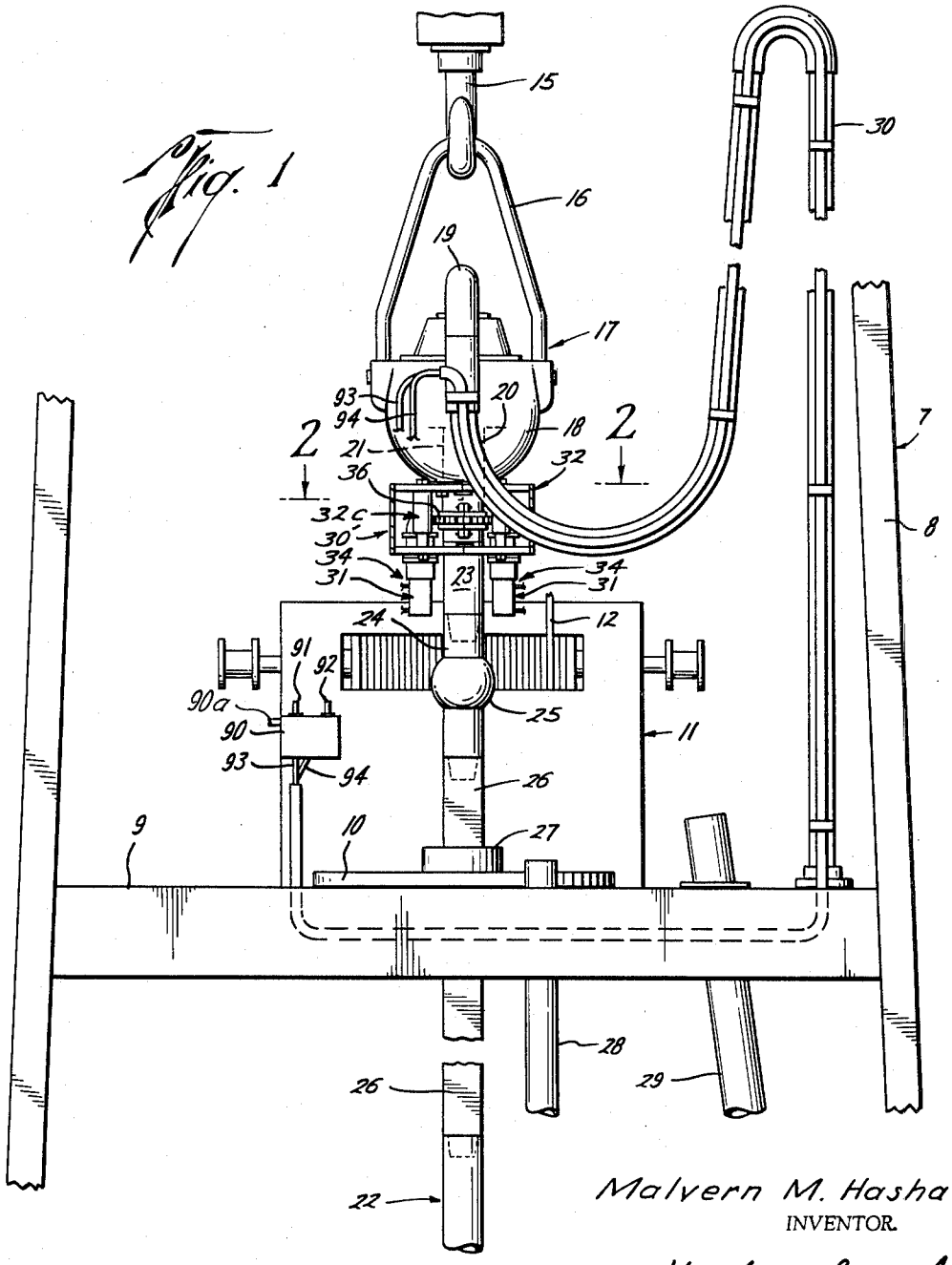
Aug. 11, 1964 M. M. HASHA 3,144,085

POWER SPINNER UNIT FOR WELL SWIVELS

Original Filed April 12, 1962 4 Sheets-Sheet 1

Fig. 1



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POWER SPINNER UNIT FOR WELL SWIVELS

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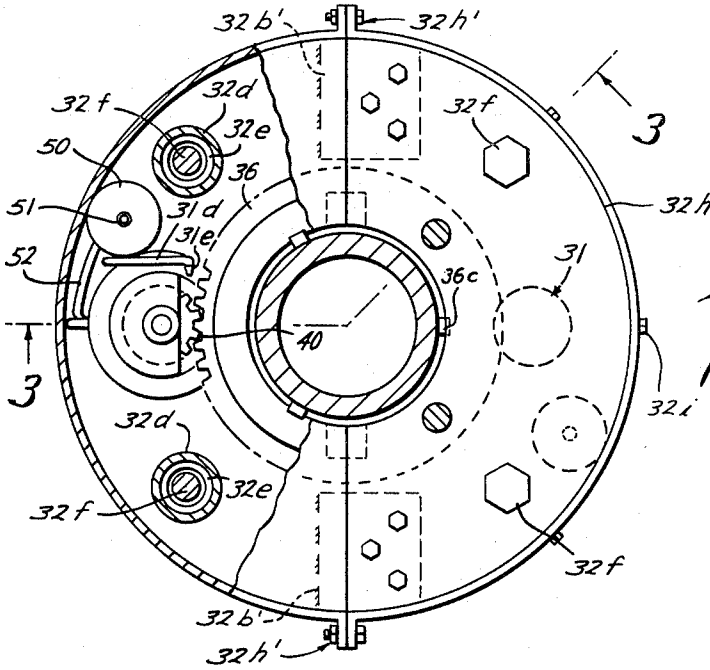

Fig. 2

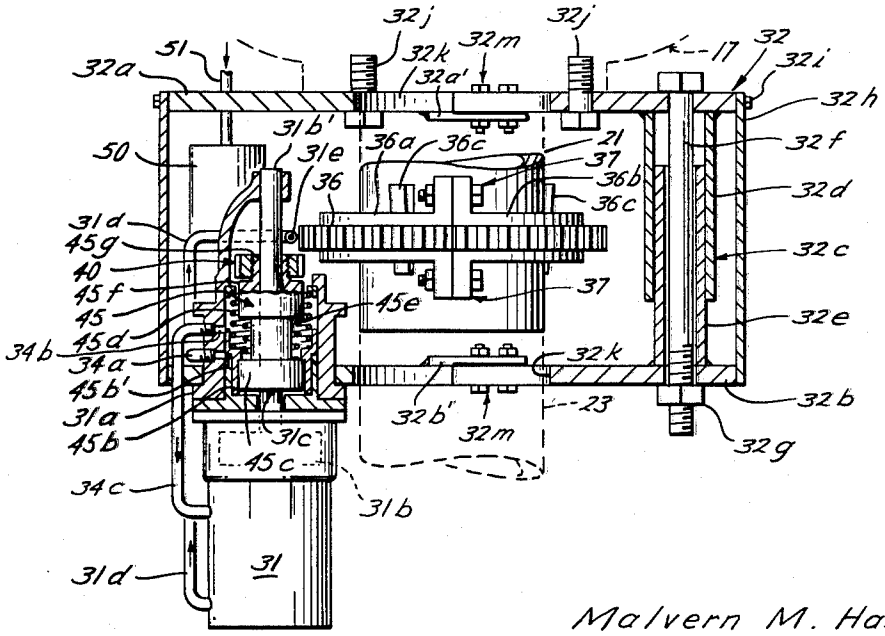

Fig. 3

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POWER SPINNER UNIT FOR WELL SWIVELS

