Oct. 27, 1970

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3,535,960

TUBING WRENCH

Filed April 26, 1968

3 Sheets-Sheet 1

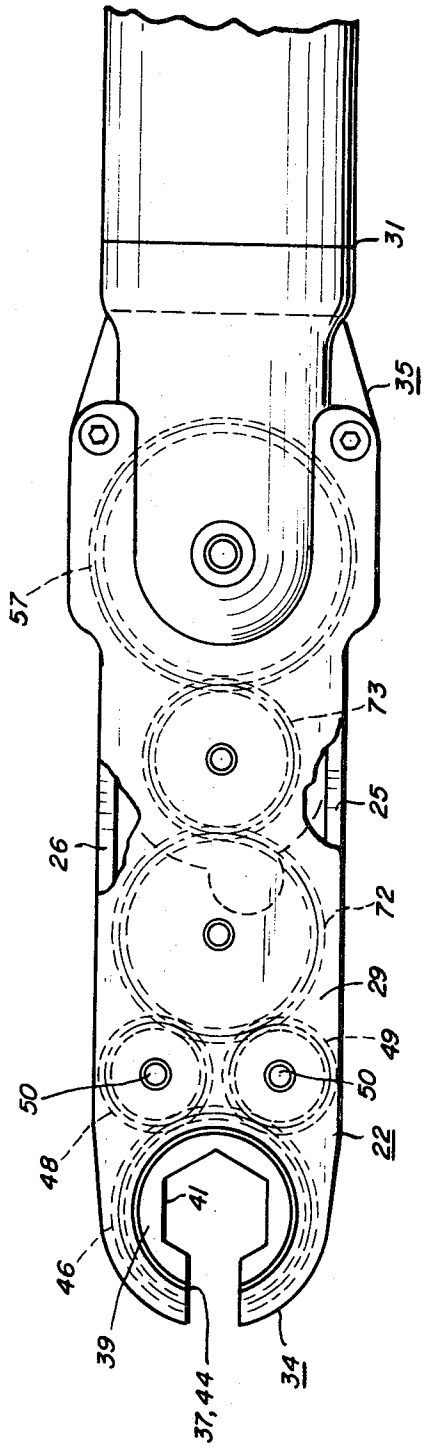


FIG. 2

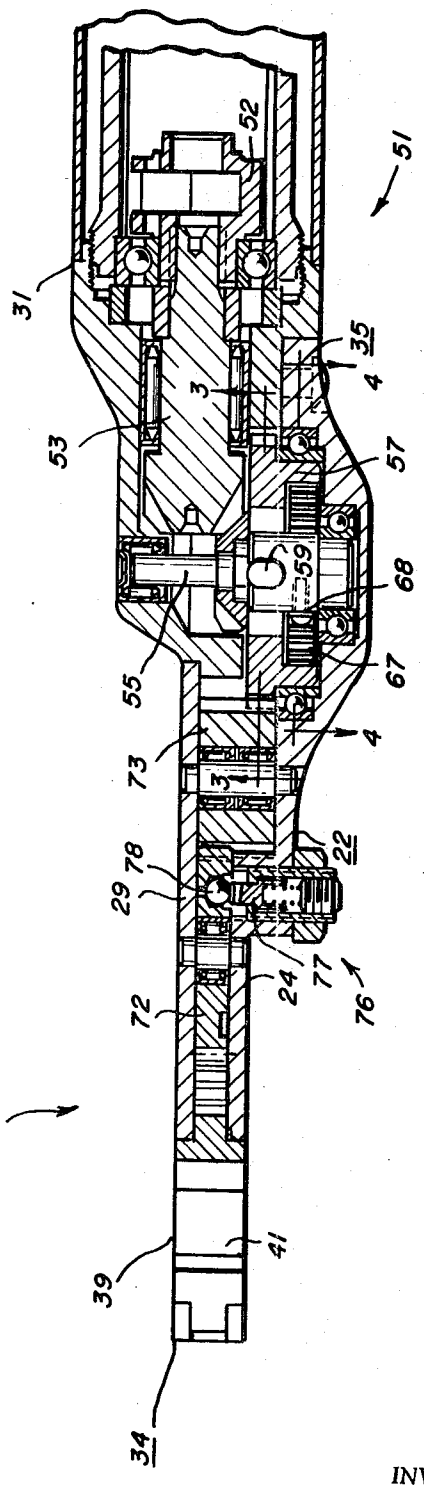


FIG. 1

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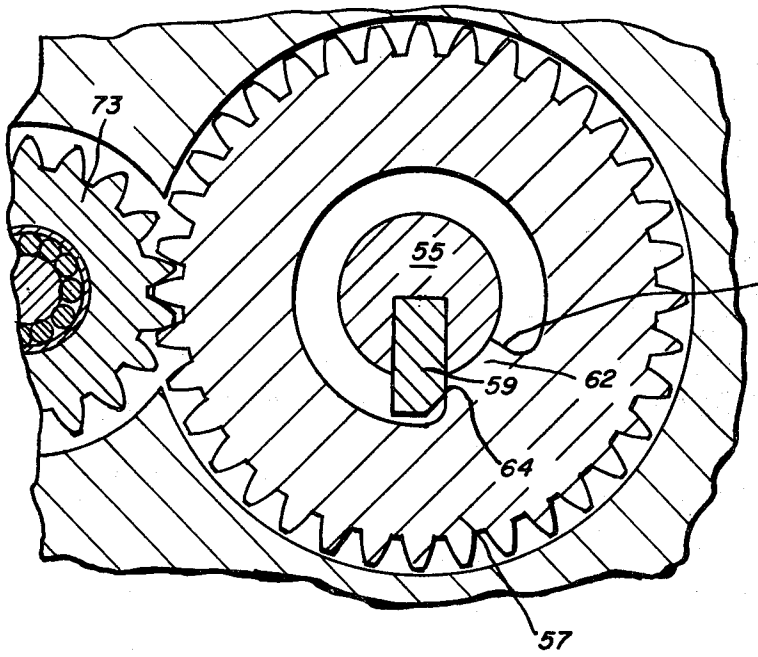


