

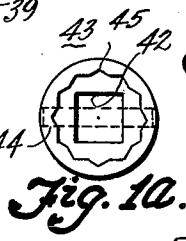
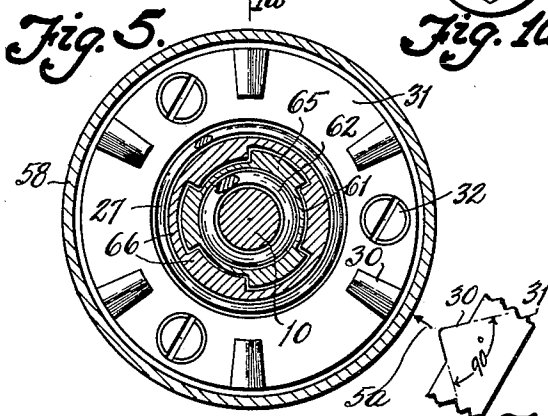
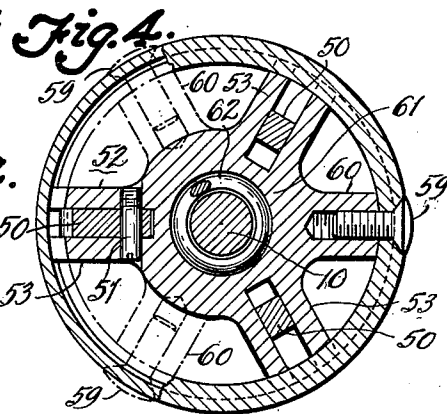
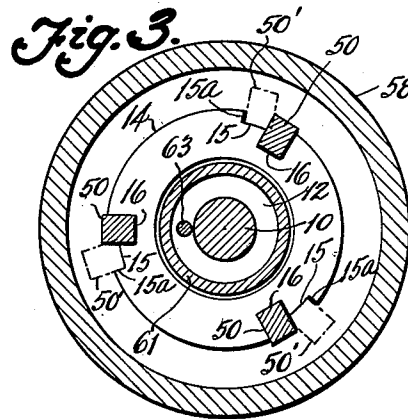
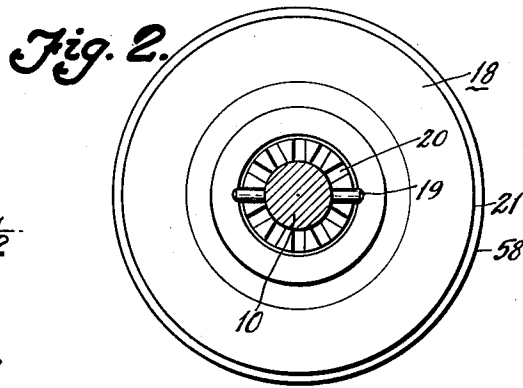
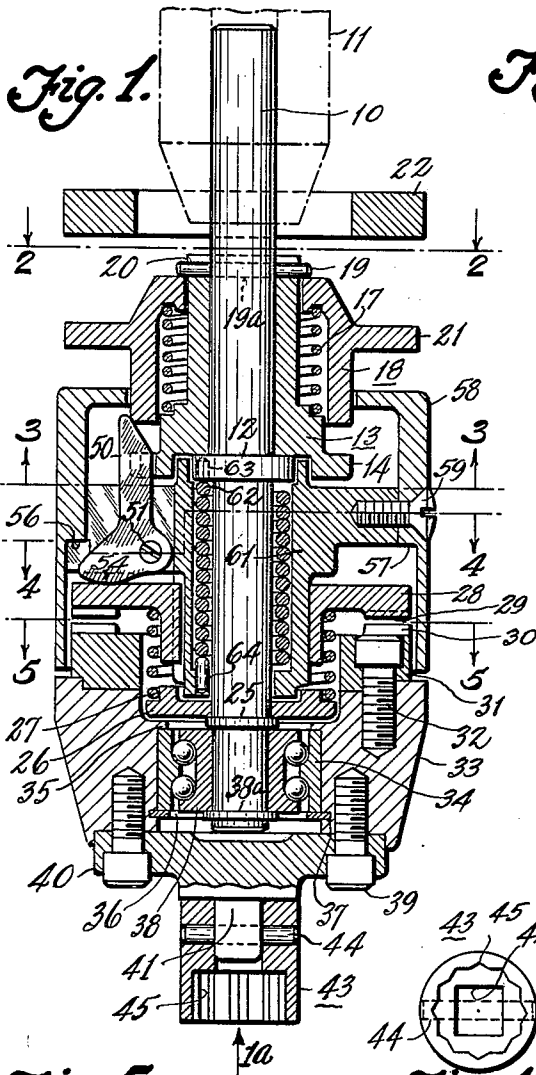
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POWER-ACTUATED ROTARY TOOL