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Fig. 4

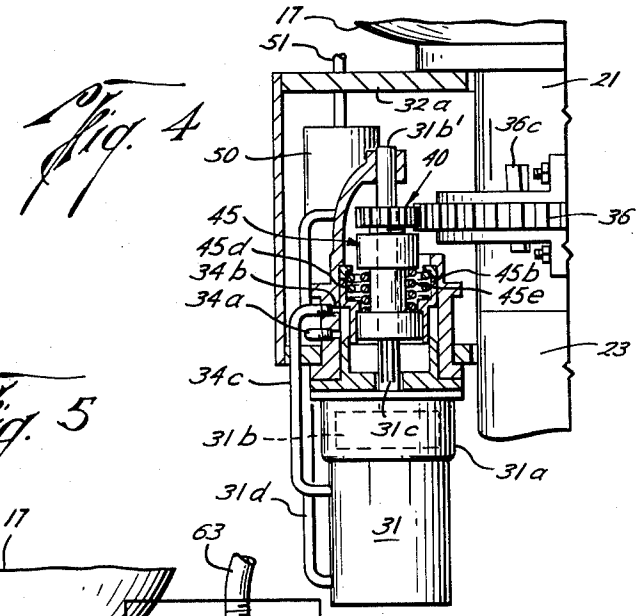
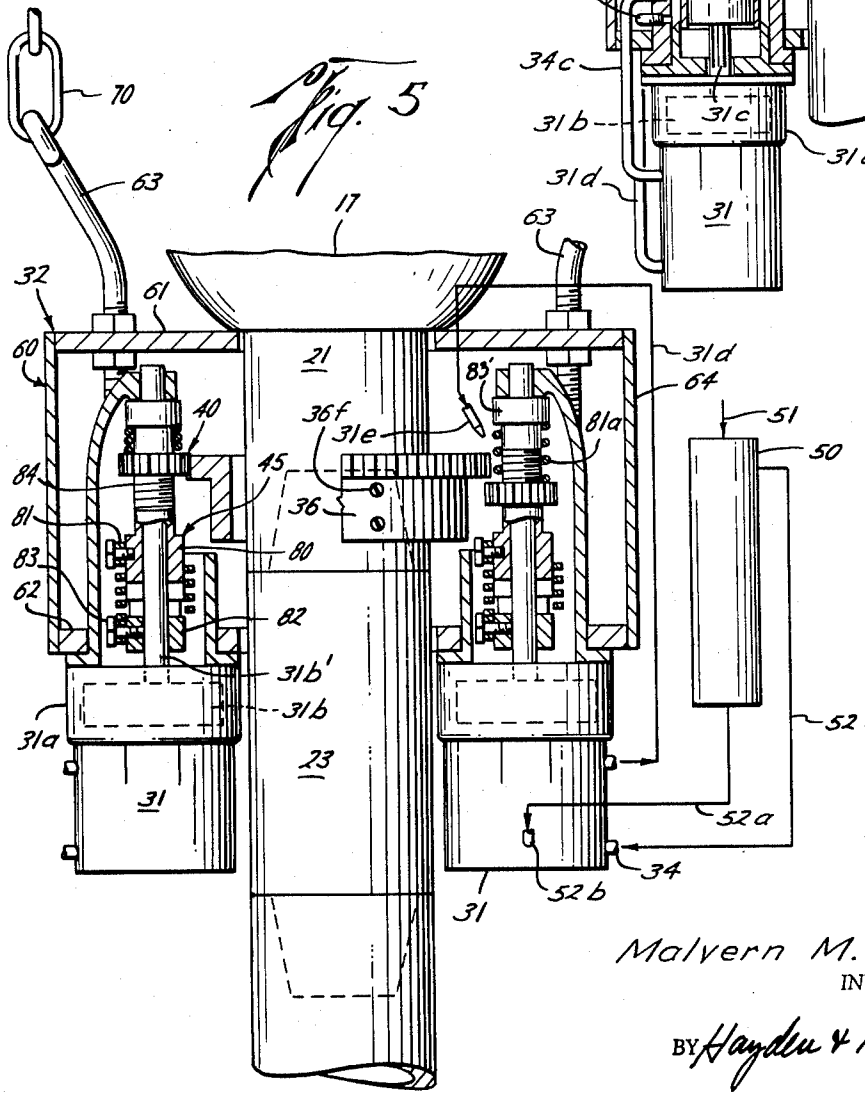


Fig. 5



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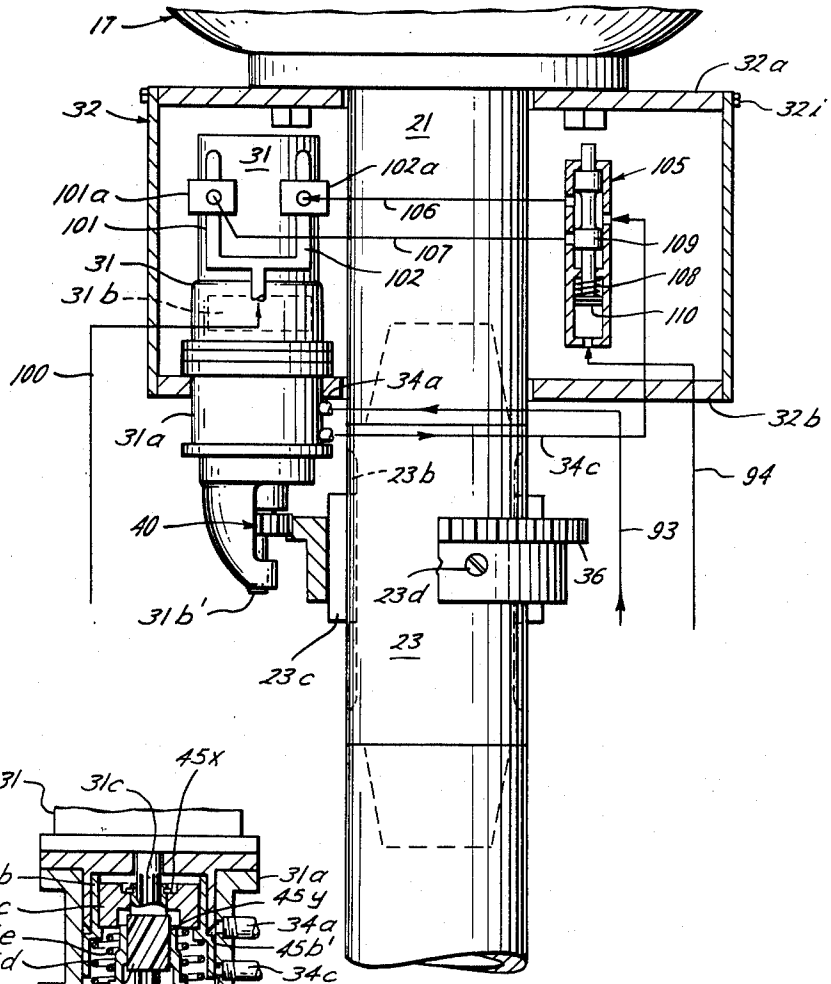
POWER SPINNER UNIT FOR WELL SWIVELS

