 extends above the rotary table 5 and is formed with a shoulder 21 and a spindle 22 of less diameter. This spindle 22 has a stop pin 23 inserted therein. The upper portion of the post comprises a head 25 which is formed with a slot 26 therein. This head 25 is arranged for limited pivotal movement upon the spindle 22, this movement being limited by the arc of the slot 26. The head 25 also carries a handle 28 which extends from the side thereof and may be grasped to rotate the head with respect to the base 20. Above the handle 28 the head has a horizontal opening 29 therein and an eye 30 on the upper end thereof. The opening 29 is arranged to receive a bolt or spindle 32 which is formed as a portion of the handle clamp 33. This clamp has two extending ears 34 and 35 which are arranged to receive the handle 40 of the tong therebetween. This handle 40 is retained in position by means of the pin 36 which is locked in position by a key 37. The bolt 32 is retained in position with respect to the head 25 by means of the nut 38 and the washer 39. Fig. 1 shows a sectional view of the head 25 and the handle clamp 33. The entire clamp 33 is mounted for tilting with respect to the horizontal due to the fact that the bolt 32 is permitted to rotate in the opening 29. In this manner when the tong is clamped in position and the joint or pipe connection is being made up or broken out, the vertical movement of the pipe, which is gripped by the tong due to the threading or unthreading of the connection, will cause pivoting of the clamp 33 with respect to the head 25. This pivoting is restrained, however, by a spring 42, which is placed upon a bolt 43 which passes through the brackets 44 and 45.

The bracket 44 is formed integral or rigidly affixed to the head 25, whereas the bracket 45 is formed as a part of the lower ear 35 of the tong clamp 33. The pin 43 passes through both of these brackets. Thus when the bracket 33, as seen in Fig. 3, tends to rotate the spring 42 will resist this rotation, as such rotation would cause the bracket 45 to move either in a clockwise or counterclockwise direction as viewed in Fig. 3. It seems apparent that the spring 42 tends to retain the clamp 33, and therefore the tong, in a horizontal position. A flange 48 is also formed on the clamp 33 and is provided with an opening 49, which is arranged to receive the set screw 50 illustrated in Fig. 1. By adjustment of this set screw 50, the movement of the handle 40 of the tong with respect to the pin 36 may be adjusted and in this manner the tong may be arranged to extend radially from the head 25 at the proper angle to grip about the pipe or drill stem in the center of the rotary table. When the tong is gripped by the clamp 33 the pin 23 and slot 26 allow the head 25 to rotate to an inoperative position and it is only necessary for the driller to push the tong in order to move it away from the center of the rotary table. It is believed that the make-up post here described permits sufficient flexibility to make it entirely satisfactory under practical conditions as the tong may pivot both horizontally and vertically and its movement is restrained in each direction so that it may be retained in the proper position and may be readily clamped onto the pipe or moved to inoperative position as desired.

The tong embodied in the present invention is best seen in plan view in Fig. 1 and embodies a handle 40 having a hook 52 pivoted thereon at 53 by means of the bolt 54. The hook 52, however, is different from those ordinarily employed and is arranged with a pivoted head 55. This head is mounted on the hook 52 by means of the pin 56 and is arranged for limited pivotal movement with respect to the hook 52, this movement being resisted by the spring 57 carried by a bolt 58, which is arranged to pass through a flange at 58' on the hook 52 and also through the portion 59 formed on the head 55. This spring 57 is retained in compression by the nut 60. The head 55 is formed with an arcuate face 61, which is crowned at 62 so that the head may rock vertically with respect to the pipe being engaged and still retain its grip. The head 55 is provided with a plurality of openings 63 so that an adapter such as 64 in Fig. 2 may be placed upon the face when it is desired to use the tong for different sizes of pipe. A handle 65 is carried by the head 55 to assist in its manipulation. This arrangement gives a certain amount of life to the hook 52 so that it tends to remain in contact with the pipe at all times.