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Fig. 5a. in ATTORNEYS

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POWER-ACTUATED ROTARY TOOL

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This invention relates to power driven devices which apply a wrench or a screwdriver to a nut or a screw and which provide for automatic disconnection of the wrench or screwdriver from the power source when a nut or screw has been tightened. Prior devices of this type have toothed clutch members which connect the power source with the wrench or screwdriver. When a certain torque is exceeded, the driving clutch member slips on the driven clutch member thereby causing noise and wear until the device is retracted from the nut or screw.

An object of the invention is to provide for complete separation of the clutch members when a predetermined torque is exceeded so that the device will be quiet in operation and no wear will occur although the device may remain in engagement with the nut or screw which it has tightened. The device provides for automatic reengagement of the clutch members in response to retraction from the nut or screw. Provision is made for the adjustment of the torque which can be transmitted before the clutch members are separated.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a longitudinal, sectional view of the device in association with a chuck shown in dot-dash lines and a stop member with which the device engages.

Fig. 1a is a view in the direction of arrow 1a of Fig. 1 and shows the bottom of a socket wrench attached to the device.

Figs. 2, 3, 4 and 5 are sectional views taken on lines 2-2, 3-3, 4-4 and 5-5, respectively, of Fig. 1.

Fig. 5a is a fragmentary side view of one of the clutch members and is looking in the direction of arrow 5a of Fig. 5.

The device includes a shaft 10 (Fig. 1) connected with a power source by a chuck 11 shown in dot-dash lines. Shaft 10 provides a collar 12 which supports a sleeve 13 having a flange 14 provided with relatively shallow notches having bottom surfaces 15 and deeper notches having bottom surfaces 16. Sleeve 13 is engaged by a compression spring 17 urging upwardly a sleeve 18 against a pin 19 extending through a transverse hole 19a in shaft 10 and received by certain ones of the diametrically opposite notches 20 in the upper end of sleeve 13. Sleeve 18 has a

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flange 21 adapted to engage a fixed stop member 22 provided by the framework of the power device which operates the chuck 11. This device is not shown, but, as known to those skilled in the art, it comprises a mechanism operated by an electric motor for driving the chuck 11 which can be lowered and raised automatically or manually.

A snap ring 25 which is received by a groove in the shaft 10 supports a disc 26 which receives a compression spring 27 which urges upwardly a clutch member 28 having teeth 29 for engaging similar teeth 30 provided by a clutch member 31 which screws 32 attach to a block 33 which is supported by a shaft 10 through the medium of a thrust ball bearing whose outer race 34 is confined between a ledge 35 provided by block 33 and a ledge provided by a snap ring 36 received by a groove 37 in block 33. The inner race 38 of the bearing is confined between the shoulder 25 and the snap ring 38a received by a groove provided by shaft 10 near its lower end. Screws 39 secure to the block 33 a disc 40 having a square shank 41 received by a square hole 42 in a socket wrench 43 attached to shank 41 by a pin 44. The wrench 43 provides a socket having twelve notches 45 (Fig. 1a), alternate ones of which are engageable with a hexagonal nut of a certain size.