Original Filed April 12, 1962 4 Sheets-Sheet 4

Fig. 6



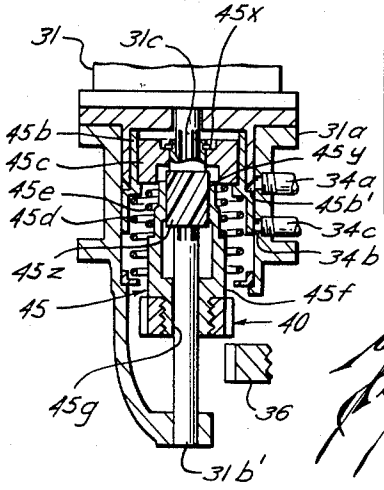


Fig. 7

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United States Patent Office 3,144,085 Patented Aug. 11, 1964

3,144,085

POWER SPINNER UNIT FOR WELL SWIVELS

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Original application Apr. 12, 1962, Ser. No. 187,059. Divided and this application Mar. 9, 1964, Ser. No. 350,164

17 Claims. (Cl. 173—164)

The present invention relates to a power spinner unit for well swivels and the like and a method of connecting and disconnecting tubular members in a well string.

This application is a division of my prior copending application bearing Serial No. 187,059, filed April 12, 1962, for "Power Spinner Unit for Well Swivels," and is entitled to the earliest filing date to which said copending application is entitled.

The present invention has particular utility in connection with its use on oil and gas well drilling swivels and will be described in greater detail in relation to such environment; however, it can be appreciated that it may have application in other situations.

In the drilling of oil, gas and water wells by the rotary method, a well bore is cut in the earth by a drill bit that is suspended on a string of pipe, and as the hole is progressively deepened, additional sections of pipe are added to the pipe string.

At the present time, in order to connect additional pipe sections into the well string which is suspended in the well bore, rotation of the well string is stopped and the pipe section is then connected into the suspended well string by use of a "spinning line" and tongs in a manner well known in the art. This operation can be dangerous to the personnel on the drilling rig platform.

Under certain well conditions, it is necessary or desirable to maintain rotation of the well string at all times in order to inhibit sticking of the well string in the well bore, and in some instances, the well string has been known to become stuck in the well bore in a relatively short interval, such as a fraction of a minute. With the present manner of connecting and disconnecting well pipe in a pipe string, it is impossible to continue rotation of the suspended well string while connecting a pipe section therewith. Thus, the present manner of connecting and disconnecting pipe in a well string enhances the possibility of the well string becoming stuck in the well bore.

Additionally, the manner of connecting the pipe sections in the well string at the present time is extremely time consuming and expensive. Not only is the manner of connecting the pipe sections into the well string time consuming, but when the well string is removed from the well bore to replace a bit or to perform testing or other operations in the well bore, the sections of well pipe must be unthreaded and disconnected from the well string as the well string is recovered from the well bore. In this instance, the sections of pipe are unthreaded from the well string by means of the tongs or rotary in the manner well known in the art so that the manner of unthreading or releasing the pipe sections from the well string also is extremely time consuming.

The present invention has for one of its primary objects a method of connecting and disconnecting pipe sections in a suspended well string which does not interfere with continued rotation of the suspended well string as the connecting and disconnecting of the pipe sections is accomplished.

Still another object of the present invention is to provide an apparatus in connection with a swivel whereby the spindle of the swivel and tubular member connected therebelow may be rotated so as to threadly connect or disconnect pipe sections in a well string.

Yet a further object of the present invention is to provide a spinner unit for rotating the spindle of a swivel and a tubular member therebelow for connecting and disconnecting pipe sections in a well string, the spinner unit being constructed and arranged so that it automatically disengages from the swivel spindle when not in use so as to not interfere with normal use and operation of the swivel during drilling operations.

Still another object of the present invention is to provide a spinner unit for a swivel spindle whereby the swivel spindle may be rotated simultaneously and independently of continued rotation of the well string in a well bore whereby a tubular member supported by the swivel spindle may be either threadedly connected or disconnected into the rotating well string.

Still another object of the present invention is to provide a power spinner for the spindle of a swivel which is constructed and arranged to selectively engage and rotate the spindle in either a clockwise or a counterclockwise direction as desired.

Still a further object of the present invention is to provide a power spinner for a swivel spindle wherein a source of power is connected to operate the spinner, the power supply also functioning as a means to lubricate certain components of the spinner of the present invention.

Yet a further object of the present invention is to provide a spinner unit for rotating the spindle of a swivel which is normally disengaged from the spindle but which automatically engages with the spindle when power is supplied to the spinner unit.

Yet a further object of the present invention is to provide a spinner unit for rotating the spindle of a swivel which is normally disengaged from the spindle but which automatically engages with the spindle when power is supplied to the spinner unit and which spinner unit also functions to again disengage when power to the spinner unit is cut off.

Still a further object of the present invention is to provide a spinner unit for the spindle of a swivel which may be used for performing various operations on a well location.

Still a further object of the present invention is to provide a spinner unit for the spindle of a swivel which may be used for performing various operations on a well location and which may be easily and quickly positioned on the spindle and easily removed for repair or replacement when necessary.

Other objects and advantages of the present invention will become more apparent from a consideration of the following description and drawings wherein:

FIG. 1 is a partial elevational view of a drilling rig illustrating a form of the present invention on a swivel;

FIG. 2 is a sectional view, partly in elevation, on the line 2—2 of FIG. 1 illustrating further structural details of the embodiment illustrated in FIG. 1;

FIG. 3 is a sectional view on the line 3—3 of FIG. 2 to illustrate further structural details of the invention;

FIG. 4 is a partial, sectional view somewhat similar to FIG. 3 but illustrating the relationship of certain components of the invention when it is actuated to rotate the spindle of the swivel;

FIG. 5 is a view somewhat similar to FIG. 2 but enlarged and illustrating another embodiment of the invention;

FIG. 6 is of another embodiment showing one motor which is operable to rotate the kelly in either direction as desired; and

FIG. 7 is a sectional view of the support means for the gear means used in connection with the motor means shown in FIGS. 1–4 and 6 of the drawings.

Attention is first directed to FIG. 1 of the drawings wherein a conventional drilling rig is illustrated generally

by the numeral **7** which includes the mast portion or derrick **8** and the drilling platform **9** upon which is supported a rotary of any conventional form represented by the numeral **10**. The draw works and power equipment for the well is represented generally by the numeral **11**, the draw works including the reel or drum for winding and unwinding the cable **12**. The cable **12** is connected by means well known in the art over the crown block (not shown) which is located at the top of the drilling rig **7** to the traveling block (not shown) that is suspended in the derrick **8**. The traveling block is connected by suitable means well known in the art to the hook **15** that is in turn engaged with the bail **16** of the swivel represented generally by the numeral **17**.