A jaw 67 is also pivoted on the hook 52 intermediate the bolt 54 and the pin 56 by means of the bolt 68 and carries a die 69 which is adapted to engage the pipe on the side opposite to that engaged by the face 61 of the head 55. The pivoting of the jaw 67 is controlled by means of the finger 70 and the hammer 71. These two members are spaced apart to form an arcuate slot 72 which is arranged to receive the roller 73 mounted on the striker 74. A spring 77 is restrained against an ear 78, which is formed on the handle 40 and an adjustable nut 79 which is carried by the bolt 80. This bolt is pivoted at 81 to the heel 82 of the striker 74 which is made up of a substantially triangular member, one point of which is pivoted at 83 to the handle 40. It seems apparent with this structure that any movement of the roller 73 will cause pivoting of the striker 74 about the bolt 83 mounted on the handle and if the movement be clockwise about the pin 83 the spring 77 will be compressed. The hammer 71 is provided with a flat end 85 and is specially formed at 86 so that the sleeves 73 will pass out of the slot 72 at the proper instant when the tong is being used.

The operation of the tong is as follows: The driller will grasp the handle 65 and swing the tong toward the pipe which is to be gripped between the die 69 and the face 61. The nose 88 of the head 55 will strike against the periphery of the pipe. The spring 57 will be somewhat compressed by this impact and allow the head 55 to move backward and the tong will pass about the pipe so that it will be properly engaged. The spring 57, however, snaps the head 55 about the pipe and retains it in this position so that it may not rebound from the pipe. This rebounding from the pipe is one of the serious defects of tongs which are now in use. When the tong is not gripping the pipe the roller 73 presses against the finger 70 due to the compression of the spring 77 and retains the die 69 in a retracted position. When the operator swings the tong about the pipe, however, the pivoting

of the hook 52 causes movement with respect to the handle 40. This movement, due to the fact that the jaw 67 is carried by the hook 52, moves the roller 73 in the slot 72. When the handle 40 is moved in a clockwise direction about the pipe which is gripped between the face 61 and the die 69 the hock 52 and the head 55 tend to remain stationary. By adjustment of the nut 79 the desired tension may be placed upon the spring 77 which, by means of the roller 73, controls the pivoting movement of the jaw 67. As the handle 40 continues in its clockwise rotation, due to the rotation of the post 2 and the rotary 5, the die 69 and face 61 grip the pipe and rotate it with the tong. However, when the threads are entirely made up the resistance on the face 61 and the die 69 increases to a point where they become equal to or greater than the compression of the spring 77. Inasmuch as the operator or driller is unable to determine the exact instant at which the joint is entirely made up the rotary 5 usually continues its movement and, in order to avoid stripping the threads, the torque which may be exerted on the handle 40 is controlled by the compression and adjustment of the spring 77.

When the joint is entirely made up the hook 52 ceases to rotate with the handle 40 but begins to pivot on the pin 54. This pivoting movement carries the bolt 68 in a counterclockwise direction about the pin 54 which in turn moves the hammer 71 in a counterclockwise direction with respect to the roller 73. If the rotation of the handle continues the torque thereon is greater than the compression which has been set on the spring 77. The roller 73, therefore, travels along the face of the hammer until it reaches the point 86. During this traveling movement it tends to compress the spring 77. However, when the roller 73 reaches the point 86 it is released from the slot 72 and the handle 40 is then free to pivot with respect to the hook 52. The compression which has been caused on the spring 77, however, moves into play instantly before the handle 40 can pivot away from the jaw 67. The roller 73, therefore, strikes a hammerlike blow upon the face 85. This blow pivots the jaw 67 about the pin 68 and withdraws the die 69 from its contact with the pipe. In this manner the tong is entirely and positively released from the pipe. The release is instantaneous and will occur automatically due to the particular construction of the hammer face 85 and the roller 73.