FIG. 3

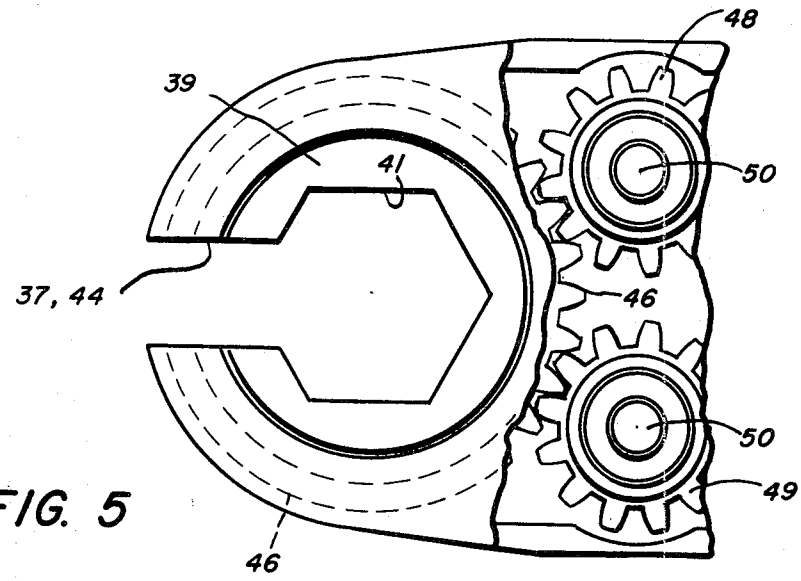


FIG. 5

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FIG. 4

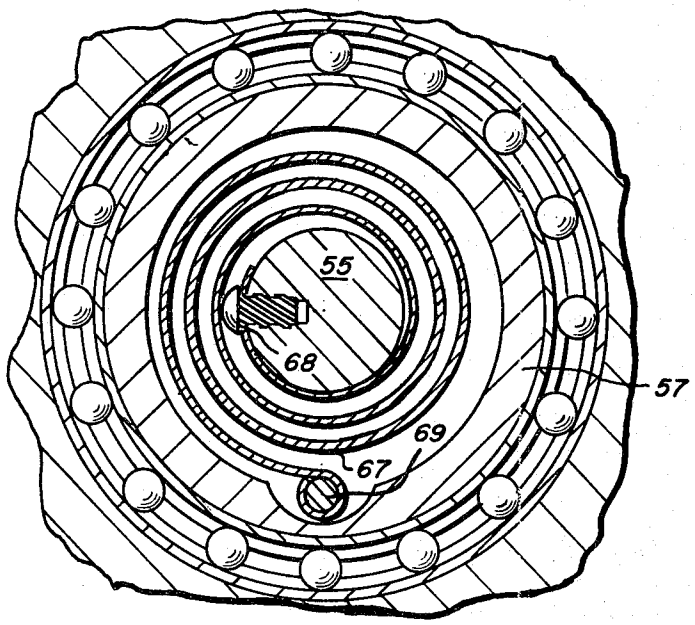


FIG. 6

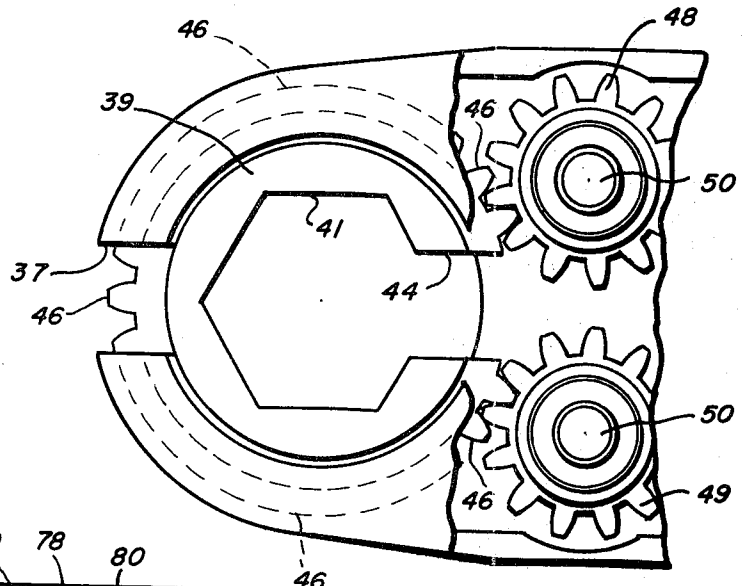
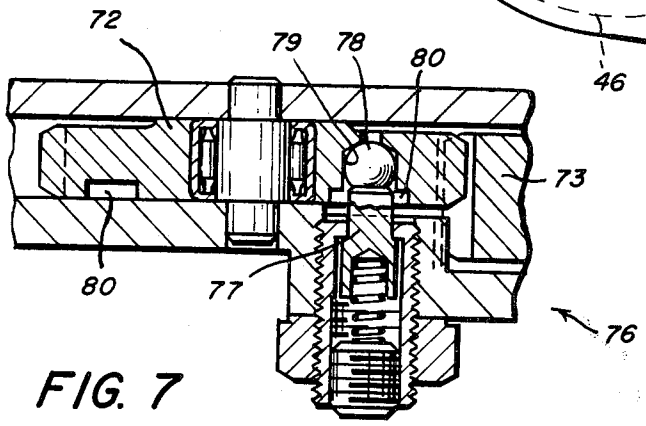


FIG. 7



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TUBING WRENCH

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Int. Cl. B25b 13/00, 17/00, 21/00
U.S. Cl. 81—57.14 8 Claims

ABSTRACT OF THE DISCLOSURE

A tubing wrench including a housing which has a socket member rotatably mounted in an end portion thereof and having a starting position whereat a slot extending through the wall of the socket member is aligned with a corresponding slot in the end of the housing to permit access of the socket onto a length of tubing or other continuous conduit. The two idler gears are adapted to engage external teeth on the socket member and are spaced apart a distance at their points of engagement with the socket member teeth greater than the width of the slot in the socket member so that there is always driving engagement from the motive power source to the socket member. Detent means are provided between the housing and one of the drive train gears so as to sense the starting position hereinabove mentioned. An energy storing device such as a clock spring is connected in the drive train so that there is a given amount of winding up of the spring when the device is first actuated before driving engagement is effected. Upon stopping of the motive power means, the wound spring continues rotation of the main drive gear and the rest of the drive train until the detent is engaged whereat the slots in the housing and the socket member are again aligned.

Prior art devices relating to the present subject have been extremely awkward to operate and have many inherent disadvantages. A difficulty with prior art devices of this type is that the workman must rotatably move the socket to a position where the slot therein will line up to withdraw the wrench from the tubing after deactuation of the device. The present invention provides an extremely reliable driving mechanism from the motive power source to the driven socket and differs from many prior devices in its continuous rotating operation. The present device also demonstrates a means for automatically returning the open end of the socket to a starting position when the motive power means is shut off, where it can be simply drawn off of the tubing or conduit member with which it is associated.