In describing the present invention, it will be assumed that it is to be built and then mounted on a swivel of any type such as commonly employed; however, it can be appreciated that the components of the present invention may be integrally built with the swivel during its initial assembly or manufacture. Either construction would not depart from the scope of the present invention.

The bail **16** is connected to the housing **18** of the swivel **17** as represented in FIG. 1 of the drawings. The gooseneck **19** of the swivel is connected to a flexible line **20** whereby drilling liquids may be supplied from the supply line **30** through the flexible line **20**, gooseneck **19**, and then discharged through the swivel to the well pipe connected therebelow and represented generally by the numeral **22**.

The gooseneck **19** communicates interiorly of the swivel housing **18** with a spindle or stem **21** illustrated at dotted line in FIG. 1 of the drawings which projects from the lower end of swivel housing **18**. The spindle **21** is rotatably supported within the housing **18** by suitable bearing means, and it as well as the gooseneck **19** are provided with suitable seal means whereby fluid or liquid communicated through the line **20** and the gooseneck **19** is discharged through the spindle **21** and into the well pipe **22** without any appreciable fluid loss. A swivel sub **23** may be threadedly connected to the lower end of the spindle or stem **21** and to the sub **23** there is ordinarily connected the safety valve stem **24** and safety valve **25**.

The well string **22** for purposes of description includes a kelly **26** which is of noncircular configuration that is adapted to be received within the kelly bushing **27** seated in the rotary **10**. The well string **22** including tubular pipe sections are connected to and extend downwardly from the kelly **26** into the well bore. Rotation is imparted to the well string **22** including the kelly **26** by means of the rotary **10** in a means well known in the art, and as this rotation is accomplished, drilling liquid is supplied through the flexible line **20** and swivel **17** into the interior of the well string **22**. The spindle **21** is connected to the well pipe at the upper end of the valve stem **24** and it also rotates when the pipe string is rotated.

The supply line **30** may be supported on one leg of the drilling rig or may be mounted on the drilling platform **9** in any suitable manner as desired.

A mouse hole is represented at **28** and a rat hole is shown at **29**, both of which extend through the drilling platform. The mouse hole **28** and rat hole **29** may be formed of casing which is of a larger diameter than the drill pipe used in the drilling operations, and the mouse hole **28** is of a suitable length so as to receive a section of drill pipe therein. The mouse hole **28** is ordinarily positioned in close proximity to the rotary table **10**, and when it is desired to add an additional section of pipe to the well string **22**, the cable **12** is wound on the drum of the draw works, and this raises the traveling block and hook **15** as well as the swivel **17** and the well pipe **22** upwardly in the drilling rig. Such lifting is continued until the noncircular kelly has cleared the top of the rotary, whereupon slips are placed in the rotary **10**

around the tubular well pipe and the kelly **26** is disconnected from the end of the well pipe that projects upwardly above the rotary. The kelly **26** is then manually shifted over to engage the section of drill pipe in the mouse hole **28**, and the present invention may be actuated while a tong is positioned on the drill pipe in the mouse hole **28** so that the lower end of the kelly **26** is threadedly engaged with the section of drill pipe in the mouse hole **28**. The swivel **17**, kelly **26**, and engaged section of well pipe is then lifted vertically in the derrick so as to raise the section of well pipe from the mouse hole **28**, and the section of well pipe is then connected into the upper end of the well string **22** extending above the rotary **10**.

This is accomplished by vertically aligning the section of well pipe engaged with kelly **26** with the end of the pipe string projecting above the rotary table **10** and lowering the swivel **17**, kelly **26**, and well pipe connected therewith until this well pipe section abuts the upper end of the well string, whereupon the present invention may be actuated so as to rotate the swivel spindle **21**, kelly **26**, and connected well pipe section to threadedly connect it to the well string **22**. It is to be noted that while the above operations are being carried out, the rotary **10** may continue to rotate the suspended well string **22** in the well bore after the kelly has been disconnected therefrom and is being engaged with the additional section of well pipe in the mouse hole **28**. Also, the well string **22** may be continually rotated as the section of well pipe is threadedly connected thereto since the spinner of the present invention independently spins the spindle **21** of the swivel **17** as well as the hollow tubular noncircular kelly **26** and pipe section connected thereto.

When it is desired to remove the swivel **17** and kelly **26** so that other well operations may be performed, the kelly **26** may be broken or disconnected from the remainder of well string **22** by raising it above the rotary table and threadedly disconnecting the kelly **26** from the well string as above described. Thereafter, the kelly **26** and swivel **17** may be lowered and guided into the rat hole **29** which is more remotely located relative to the rotary **10** than the mouse hole **28** and retains the swivel **17** and kelly **26** in a position so as not to interfere with the other well operations to be carried out.

The spinner unit of the present invention may be used for threadedly disconnecting the kelly and pipe sections from the well string when removing the well string from the well bore as well as threadedly connecting the sections of well pipe into the well string in the manner as above described.

The present invention is referred to generally by the numeral **30'**, and in the forms illustrated in the drawings, it is shown as being assembled on the swivel **17** and the spindle **21** depending from the housing **18** of the swivel **17**.

Generally speaking, the invention includes motor means represented by the numeral **31** which is supported on the swivel **17** by any suitable means such as that represented generally at **32**. The motor is provided with a connection represented generally at **34** for receiving power from a power source (not shown) whereby the motor means **31** may be actuated. A ring gear **36** is adapted to be supported for rotating the spindle **21** and is illustrated in FIG. 1 of the drawings as being mounted on the spindle or stem **21** below housing **18**.

Gear means generally designated by the numeral **40** is operatively connected with the motor means **31** to be driven thereby and as better represented in FIGS. 3 and 5, the gear means **40** includes support means represented generally by the numeral **45** which aids in retaining the gear means **40** normally disengaged from the ring gear **36** as illustrated in FIG. 3 of the drawings and on the right-hand side of FIG. 5 of the drawings.

When power from the source is supplied through the connection **34** to the motor means **31**, the support means

45 and gear means 40 move to engage the gear means 40 with the ring gear 36 whereby rotation may be imparted to the swivel spindle 21 and kelly 26 connected therebelow.

One of the advantages of the present invention is that it normally is disengaged from the swivel spindle 21, and this enables the spindle 21 to be rotated in a manner well known in the art when the well string 22 and rotary 10 are rotating during drilling operations or other well operations. However, when it is desired to rotate the spindle 21 of the swivel 17, the present invention may be easily and quickly actuated to accomplish such function.

In FIG. 3 of the drawings, the support means 32 is illustrated in one form in greater detail and is shown as including an upper member 32*a*, a lower member 32*b*, and circumferentially spaced means 32*c* for retaining the upper and lower members 32*a* and 32*b* in a predetermined or desired spaced relationship. The means 32*c* is shown as including the tubular telescoping members 32*d* and 32*e* which are affixed respectively to the upper member and lower member 32*a* and 32*b* by any suitable means such as welding or the like as illustrated in the drawings. A bolt 32*f* extends through the members and is provided with a nut 32*g* for adjustment of the upper member 32*a* and lower member 32*b* relative to each other as may be desired or necessary so as to properly space or position the gear means 40 relative to the ring gear 36 on the spindle 21 to assure proper engaagement therebetween.