It is to be understood that during the foregoing operations the stop lug 90 will be moved to the dotted line position at 91 in Fig. 1 and will not interfere with the pivoting movement of the jaw 67. This stop lug 90 is only used when the tong is to be used for breaking out or unscrewing the tool joints or pipe coupling. When this lug is moved to the position illustrated by the full lines in Fig. 1 it then prevents any pivotal movement of the jaw 67 and for all practical purposes the entire tong becomes a rigid structure with the exception of the limiting movement of the head 55. The tong may then be used to unscrew the threads as desired and the use of the make-up post 2 may be employed to drive the handle 40 in a counterclockwise direction.

From the foregoing description it will be apparent that a power driven automatic release make-up tong has been provided which will prevent stripping of the threads and may be adjusted to release at any predetermined torque so that the joints and couplings will not be made up at a stress exceeding that for which they are designed but yet will not be loose as all the joints will be made up uniformly. The head 55 will be made up in various sizes to accommodate different sizes of pipe and may be attached to the hook 52 very readily. Another adjustable feature is the adapter 64 which may be connected to the head 55 as desired. The provision of the spring 57 to allow sliding movement of the head 55 is a very important feature as it adds life to the tong and causes it to grip the pipe at all times and allow the tong to be swung against the pipe and also assist in throwing the tong away from the pipe when the jaw 67 is automatically released. With other tongs of this type, if and when the jaw releases, the tong is not thrown away from the pipe and very often grips the pipe before it can be removed by the driller, but with my improved tong the spring 57 tends to throw the tong away from the pipe when the hammer blow is struck by the roller 73.

Particular attention is directed to the fact that the jaw 67 is pivoted on the hook 52 and not upon the handle 40. It is due to this arrangement that the hammer blow may be forcibly struck when a predetermined torque has been exerted upon the joint being made up. Still another important feature of the invention is the fact that the die 69 and the face 61 are both crowned to allow the tong to tilt vertically with respect to the pipe which is being gripped. In this manner the hold of the tong upon the pipe will not be effected due to the fact that the pipe moves several inches while the pipe is being made up. The swinging movement of the tong is limited, first, by the movement of the subpost with respect to the periphery of the rotary table. It is also limited by the arc of the slot 26, and the pin 23, and, thirdly, by adjustment of the screw 50 which limits the movement of the handle 40 with respect to the clamp 33. With these various adjustments it is possible for a driller to obtain any desired position of the tong which is necessary and which will comply with the various other conditions existing about the ring.

The die 69′ illustrated in Fig. 2 has the teeth thereof in a position such that it may be used for unscrewing or breaking out the tool joints or couplings. The die 69, however, may be used for this purpose and it is intended that the dies may be interchangeable in the jaw 67. These dies are preferably of greater width than the head 55 or jaw 67 so that they will give a greater bearing area on the surface of the pipe and will not disfigure or cut into the pipe. The plurality of openings 41 in the handle 40 allow the placement of the bolt 36 in position to determine the angularity of the tong with respect to the pipe engaged or to accommodate different sizes of rotary tables. The size of the handle 40 is such that it may normally pivot about on the pin 36 for a limited distance during the manipulation of the tongs.

Having thus described my invention what I claim as new is:

1. A combination make-up and break-out tong including a handle, a hook pivoted thereto, a head and jaw both pivoted to said hook, said head and said hook opposing each other in gripping a pipe, and cam means to move said jaw upon relative pivoting of said handle and hook.

2. A combination make-up and break-out tong including a handle, a hook pivoted thereto, a head and jaw both pivoted to said hook at differ-

ent distances from the hook pivot, a releasable connection between said jaw and handle, and spring pressed means to release said jaw connection when a predetermined torque is exerted thereon.

3. A combination make-up and break-out tong of the character described and including a handle, a hook, and a plurality of opposed spring pressed means to engage and disengage the pipe, said means being independently operable and adjustable.

4. A tong including a handle, a pipe engaging clamp pivoted to one end thereof, a jaw pivotally connected to the handle and arranged to engage the pipe held by said clamp, means for holding said jaw in engagement with the pipe said holding means being mounted to yield to release said jaw when a predetermined resistance is encountered by said jaw and other means adapted to lock said jaw to prevent such release of the jaw from the pipe.

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