FIG. 1 is an elevational view in section of the present invention;

FIG. 2 is a plan view of FIG. 1;

FIG. 3 is a view taken generally along the line 3—3 of FIG. 1;

FIG. 4 is a view taken generally along the line 4—4 of FIG. 1;

FIG. 5 is an enlarged view of the left end of the wrench shown in FIG. 2 with parts broken away to show the driving engagement of the socket member;

FIG. 6 is a view similar to FIG. 5 but showing the socket member in a different rotative position with respect to the housing; and

FIG. 7 is an enlarged view of the detent means shown in FIG. 1.

The tubing wrench of the present invention has been indicated generally by the reference numeral **20** and as will be seen from the drawings, includes in combination a housing **22** which has first and second end portions **34** and **35**, respectively. The housing is comprised essentially of a bottom plate **24** which has first and second side walls **25** and **26** which are integrally secured thereto and which extend at generally right angles thereto. A top plate **29** serves to close and cover the cavity defined by the bottom plate **24** and its attached side walls **25** and **26**. The housing **22** also includes, at the second end portion **35**, a gear and motor housing **31** appropriately secured thereto. The first end portion **34** of the housing **22** is provided with wall means which define a slot **37** which extends generally longitudinally a short distance into the housing in a direction toward the second end portion **35** of the housing. This slot or opening **37** may be said to extend axially into the housing. The slot **37** opens up into what will be referred to as a circular opening which serves to rotatably support an annular nut driving socket member **39**. This socket member **39** is provided with socket engaging walls **41** on the inner annular surface thereof. These walls **41**, as shown in this particular embodiment, are hexagonal in shape to appropriately accommodate and manipulate a hexagonal nut. Different sizes of hexagonal sockets or different shapes will be used to accommodate various sizes and types of nuts. The socket member **39** is also provided with walls which define a slot **44** which extend generally radially through the wall of the socket member and is about the same width as the slot **37** in the housing. The socket member **39** is provided with a plurality of circumferentially spaced gear teeth **46** on the outer pehiphery thereof and these gear teeth **46** extend completely around the periphery of the socket member with the exception of the slot **44**, as best seen in FIG. 6.

First and second idler gears **48** and **49** respectively are rotatably mounted by the housing on pivot members **50** and as will be seen, the teeth thereof are located in driving engagement with the gear teeth **46** on the socket member **39**. The circumferential distance between the points or area of driving engagement of the first and second idler gears **48** and **49** with the gear teeth **46** is greater than the width of the slot **44**, or more technically, is greater than the distance across the slot in a circumferential direction defined by the gear teeth **46** (see FIG. 6).

The gear and motor housing **31** serve to house motive power means indicated generally by the reference numeral **51** which includes an air driven motor (not shown) which serves to drive an output spindle **52** which in turn drives a pinion **53** which drives a drive spindle **55**. As best seen in FIG. 3, the drive spindle **55** cooperates with a main drive gear **57** and serves to rotate the same by means of a driving pin **59** which cooperate with a driving lug **62** on the main drive gear **57**, which lug includes first and second abutments **63** and **64**, respectively. This will be clear from a description of the operation of the device as detailed hereinafter. The arrangement of the driving pin **59** and driving lug **62** permits limited relative rotation between the drive spindle **55** and the main drive gear **57**. As best seen in FIG. 4, an energy storing device in the nature of a clock spring **67** surrounds the lower end of the drive spindle **55**, as viewed in FIG. 1, and has one end **68** fixedly connected to the drive spindle **55** and has the other end **69** fixedly connected to the main drive gear **57**. This clock spring has been pre-wound to a desired degree.

As best seen in FIG. 2, first and second power train gears **72** and **73**, respectively, are rotatably mounted by the housing **22** and are in driving engagement with each other, with the first power train gear **72** being in driving engagement with the first and second idler gears **48** and **49** and the second power train gear **73** being in driving engagement with the main drive gear **57**. The particular mounting of each of the gears and shafts which have been referred to hereinabove will not be described in any

greater detail and will be apparent to those skilled in the art.