If desired, a suitable covering as represented at 32*h* may be secured by any suitable means such as bolts 32*i* to the upper member 32*a* to protect or cover the operating parts of the invention.

The support 32 may be held on the swivel 17 by any suitable means such as the threaded bolts 32*j* which extend through the upper member 32*a* and into the lower end of the swivel 17 as illustrated in FIG. 3 of the drawings. The upper member 32*a* and the lower member 32*b* are each provided with a central aperture 32*k* for receiving the spindle 21 which depends from the housing 18 of the swivel 17 and the spindle sub 23 threadedly connected into the lower end of the spindle 21 as represented in FIG. 3 of the drawings.

In some instances, it may be desirable to form the upper member 32*a* and lower member 32*b* into two half portionse as illustrated in FIG. 3 of the drawings. In this event, a plate or extension 32*a'* may be welded at each edge of one of the half portions of the upper member 32*a* and a plate 32*b'* may be welded at each edge of one of the half portions of the member 32*b* as shown in FIG. 3 of the drawings so as to overhang the edges of the other half portion of the members 32*a* and 32*b*, respectively. The two half portions of each member are then secured together by suitable means such as the nuts and bolts represented generally at 32*m*.

Similarly, the ring gear 36 may be formed in two half portions 36*a* and 36*b* which half portions are held together by suitable means such as the nuts and bolts designated generally at 37. The ring gear 36 may be held in position on the spindle 21 by any suitable means, and as illustrated in the drawings, removable wedges 36*c* are provided for fitting in between the spindle 21 and the ring gear 36. Thus, the ring gear 36 may be made to fit the largest spindle 21 normally encountered, and the wedge members 36*c* then used to hold the ring gear in position on the spindle 21. This construction also permits the ring gear 36 to be adjusted longitudinally of the spindle 21 so as to position it properly in relation to the gear 40 to enable proper engagement of the gear means 40 and ring gear 36 when the present invention is actuated.

The housing 32*h* may also be formed in two half portions as better illustrated in FIG. 2 of the drawings, and in such event, the two half portions of the housing 32*h* may be secured by means of the bolt and nut means designated generally by the numeral 32*h'*.

The motor means 31 may be air, hydraulic, or electric driven, and it has been found that air motors serve the purpose quite well for the purpose of the present invention. The motor means 31 may be secured to the support 32 by any suitable means such as bolts or the like (not shown). The power connection 34 includes the inlet 34*a* which conducts the air from a power source which discharges air into the interior of the housing extension 31*a* which is axially offset but connected with the motor 31. The motor 31 includes a shaft (not shown) which is arranged axially of the motor 31 and is adapted to rotate when air is supplied to the motor 31. A gear (not shown) is mounted on the end of the motor shaft and is engaged with a gear 31*b* illustrated in dotted line in FIG. 3 in housing extension 31*a*. The gear 31*b* is mounted on shaft 31*b'* and rotates it when the motor shaft is rotated. Positioned within the housing extension 31*a* is the support means designated heretofore generally by the numeral 45, on which support means 45 the gear means 40 is supported. The support means 45 in turn is carried on the shaft 31*b'* in the housing extension 31*a*.

The support 45 used with the motor means 31 shown in FIGS. 1–4 and 6 of the drawings is illustrated in greater detail in FIG. 7 of the drawings. It is shown as including the collar 45*c* which abuts the shoulder on the annular sleeve 45*b*. A lock ring 45*x* holds collar 45*c* in abutting engagement with sleeve 45*b* and also locks collar 45*c* on the tubular member 45*y*. Tubular member 45*y* in turn is longitudinally slidable on the shaft 31*b'* on the splined connection 31*c*.

Tubular member 45*y* has a longitudinally extending threaded surface 45*z* which is inclined axially as illustrated in FIG. 7 and engages the mating threads in collar 45*f*. Gear means 40 is mounted on the end 45*g* of collar 45*f* by any suitable means as shown in the drawings. Spring means 45*d* and 45*e* are arranged as shown and normally urge the sleeve 45*b*, collar 45*c*, and collar 45*f* longitudinally of the shaft 31*b'* to the position illustrated in FIG. 3 of the drawings so that gear means 40 is disengaged from ring gear 36 when the air supply to the motor 31 is cut off.

When air is supplied through the connection 34 to the inlet 34*a*, it first enters and acts on the annular shoulder 45*b'* of the annular sleeve 45*b* so as to collapse the springs 45*d* and 45*e* and move the collar 45*c*, member 45*y*, and collar 45*f* along the splined connection 31*c* formed on the shaft 31*b'* as illustrated in FIG. 4 of the drawings. This moves gear means 40 to engage ring gear 36. If gear means 40 does not mesh with the teeth on gear 36, spring 45*e* and the threaded arrangement between member 45*y* and collar 45*f* aid in permitting slight rotation of the gear 40 to mesh its teeth with the gear teeth on ring gear 36.

When sleeve 45*b* has cleared port 34*b* in housing extension 31*a*, air is then permitted to pass through the conduit 34*c* into the motor 31 to actuate it. This causes the motor shaft and gear connected thereto to rotate which also rotates gear 31*b* and shaft 31*b'*. Thus, it can be seen that the above construction functions so as to first position the gear means 40 in engaging relationship with the ring gear 36 before air is supplied to actuate the motor means 31, and the gear means 40 will be locked in engagement with ring gear 36 as long as power is supplied to the motor 31.

When the power supply is cut off, the sleeve 45*b* and collars 45*c* and 45*f* return to their original positions as illustrated in FIG. 3 of the drawings thereby serving to automatically disengage the gear means 40 from the ring gear 36 whereby the spindle 21 may then rotate independently of the present invention and without interference from the present invention.

It should be noted that the connection means 34 to the motor 31 includes a lubricator 50 which is of a well-known construction and that it is connected in the air supply line going to the motor means 31. Thus, the air passes in through the opening 51 in the lubricator

and is discharged through the conduit 52 to the inlet 34*a* described hereinabove and represented in FIG. 3 of the drawings. The air thereby serves to pick up lubricant and conducts it interiorly of the motor and lubricates the motor as it also operates it. This air is exhausted from the motor 31 through the conduit 31*d*, which conduit 31*d* terminates adjacent the gear ring 36 as illustrated in FIGS. 2 and 3 of the drawings. A suitable nozzle 31*e* may be connected on the end of the conduit 31*d* so as to spray or discharge the exhaust from the motor 31 onto the ring gear 36 and gear means 40 to lubricate them when they are engaged.

A slightly modified form of the present invention is illustrated in FIG. 5 of the drawings wherein like reference numerals are used to refer to like parts described with regard to the embodiment of the invention shown in FIGS. 1–4, inclusive. A swivel is illustrated at 17 on which is provided a support means 32 for supporting the motor means 31. Operatively connected with the motor means 31 is the gear means 40 carried on the support means 45 which support means in turn is carried on the shaft 31*b'*. The motor 31 is connected to shaft 31*b'* by means of a gear on its shaft which is in turn engaged with a gear 31*b* in offset housing 31*a* as described with regard to FIG. 2 and FIG. 3.