As shown in Fig. 1, the clutch member 28 is separated from the clutch member 31. Under this condition the deeper notch surfaces 16 of flange 14 (Fig. 3) receive portions of bell crank levers 50 pivoted on screw pins 51 (Fig. 4) attached to a spider 52 having three arms 53 which are notched to receive the levers 50. Each lever 50 has a cam surface 54 against which the spring 27 urges the clutch member 28. Therefore, the spider 52 is supported by the shaft 10 through the snap ring 25, disc 26, spring 27, clutch member 28, levers 50 and pins 51. The spider arms 53 provide ledges 56 which receive an annular shoulder 57 provided by a shell 58 which screws 59 attach to spider arm 60 (Fig. 4). Shell 58 provides in its upper wall a central opening for receiving the sleeve 18. The spider arms extend from a tubular hub 61 through which the shaft 10 extends and this hub provides a recess for a torque transmitting spring 62 which is wound left hand and has an end 63 connected with a collar 12 and an end 64 connected with the spider hub 61. This hub is connected with the clutch member 28 through splines 65 provided by the hub and splines 66 provided by the clutch member.

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The device is adjustable to transmit a certain torque before the clutch members are disengaged. To do this the shell or case 58 is clamped and pin 19 is removed. The levers 50, being in the deeper notches of flange 14, tie the sleeve 13 to the spider to which the lower end 64 of the spring 62 is attached. The shaft 10 is turned clockwise (looking down upon it) through the medium of a device which will indicate the torque applied to the shaft. When that torque is a certain amount, the pin 19 is replaced, it being understood that a slight rotation of shaft 10 may be required to align its pin receiving hole 19a with a pair of diametrically opposite cross slots 20 in the upper end of the sleeve 18. At any rate the spring 62 will be stressed torsionally substantially the amount required. The chuck 11 is lowered to facilitate attaching the shaft 10 thereto and the chuck is raised to its upper limit at which the stop 22 is engaged by the flange 21 of sleeve 18. This causes the lower edge of the sleeve 18 to pry the upper ends of the levers 50 outwardly to release the levers from the deeper notch surfaces 16 and to permit them to be received by the shallower notch surfaces 15, the levers 50 being rotated counterclockwise as viewed in Fig. 3 by the spring 62 into the dot-dash line positions 50' and against the shoulders 15a of the shallower notches. This outward movement of the upper ends of levers 50 causes the clutch member 28 to be brought into engaging relation with the clutch member 31 and the spring 27 is further compressed to urge the levers 50 against the surfaces 15 of the shallower notches. During the lowering of the chuck 11 to cause the wrench 43 to be applied to a nut, the flange 21 of sleeve 18 is separated from the stop member 22 and spring 17 causes sleeve 18 to engage pin 19. Therefore when wrench 43 engages a nut, levers 50, then received by the shallower notches 15 in flange 14 as indicated at 50' in Fig. 3, are separated from the lower, outer edge of sleeve 18. Rotary movement of the chuck in a clockwise direction looking down on the shaft is transmitted to socket wrench 43 through the shaft, the torsion spring 62, the spider hub 52, the splines 65 and 66 (Fig. 5); the clutch member 28 and through its teeth 29 to the teeth 30 of the clutch member 31 and thence through the block 33, the plate 40 to the wrench 43 which is applied to a nut by lowering the chuck 11.

As the nut is tightened and resistance is encountered by the wrench 43, the wrench tends to lag behind, thereby causing an increase of torsion of spring 62 up to the value at which the clutch member should be separated. Accompanying this winding of the spring 62 relative motion occurs in a clockwise direction as viewed in Fig. 3 between the levers 50 and the flange 14 of sleeve 13. By the time the spring 62 is transmitting the maximum allowable torque, the levers 50 will have been located in radial alignment with the deeper notch surfaces 16 whereupon the spring 27 is released to disengage clutch member 28 from clutch member 31 and to force the levers 50 against the deeper notch surfaces 16. Movement of levers 50 into the position shown in Fig. 3 is permitted because sleeve 18 had been moved by spring 17 upwardly against pin 19. Thereafter no torque is transmitted to the wrench 43 since the clutch members are completely disengaged and furthermore the device operates without noise and wear since there are no clutch teeth snapping over one another.