As best seen in FIG. 7, detent means **76** are provided and act between the housing **22** and the power train gear **72** so as to locate the tool including the socket **39** in a starting or inactive position. The detent means include a spring biased plunger **77** carried by the housing, which serves to constantly urge a ball detent **78** into an opening **79** in the underside of the first power train gear **72**. The underside of the gear **72** is also provided with an annular track **80**. When the gear train is caused to operate upon actuation of the motive power means **51**, the detent means is rendered ineffective and the gear **72** rotates relative to the detent means **76** with the ball detent **78** traveling in track **80**, or more specifically the track **80** travels relative to the ball detent **78**. It will be appreciated that the detent means **76** may assume many forms and for example might act on the socket member itself as distinguished from one of the drive gears.

The operation of the device is as follows. Assume that the tool is in the starting position as shown in FIGS. 1 through 5, with the motive power means deactuated. In this condition with the slot **44** in alignment with the slot **37**, the tool is manipulated by an operator so as to pass the slots **37** and **44** over a piece of tubing so as to locate the tube within the confines of the socket engaging walls **41**. The tool then is moved so as to move the socket engaging walls **41** in the axial direction of the tubing so as to pass the hexagon shaped socket walls **41** into engagement with a hexagonally shaped nut (not shown) to either be tightened or loosened. When the motive power means are actuated, the drive spindle **55** is caused to rotate (counterclockwise as seen in FIG. 3), moving the driving pin **59** into engagement with the abutment **64** which causes rotation of the main drive gear **57** with subsequent rotation of the other gears in the drive train and rotation of the annular nut driving socket member **39**. This causes appropriate rotation of the nut. Upon initially actuating the motive power means **51**, the relative movement of the drive spindle **55** in traveling to the position shown in FIG. 3 to engagement with the abutment **64** causes further winding of the clock spring **67** which does not cause movement of the drive train because the force of the detent means **76** is sufficient to retain the gear train in the given position. Engagement of the driving pin **59** with the abutment **64**, however, overcomes the action of the detent means **76** and causes rotation of the drive train.

After the nut has been tightened, the motive power means are deactuated and it will be appreciated that the stopping of the socket member may occur at any angular position. For example, it may occur at the position shown in FIG. 6. The tubing wrench is then moved axially so as to draw the hexagonally shaped walls **41** off of the nut which has been tightened. However, with the socket member **39** in the position shown in FIG. 6, it will be observed that normally it would be impossible to withdraw the tool from the tube. The pre-wound clock spring **37**, however, is of sufficient force to cause the main drive gear **57** to continue to rotate with subsequent rotation of gears **73**, **72**, **48**, **49** and socket member **39**. This rotation continues until the ball detent **78** of the detent means **76** locates itself in the opening **79** in power train gear **72**. This continued rotation will cause the pin **59** to be spaced from abutment **64** toward abutment **63**. This position has been designed to come into effect when the socket member has reached the position shown in FIGS. 2 and 5 which is the starting position of the device and at this position the tool can then be withdrawn from the tubing as desired.

It will be appreciated by those skilled in the art that the socket member **39** will normally be rotated in a given direction by the motive power means to tighten or loosen a nut. In order to reverse the rotation of the nut with the same rotation of the socket member all that need be done is to rotate the tool 180 degrees about its longitudinal axis to present the opposite side of the socket member to the nut.