In FIG. 5, the support means 32 is shown as being in the form of a cage or assembly 60 with the upper member 61 and lower member 62 held in fixed relation by suitable means such as the bolts 63 secured through the upper and lower members, respectively. If desired, a housing 64 may be provided for covering all or a portion of the components of the present invention. The bolt means 63 may be extended upwardly as illustrated in FIG. 5 and is connected with a chain 70 or the like. The chain 70 extends upwardly and over the swivel 17 to be secured to one of the other bolt means 63 which is also extended upwardly and outwardly in a manner similar to that shown in FIG. 5 of the drawings.

The support means 45 on the shaft 31*b'* of the extension 31*a* includes the collar 80 on which is mounted the gear means 40. Secured to the collar 80 is one end of a spring 81, the other end of the spring 81 being secured to the collar 82 which in turn is locked on the shaft 31*b'* by suitable means such as the bolt 83 or the like. The collar 80 and the gear means 40 are threadedly connected together by the threaded portion 84 on the collar 80 as illustrated in FIG. 5 of the drawings. A spring 81*a* abuts gear 40 and collar 83' to urge the gear to nonengagement with the ring gear 3 as shown on the right of FIG. 5.

This construction normally retains the gear 40 in nonengaged relationship with the gear ring 36, and when air is supplied to the connection 34 of the motor means 31, this rotates the shaft 31*b'*, and the initial rotation of the shaft 31*b'* will cause the spring 81 to function in a manner so as to sling the gear means 40 along the threaded portion 84 of collar 80 and engage with the gear ring 36 as illustrated on the left-hand side of FIG. 5 of the drawings. The engagement of the gear 40 with gear ring 36 is accomplished substantially instantaneously with initial rotation of the shaft 31*b'* whereupon continued rotation of the shaft 31*b'* retains the gear 40 and the gear ring 36 locked together as shown on the left side of FIG. 5 for rotation of the spindle 21 and members connected thereto. The gear means 40 disengages from ring gear 36 when the motor 31 shops, whereupon the gear means 40 returns to its disengaged position illustrated on the right side of FIG. 5.

As shown in FIG. 5 of the drawings, the air supply from a source is first conducted through the line 51 to a lubricator 50, and the air pressure functions to discharge lubricant through the line 52*a* into a lubricant hole 52*b* on the motor means 31. This manner of lubricating a motor of this type is well known in the art. The air supply for running the motor means is discharged from the lubricator 50 through the line 52 and into the connection 34 of the air motor 31 to operate the air motor in a manner as previously described.

The air motor used in connection with the present invention may be of any suitable form well known in the art.

In the form of the invention shown in FIG. 5 of the drawings, the ring gear 36 is illustrated as being mounted on the spindle 21 by means of the set screws 36*f*. The screws 36*f* may be arranged in any suitable manner on ring gear 36, and as shown, they are provided in pairs and may be provided in circumferentially spaced arrangement such as 90° apart on ring gear 36.

The exhaust from the motor means 31 may be discharged through a conduit 31*d* and nozzle 31*e* so as to lubricate the gear 40 and gear ring 36 when they are engaged as illustrated in FIG. 5 of the drawings.

FIG. 6 illustrates another embodiment of the invention. The motor means 31 is carried by support means 32 on the swivel 17. The support means 32 may be of any suitable form such as illustrated either in FIG. 3 or FIG. 5.

In FIG. 6, the position of the motor means 31 is inverted from that shown in FIGS. 1–5; however, the motor means 31 functions equally well in either position. Also, in FIGS. 1–5, two motor means 31 are illustrated, one for rotating the ring gear 36 and kelly in one direction, and one for rotating the ring gear 36 and kelly in the opposite direction, whereas only one motor means 31 is shown in FIG. 6. The motor means 31 in FIG. 6 is reversible so that it can rotate the ring gear 36 and kelly in either direction as desired.

The motor shaft of the motor 31 is connected to a gear which is engaged with a gear 31*b* in offset housing extension 31*a*. The gear 31*b* is mounted on shaft 31*b'* and supported on the shaft 31*b'* are the support means 45 and gear means 40 in a manner as described with regard to FIGS. 1–4. The function and operation of the motor means 31 and gear means 40 is similar to that described with regard to FIGS. 1–4; however, the air supply system is somewhat modified for operation of the motor means 31.

A main air supply 100 is connected directly to the air supply on the drilling rig and extends up the standpipe 30 and along flexible hose to connect with the motor means 31 through lines 101 and 102. Air operated relay valves 101*a* and 102*a* are positioned in each conduit 101 and 102 and are normally closed, thus closing off flow of air to motor means 31 through 101 or 102. The construction of the air operated valves 101*a* and 102*a* is well known, and therefore a detailed description is believed unnecessary.

In operating the motor means 31 of the FIG. 6 invention, the connection of air lines 93 and 94 is somewhat different from that which will be given hereinafter relative to FIGS. 1–5. The control panel 90 is connected by the conduit 90*a* to the air supply tank. The flow of air to lines 93 and 94 is controlled by toggle switches 91 and 92, respectively. The line 93 is connected up the standpipe 30 and flexible hose 20 to the air inlet 34*a* in housing extension 31*a*. Air discharge line 34*c* is connected with the valve 105 and the air line 94 is connected directly to valve 105. The valve 105 may be positioned on the top of standpipe 30. The lines 106 and 107 are connected from valve 105 to the relays 102*a* and 101*a*, respectively, and the lines 106 and 107 may be carried on the flexible hose 20.

The valve 105 is provided with a spring 108 which normally urges the piston 109 of the valve 105 to a position so that the line 34*c* is normally communicated to the line 107. When the spring is collapsed as illustrated in FIG. 6 of the drawings, the line 34*c* communicates with the conduit or line 106. As previously noted, the air line 94 is connected to the valve 105, and as illustrated in the drawings, when air is supplied through the line 94, it acts

on the piston 110 so as to collapse the spring 108 and thereby position the conduits 34c and 106 for communication as noted above.

In order to describe the operation of the form of the invention illustrated in FIG. 6 of the drawings, it will be assumed that it is desired to rotate the kelly 26 so that it may be threadedly disconnected from a tubular member or pipe section. To accomplish this, the kelly 26 must be rotated to the left, which in the drawings is toward the right-hand side of the page. The toggle switches 91 and 92 may be manually operated so that air may be supplied through the line 90a to the control panel 90 and into the lines 93 and 94. The air supplied through the line 93 will pass first of all to the inlet 34a on the housing extension 31a so as to engage the gear means 40 with the ring gear 36 as illustrated in FIG. 6. Thereafter, the air is discharged through the conduit 34c and into the valve 105. In the meantime, air supplied through the conduit 94 acts against piston 110 to position the piston rod 109 so that air supplied through the line 34c may be discharged through the valve 105 and into the line 106.