During the latter part of the upward movement

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of the chuck 11 to retract the wrench from the nut, the flange 21 of sleeve 18 engages the stop 22 thereby causing such relative movement between the sleeve 14 and sleeve 18 that the levers 50 are pried outwardly so that, due to the action of the spring 62, they will be moved relatively counterclockwise as viewed in Fig. 3 back into the position 50' and the clutch will be reengaged.

The device is adapted for use with a machine in which parts to which nuts or screws are to be applied and tightened are mounted on workholders carried by a rotary conveyor or dial which moves intermittently to locate the work successively in alignment with the device, and in which the longitudinal movements of the chuck are coordinated automatically with the movements of the dial so that, while the dial is stationary, the device moves into engagement with the nut or screw to tighten it and out of engagement before the dial starts moving. The timing of the elevation of the device is not critical since there is no noise and wear when nut or screw tightening ceases because the clutch members are separated.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A power driven hand tool comprising a shaft to be connected with a rotary power driven shaft, a member adapted to be attached to a tightening tool, transmission means between the shaft and member and including a torsion spring connected with the shaft, a clutch having a driven element attached to the member and having a driving element and a part connected with the torsion spring and providing a longitudinal spline connection with the driving element, a compression spring for separating the driving element from the driven element, means for axially moving the driving member into driving relation with the driven element against the action of the compression spring and including a movable device supported by said part and rotating bodily therewith, and a plurality of pivotally mounted camming members for latching said device in the position in which they retain the driving element into driving relation with the driven element until the torque transmitted by the torsion spring exceeds a certain value.

2. A power driven hand tool comprising a shaft to be connected with a rotary power driven shaft, a member adapted to be attached to a tightening tool, transmission means between the shaft and member and including a torsion spring connected with the shaft, a clutch having a driven element attached to the member and having a driving element and a part connected with the torsion spring and providing a longitudinal spline connection with the driving element, a compression spring for separating the driving element from the driven element, means for axially moving the driving member into driving relation with the driven element against the action of the compression spring and including a movable device supported by said part and rotating bodily therewith, and a latch attached to the shaft and providing adjoining shallow and deep notches, the movement of said device to force the clutch driving element into driving relation with the driven element causing said device to be located for reception by the shallower notch of the latch and the rotation of said part relative to the shaft by the torsion spring causing said device to be received by the shallower notch, said latch turning rela-

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tive to the device when a certain torque is being transmitted by the torsion spring to retract the shallower notch from the device and to present the deeper notch for reception of the device whereupon the compression spring is released to separate the clutch driving element from the driven element and to move the device into the deeper notch of the latch.

3. A power driven hand tool comprising a shaft to be connected with a rotary power driven shaft, a member adapted to be attached to a tightening tool, transmission means between the shaft and member and including a torsion spring connected with the shaft, a clutch having a driven element attached to the member and having a driving element and a part connected with the torsion spring and providing a longitudinal spline connection with the driving element, a compression spring for separating the driving element from the driven element, means for axially moving the driving member into driving relation with the driven element against the action of the compression spring and including a lever pivotally supported by said part and having an arm engageable with the clutch driving element and movable longitudinally of the axis thereof and having an arm movable transversely of the shaft and a latch disc attached to the shaft and providing adjoining shallow and deep notches, the movement of the lever to force the clutch driving element into driving relation with the driven element causing the second mentioned lever arm to be located for reception by the shallower notch of the latch disc and the rotation of said part relative to the shaft by the torsion spring causing the second mentioned lever arm to be received by the shallower notch, said latch disc turning relative to the lever when a certain torque is being transmitted by the torsion spring to retract the shallower notch from the lever and to present the deeper notch for reception by the lever, whereupon the compression spring is released to separate the clutch driving element from the driven element and to move the lever into the deeper notch of the latch disc.