As a result of the above described structure, operation and result, it will be readily apparent that the advantages pointed out hereinabove are readily accomplished. It will be seen that by the use of the drive train and particularly the cooperation of the idler gears **48** and **49** with the socket gears **39**, that a reliable driving of the socket member **39** results. The positioning of the idler gears **48** and **49** is such that it will bridge the width of the slot **44** in the socket member **39**, assuring that no more than one of the idler gears will be located in the space of the slot **44** upon rotation of the socket member **39**. The energy storing device in this embodiment, specifically a clock spring **37**, which is interposed in the gear train and acts between the gear train and the housing, serves in combination with the detent means **76** to automatically return the socket member **39** to its starting position shown in FIGS. 2 and 5.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A power driven tubing wrench comprising, in combination, an elongate housing having first and second end portions, wall means at said first end portion of said housing defining a housing slot extending generally longitudinally a short distance toward said second end portion and into said housing, an annular fastener driving socket member rotatably mounted in said housing at said first end portion of said housing and having fastener engaging means on the inner surface thereof, wall means defining a generally radially extending socket slot through said annular fastener driving socket member, said socket member having circumferentially spaced gear teeth on the outer periphery thereof terminating on either side of said socket slot, first and second idler gears rotatably mounted by said housing and being positioned for driving engagement with said gear teeth on said socket member, the circumferential distance between the points of driving engagement of said first and second idler gears with the gear teeth on said socket member being greater than the width of said socket slot, motive power means located in said second end portion of said housing and including a motor operably connected to a drive spindle and effective to drive said spindle in one direction, a main drive gear coaxial with said drive spindle, a driving pin carried by said spindle, a driving lug carried by said main drive gear and engageable with said driving pin to permit relative rotation of less than 360° between said drive spindle and said main drive gear, a spring member having one end connected to said drive spindle and another end connected to said main drive gear, said spring biased to urge said main drive gear in the same direction as said one direction of rotation of said spindle, an intermediate gear connecting said main drive gear and said idler gears, detent means acting between said housing and said intermediate gear and which, when engaged in the inactive position of the tool, locate said socket and housing slots in alignment, whereby activation of said motor will drive said drive spindle in said one direction to further bias said spring until said driving pin and lug make contact to drive said main drive gear, intermediate gear and idlers to drive said socket in said one direction and whereby, when said motor stops and said socket is removed from said fastener, said spring will unwind to drive said main drive gear, intermediate gear, idler gears and said socket in said same one direction until said detent means stop said spring movement and said socket and housing slots are aligned.

2. A power driven tubing wrench compising, in combination, an elongate housing having a source of rotary power at one end and a rotatable socket for detachable connection to the fastener to be rotated at the other end, said socket and said housing each having an open slot which slots, when aligned by rotation of said socket, will provide a passage into said socket from ouside said housing, and drive means operably connecting said rotatable socket and said rotary power source whereby rotation of said power source in one direction will rotate said socket in one direction, said drive means including a first driven member rotated in said one direction by said power source, a second driven member coaxial with said first driven member, a detent and lug located on said first and second driven members in interfering position to permit relative rotation thereof less than 360°, a bias member interconnected between said first and second driven members to urge said second driven member in said one direction relative to said first member, intermediate gear means operably connecting said second driven member to said rotatable socket and detent means (1) effective to stop movement of said intermediate gear means at a predetermined angular position corresponding to the aligned positions of said socket and housing slots when said intermediate gear is moved solely by said bias member but (2) ineffective to stop said intermediate gear when driven by said rotary power source, whereby rotation of said drive means by said power source in said one direction will continuously drive said socket in said one direction and whereby, when said power source stops and resistance to further rotation of said socket in said one direction is removed, said bias means will move said second driven member, said intermediate gear means and said socket in the same direction until said detent means stops said movement.

3. The power driven tubing wrench of claim 2 wherein said rotary power source is a fluid motor having an output shaft operably connected to said first driven member.

4. The power driven tubing wrench of claim 2 wherein said detent means comprises a member secured relative to said housing and positioned to interfere with free rotation of said intermediate gear at said predetermined angular position thereof, with said interfering force sufficient to prevent further rotation of said intermediate gear beyond said predetermined angular position when driven

solely by said bias means but insufficient to do so when said rotary power source is driving said drive means.

5. The power driven tubing wrench of claim 4 wherein said member secured relative to said housing is a spring biased element effective to create an interfering force effective to overcome the driving force of said bias member but ineffective to overcome the driving force of said rotary power source.

6. The power driven tubing wrench of claim 2 wherein said bias member interconnected between said first and second driven members is a coil spring having its opposite ends connected to said first and second driven members and arranged so as to bias said second driven member in the said one direction of rotation of said first driven member.

7. The power driven tubing wrench of claim 2 which further includes a pair of idler gears interconnecting said intermediate gear and said rotatable socket, said idler gears in driving engagement with the external periphery of said socket and spaced apart a distance, measured along the periphery of said socket, greater than the width of said socket slot.

8. A tubing wrench for threaded fasteners and driven by an air motor comprising, in combination, a housing containing an air motor and an annular rotatable socket journalled for rotation in the one end, said one end of said housing and said socket each having an open slot extending radially into the socket interior, drive means connecting said air motor to said rotatable socket to rotate said socket in one direction, and auxiliary drive means incorporated in said drive means and actuated upon stopping rotation of said air motor and upon release of said socket from the fastener being driven and effective to further rotate said socket in said one direction to a position with its slot in alignment with said housing slot.

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JAMES L. JONES, JR., Primary Examiner

U.S. Cl. X.R.

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