The discharge of the air through line 106 actuates the relay valve 102a to open it, whereupon air is then supplied from the main air supply line 100 to the motor means 31 through the conduit 102.

When air flows into the motor through the conduit 102, as viewed in the drawings, it causes the motor to rotate clockwise (viewing the motor from the drilling platform 9). This then rotates the gear 31b in the housing extension 31a counterclockwise and causes the shaft 31b' to rotate counterclockwise when viewed from the drilling platform 9 so as to rotate the kelly to the left and in a direction to unthread it from a pipe section at its lower end.

When it is desired to rotate the kelly 26 connected to the stem 21 in a direction so as to threadedly connect the kelly with a tubular member, air may be supplied through the line 93 so as to first engage the gear means 40 with the ring gear 36 as described above. The air is then discharged from the housing extension 31a through the line 34c and into the valve 105. At this time, the air supply through line 94 is closed so that the piston rod 109 is moved downwardly in the valve 105 to communicate the conduit 34c with the line 107. When air passes through line 107 to air relay valve 101a, it opens the air relay valve 101a, whereupon air is then discharged through the line 101 into the motor means 31. This rotates the motor 31 counterclockwise and gear 31b and shaft 31b' clockwise whereby ring gear 36 and kelly 26 are rotated in a direction so as to threadedly connect the kelly with a pipe section positioned vertically therebeneath.

As previously noted, air is maintained in the main air supply 100 at all times from the main air supply tank, and the flow of air to the lines 93 and 94 is controlled through the control panel 90 and toggle switches 91 and 92 on the drilling platform 9, the control panel 90 being connected to the air tank by means of the line 90a.

It can be seen from the foregoing description that the motor means illustrated in FIG. 6 is reversible so that it can be rotated in either direction as desired to in turn rotate or spin the kelly in either direction as desired.

In the form of the invention illustrated in FIG. 6 of the drawings, the ring gear 36 is shown as being mounted on the spindle sub 23 instead of the spindle 21. The ring gear 36 may be connected to the sub 23 by any suitable means, and one form of connection is illustrated in FIG. 6 wherein longitudinally extending keyways 23b are provided in the sub 23, and keys 23c of suitable size are provided for fitting in the keyways 23b and in the keyway in the ring gear 36. It can be appreciated that any suitable number of keyways may be provided, two being shown in the drawings. When the ring gear 36 is positioned at the desired longitudinal position on the sub 23, the ring gear 36 may be locked thereagainst by suitable means such as the threaded bolts 23d extending through the ring gear 36 and engaging the sub 23. This serves to position the ring gear 36 on the sub 23 but enables removal thereof when desired.

While it is believed that the operation of the invention illustrated in FIGS. 1–5 is apparent by reason of the foregoing description, to further amplify and describe, reference is now made to FIG. 1 of the drawings. A control assembly or panel for controlling the flow of power to the motor means 31 is represented generally by the numeral 90 in FIG. 1. In order that the ring gear 36 may be rotated either clockwise or counterclockwise, it will be noted that two motor means 31 are illustrated in connection with FIGS. 1–5 of the drawings of the present invention, one of which is right-hand rotating and the other being left-hand or counterclockwise rotating. Separate controls 91 and 92 are provided for supplying air through the conduits 93 and 94 to each of the motors. As previously noted, the power supply to the control panel 90 is not shown as an air supply source is normally supplied around the drilling rig. This supply may be conducted to the control panel 90 by any suitable means such as a conduit 90a or the like, and the flow through panel 90 is controlled by the control means 91 and 92 in the form of toggle switches. The control means 91 and 92 in turn communicate 90a either with the conduit 93 or the conduit 94, respectively, and the conduits 93 and 94 are in turn connected with their respective motor means 31. If desired, the conduits 93 and 94 may be secured on the exterior of the mud supply means 30 and on the exterior of the flexible hose 20 as illustrated in FIG. 1 of the drawings.

For purposes of description and illustration, it will be assumed that the conduit 93 is connected to the motor means 31 on the left of FIG. 1 of the drawings and that the conduit 94 is to be connected with the motor means 31 on the right as viewed in FIG. 1 of the drawings. In the view illustrated in FIG. 2 of the drawings, it can be seen that when power in the form of air is supplied through the conduit 93 by operating the control 91, air is supplied to the motor means 31 on the left of FIG. 1 of the drawings to rotate it clockwise (when looking up at the bottom of the motor means 31). This rotates shaft 31b' counterclockwise and in turn rotates the ring gear 36 in a clockwise direction or toward the right-hand side of the drawings. Thus, when it is desired to use the present invention to disconnect pipe sections from the well string while rotating the suspended well string in the rotary at a predetermined rate, air will be supplied to the motor means 31 connected with the conduit 93 so as to actuate it.

On the other hand, when the present invention is to be used to connect pipe sections into the well string in a manner as described hereinbefore, air may be supplied through the conduit 94 by actuating the control 92 whereupon the counterclockwise motor means 31 viewed on the right in FIGS. 1 and 2 of the drawings moves counterclockwise and in turn moves gear means 40 to engage and rotate the ring gear 36 clockwise (viewed looking up at the bottom of spindle 21 and connected kelly 26) so as to threadedly connect the pipe section into the well string.

As noted, a particular advantage of the present invention is that the present invention may be selectively engaged with the swivel spindle 21 and rotate the swivel spindle independently of rotation of the well string by the rotary 10. This enables the suspended well string in the well bore to be continually rotated even while connecting and disconnecting pipe sections in the well string. Also, the present invention eliminates the use of the spinning line and the dangers normally encountered by personnel in connection with its use.

Also, the present invention greatly speeds up well drilling operations and greatly reduces the possibility of stuck pipe and fishing operations during the drilling operations. It can be quickly and easily positioned on

swivels and readily removed therefrom for repair or replacement of parts as may be necessary.

Furthermore, when the present invention is not in use, it does not interfere with the normal rotation of the spindle during normal drilling operations and other operations in connection with the well bore.

The parent application of which this is a division is a continuation-in-part of my copending application bearing Serial No. 154,701, filed on November 24, 1961, now abandoned.

Broadly, the present invention relates to a spinner and method of connecting and disconnecting pipe in a well string, and more particularly, to a spinner which has particular utility for use with rotary swivels.

What is claimed is:

1. A device for rotating the spindle of a swivel including:
(a) support means adapted to be carried by a swivel having a spindle,
(b) motor means mounted on said support for imparting rotation to the spindle of the swivel,
(c) gear means between the spindle and said motor means, and
(d) means to move said gear means to disconnect said motor means from the spindle.

2. A device for rotating the spindle of a swivel including:
(a) support means adapted to be carried by a swivel having a spindle,
(b) motor means mounted on said support for imparting rotation to the spindle of the swivel,
(c) said motor means having a connection for receiving power from a power source whereby said motor may be actuated to rotate the spindle,
(d) gear means between the spindle and motor means, and
(e) means to move said gear means to disconnect said motor means from the spindle.

3. A device for rotating the spindle of a swivel including:
(a) support means adapted to be secured to a swivel having a spindle,
(b) motor means mounted on said support,
(c) said motor means having a connection for receiving power from a power source whereby said motor may be actuated,
(d) means for coupling said motor to the spindle for rotation thereof, and
(e) said last named means being uncoupled from the spindle but operable when said motor is actuated to couple said motor and spindle for rotation.