4. A power driven hand tool comprising a shaft to be connected with a rotary power driven shaft, a member adapted to be attached to a tightening tool, transmission means between the shaft and member and including a torsion spring connected with the shaft, a clutch having a driven element attached to the member and having a driving element and a tubular part attached to the torsion spring and surrounding it and providing a longitudinal spline connection with the clutch driving element, a compression spring for separating the clutch elements, means for retaining the torsion spring under torsion, said means comprising said tubular part and a device connected therewith and movable relative thereto as well as bodily therewith and a latch having adjoining shallow and deep notches each for receiving the device and into the deeper of which the device is urged by the compression spring when separating the clutch elements and means for variably connecting the latch with the shaft, the torsion spring having been wound up by effecting rotation of the shaft relative to the tubular part until the spring transmits a required torque from the shaft to the tubular part, means for moving the clutch driving element into driving relation with the clutch driven element against the action of the compression spring and including said device and including a member which, upon retraction of the power driven device from the work, engages a

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fixed stop and the member is caused to move relative to the latch-received device, said member and said device having engaging surfaces whereby said movement of said member effects retraction of said device from the deeper notch of the latch and presents it for reception by the shallower notch, said torsion spring turning the tubular part relative to the shaft to cause said device to be received by the shallower notch, said device, on being retracted, acting in opposition to the compression spring to cause the clutch driving element to be located in driving relation to the driven element, said latch turning relative to the device when a certain torque is being transmitted by the torsion spring to retract the shallower notch from the device and to present the deeper notch for reception of the device whereupon the compression spring is released to separate the clutch driving element from the driven element and to move the device into the deeper notch of the latch.

5. A power driven hand tool comprising a shaft to be connected with a rotary power driven shaft, a member adapted to be attached to a tightening tool, transmission means between the shaft and member and including a torsion spring connected with the shaft, a clutch having a driven element attached to the member and having a driving element, and a spider having a tubular hub surrounding the torsion spring and shaft and attached to the torsion spring and providing a longitudinal spline connection with the clutch driving element, said spider having a plurality of arms extending from its hub, a compression spring for separating the driving element from the driven element, bell crank levers each pivotally supported by a spider arm and each having an arm engaging the clutch driving element to move it axially into engagement with the clutch driven element and to be moved by the driving element when it separates from the driven element, each lever having an arm movable laterally of the shaft axis, a sleeve surrounding the shaft and providing a flange having sets of notches, each set comprising adjoining shallow and deep notches for receiving a second mentioned arm of the lever, the deeper notches receiving the lever when the clutch elements are separated, the torsion spring being retained under a certain torsion effected by turning the shaft relative to the sleeve while the levers are received by the deeper notches of the flange of the sleeve, one end of the sleeve providing a plurality of diametrically opposite sets of notches, and a pin for connecting the sleeve with the shaft and received by a cross hole in the shaft and by that set of notches in the sleeve closest to the cross hole when the torsion spring has been wound up to transmit a required torque, and a second sleeve surrounding the first sleeve and having one end engageable with the levers to retract them from the deeper notches of said flange whereby the torsion spring rotates the spider relative to the shaft to locate the levers in the shallower notches of the flange, the retraction of said levers causing the first mentioned arms thereof to force the clutch driving element with the clutch driven element against the action of the compression spring, said flange turning relative to the levers when a certain torque is being transmitted by the torsion spring to retract the shallower notches from the levers and to present the deeper notches for reception by the levers whereupon the compression spring is released to separate the clutch driving element from the clutch

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driven element and to move the levers into the deeper notches of the flange.

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