4. In a power spinner for rotating the spindle of a swivel.
(a) motor means adapted to be supported on the swivel and having a connection for receiving power from a power source whereby said motor may be actuated,
(b) a ring gear adapted to extend about the spindle for transferring rotation of said motor to the spindle,
(c) means interposed between said motor means and the spindle for coupling said motor and the spindle in one position for rotation, and for uncoupling said motor from the spindle in another position, and
(d) said motor being fixedly supported on the swivel in both positions.

5. In a power spinner for rotating the spindle of a swivel,
(a) motor means adapted to be supported on the swivel and having a connection for receiving power from a power source whereby said motor may be actuated,
(b) a ring gear adapted to be supported on the spindle,
(c) gear means operatively connected with said motor to be driven thereby,
(d) said gear means including support means which retains said gear means disengaged from said ring gear,
(e) and said support and gear means movable by power from the power source to first engage said gear means with said ring gear prior to rotation of the spindle by said motor.

6. In a power spinner for rotating the spindle of a swivel,
(a) motor means adapted to be supported on the swivel and having a connection for receiving power from a power source whereby said motor may be actuated,
(b) a ring gear adapted to be supported on the spindle,
(c) gear means operatively connected with said motor to be driven thereby,
(d) said gear means including support means which retains said gear means disengaged from said ring gear.
(e) and said gear means movable to engage with said ring gear when said motor means is actuated.

7. In a power spinner for rotating the spindle of a swivel.
(a) motor means adapted to be supported on the swivel and having a connection for receiving power from a power source whereby said motor may be actuated,
(b) a ring gear adapted to be supported on the spindle,
(c) gear means operatively connected with said motor to be driven thereby,
(d) said gear means including support means which retains said gear means disengaged from said ring gear.
(e) said support and gear means movable to engage said gear means with said ring gear when power is supplied from the power source for actuation of said motor means,
(f) and said motor means and ring gear being removable relative to the swivel and spindle respectively.

8. In a power spinner for rotating the spindle of a swivel,
(a) motor means adapted to be supported on the swivel and having a connection for receiving power from a power source whereby said motor may be actuated,
(b) a ring gear adapted to be supported on the spindle,
(c) gear means operatively connected with said motor to be driven thereby,
(d) said gear means including support means which retains said gear means disengaged from said ring gear.
(e) said gear means movable to engage with said ring gear when power is supplied from the power source for actuation of said motor means,
(f) and means for lubricating said ring gear and gear means when said motor means is actuated.

9. An apparatus to be secured to a rotary swivel for rotating the spindle of the swivel comprising,
(a) a support adapted to be secured to the swivel,
(b) said support including an upper member and a lower member and means for maintaining said upper and lower support members in spaced relation,
(c) a ring gear,
(d) means to support said ring gear on said spindle,
(e) motor means carried by said support,
(f) said motor having a connection for receiving power from a power source whereby said motor may be actuated,
(g) gear means adapted to be rotated by said motor,
(h) means supporting said gear means in nonengagement with said ring gear,
(i) and said last named support means accommodating movement of said gear means into engagement with said ring gear when power is supplied from the power source for actuation of said motor means, and said gear means disengaging from said ring gear when said motor is shut off.

10. An apparatus to be secured to a rotary swivel for rotating the spindle of the swivel comprising,
(a) a support adapted to be secured to the swivel,
(b) said support including an upper member and a

lower member and means for maintaining said upper and lower support members in spaced relation,

(*c*) a ring gear,

(*d*) means to support said ring gear on said spindle,

(*e*) motor means carried by said support,

(*f*) said motor having a connection for receiving power from a power source whereby said motor may be actuated,

(*g*) gear means adapted to be rotated by said motor,

(*h*) means supporting said gear means in non-engagement with said ring gear,

(*i*) and said last named means movable by power from the power source to first engage said gear means with said ring gear prior to rotation of the spindle by said motor, and said gear means disengaging from said ring gear when said motor is shut off.

11. An apparatus to be secured to a rotary swivel for rotating the spindle of the swivel comprising,

(*a*) a support adapted to be secured to the swivel,

(*b*) said support including an upper member and a lower member and means for maintaining said upper and lower support members in spaced relation,

(*c*) a ring gear,

(*d*) means to support said ring gear on said spindle,

(*e*) motor means carried by said support,

(*f*) said motor having a connection for receiving power from a power source whereby said motor may be actuated,

(*g*) gear means adapted to be rotated by said motor,

(*h*) and gear support means movable longitudinally to engage with said ring gear upon actuation of said motor means, and said gear means disengaging from said ring gear when said motor is shut off.

12. An apparatus to be secured to a rotary swivel for rotating the spindle of the swivel comprising,

(*a*) a support adapted to be secured to the swivel,

(*b*) said support including an upper member and a lower member and means for maintaining said upper and lower support members in spaced relation,

(*c*) motor means carried by said support,

(*d*) said motor having a connection for receiving power from a power source whereby said motor may be actuated,

(*e*) gear means adapted to be rotated by said motor,

(*f*) and additional gear means for contacting the spindle and rotating it, and

(*g*) said gear means being in non-driving relation with said additional gear means and the spindle, and means operable when said motor is actuated to engage in driving relation with said additional gear means and spindle for imparting rotation to the spindle.

13. An apparatus to be secured to a rotary swivel for rotating the spindle of the swivel comprising,

(*a*) a support adapted to be secured to the swivel,

(*b*) motor means carried by said support,

(*c*) said motor having a connection for receiving power from a power source whereby said motor may be actuated,

(*d*) gear means adapted to be rotated by said motor,

(*e*) additional gear means for imparting rotation to the spindle engaged thereby, and

(*f*) said gear means being in non-driving relation with said additional gear means and the spindle, and means operable when said motor is actuated to engage in driving relation with said additional gear means and spindle for imparting rotation to the spindle.

14. The invention recited in claim 9 wherein said upper and lower members of said support and said ring gear are split whereby said upper and lower members and ring gear may be assembled about the swivel spindle, and means for securing said upper and lower members and ring gear about the swivel spindle.

15. The invention of claim 4 wherein said motor means is capable of rotating said ring gear clockwise and counterclockwise.

16. The invention of claim 4 wherein said motor means is an air motor and wherein the connection to the power source includes a lubricator to supply lubricant to the motor as it is actuated, conduit means connected with the exhaust of said motor, said conduit means discharging exhaust from said motor means on said ring gear and gear means to lubricate them.

17. In a power spinner for rotating the spindle of a swivel,

(*a*) reversible motor means adapted to be supported for rotating the spindle on the swivel and having a connection for receiving power from a power source whereby said reversible motor means may be actuated,

(*b*) a ring gear surrounding the spindle for transferring rotation of said motor to the spindle,

(*c*) means interposed between said motor means and the spindle for coupling said motor and the spindle in one position for rotation, and for uncoupling said motor from the spindle in another position, and

(*d*) said motor being fixedly supported on the swivel in both positions.

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