AUTOMATIC SELF-RELEASING ADJUSTABLE TORQUE WRENCH

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This invention relates to new and useful improvements in wrenches, and more specifically to an improved automatic adjustable torque wrench which is of the self-releasing type.

This invention is an improvement over our automatic adjustable torque wrench disclosed in our Patent No. 2,527,317, issued October 31, 1950.

In our prior torque wrench, we set forth a novel clutch arrangement which was extremely simple and at the same adjustable so that the wrench could be set for various torques. However, the clutch was so constructed whereby once the wrench was removed from a nut or bolt and the restraining force of the nut or bolt removed from the socket end of the wrench, then the socket began to turn again with the result that the motor driving the wrench would have to be stopped before the wrench could be engaged on another bolt or nut. It is therefore the primary object of this invention to provide an improved automatic adjustable torque wrench which is of the self-releasing type and which will stop rotating upon the application of the desired torque on a nut or bolt.

Another object of this invention is to provide an improved torque wrench which includes a first clutch assembly for connecting together halves of the torque wrench whereby the halves may be separated upon the application of a predetermined torque to limit the torque applied to nuts and bolts, and a second clutch which is operative to render the first clutch ineffective whereby a socket portion of a torque wrench will stop rotating when the desired torque is applied to a nut or bolt, and will not again operate until reapplied to another nut or bolt.

A further object of this invention is to provide an improved cam type clutch for use in adjustable torque wrenches, the cam type clutch being of such a nature whereby it may be readily applied to existing types of torque wrenches so as to make them self-releasing.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is an elevational view of the improved torque wrench and shows the general appearance thereof, a portion of the shank thereof being omitted;

Figure 2 is a longitudinal vertical sectional view taken through the center of the torque wrench of Figure 1 and shows the details of the various components thereof;

Figure 3 is a transverse horizontal sectional view taken substantially upon the plane indicated by the section line 3—3 of Figure 2 and shows the connection between the two bodies which form the housing portion of the wrench and the connection between one of the bodies and a drive member of the cam type clutch assembly;

Figure 4 is a horizontal sectional view taken substantially upon the plane indicated by the section line 4—4 of Figure 2 and shows the general details of the slip type clutch;

Figure 5 is an enlarged perspective view of a member incorporating at the upper end thereof one-half of the cam type clutch;

Figure 6 is an enlarged perspective view of a male clutch member of the slip type clutch;

Figure 7 is an enlarged perspective view showing the underside configuration of an annular member removably securable to the upper end of the male clutch member of Figure 6, the annular member incorporating one-half of the cam type clutch;

Figure 8 is an elevational view of the upper body with portions thereof shown in section in order to clearly illustrate the details thereof; and

Figure 9 is a vertical sectional view taken through the female clutch member of the slip type clutch and shows the general details thereof with the male clutch member and a shank normally carried thereon.

Referring now to the drawings in detail, it will be seen that the torque wrench includes an upper body 10 which is provided at the upper end thereof with an internally threaded bore 12 in which is threadedly engaged a threaded lower end 14 of a shank 16.

The upper body 10 is hollow to form a chamber 18 and is telescoped within a hollow lower body 20, there being provided in the lower body 20 a chamber 22. In order that the upper body 10 and the lower body 20 may be adjustably connected together to form a housing, which is referred to in general by the reference numeral 24, of a predetermined adjusted length, the upper portion of the lower body 20 is internally threaded, as at 26, and has threadedly engaged therewith external threads 28 formed in the lower portion of the upper body 10.

In order that the bodies 10 and 20 may be retained in selected adjusted position with respect to each other, there is formed in an intermediate portion of the lower body 20 an internally threaded bore 30 which extends radially therethrough. Threadedly engaged in the bore 30 is a set screw 32. The exterior of the upper body 10 in the vicinity of the threads 28 is provided with a plurality of vertical slots 34, as is best illustrated in Figure 3, for selectively receiving the set screw 32. In this manner, the bodies 10 and 20 are locked against rotation.

The lower body 20 is provided with a bottom wall 36 having a relatively large bore 38 therethrough, the bore 38 forming a shoulder 40 at the upper side of the bottom wall 36.

Disposed in the lower portion of the chamber 22 and passing downwardly out through the bore 38 is a shank portion 42. The shank portion 42 includes an enlarged upper part 44 which seats on the shoulder 40 to limit downward movement of the shank portion 42 through the bore 38. The lower end of the shank portion 42 is provided with a square cross-sectional socket 46 in which is received a complementary-shaped upper end portion 48 of a shank 50. The upper end part 48 is retained in the bore 46 by a conventional type of ball and socket connection 52.

The shank 50 also includes a square cross-sectional lower part 54. Retained on the lower part 54 by a second conventional type ball and socket connection 56 is a removable socket 69, the socket 68 having a nut or bolt receiving recess 56 in the lower end thereof.

As is best illustrated in Figure 9, there is formed in the upper part of the shank portion 42 and opening through the upper end thereof an inverted, frusto-conical-shaped recess 62. Seated in the recess 62 is a complementary-shaped lower part 64 of a male clutch member 66. For the purposes of this invention, the shank portion 42 may have the upper part thereof considered a female clutch member. The lower part 64 is provided with a plurality
of circumferentially spaced, longitudinally extending recesses 68 in which are received suitable friction inserts 70, as is best illustrated in Figure 4. The friction inserts 70 engage with the wall of the recess 62 to form a driving connection between the male clutch member 66 and the female clutch member part of the shank portion 42. In order to normally retain the two halves of the friction type clutch in driving relation, there is disposed within the housing 24 a coil spring 72 which has its upper end seated against a thrust washer 74 carried by the upper part of the upper body 10. The lower part of the coil spring 72 is disposed in an elongated vertical bore 76 formed in the upper part of the male clutch member 66, as is best illustrated in Figure 2. The spring 72 urges the male clutch member 66 down into the recess 62 of the shank portion 42. It is readily apparent that by adjusting the length of the housing 24 by selectively positioning the bodies 10 and 20 with respect to each other, the tension of the spring 72 may be varied so as to selectively vary that torque which will cause separation of the friction inserts 70 from the surfaces of the recess 62.

With the exception of a suitable mechanical connection between the housing 24 and the male clutch member 66, the foregoing elements are generally set forth in our prior Patent No. 2,527,517. However, this particular arrangement results in the socket 60 being rotated as soon as it is removed from a nut or bolt so that while the torque wrench will operate effectively, it must be shut off before it can be applied to another nut or bolt. In order to automatically stop the rotation of the socket 60 once a predetermined torque has been reached with a nut or bolt disposed in the socket 60, there is provided a cam type clutch between the male clutch member 66 and the housing 24.

Referring now to Figure 5 of the drawing, it will be seen that there is illustrated a coupling member which is referred to in general by the reference numeral 78. The coupling member 78 includes a generally cylindrical portion 80 having an annular flange 82 at the lower end thereof. The cylindrical portion 80 is provided with a plurality of circumferentially spaced slots 84 in which are seated keys 86. The keys 86 are also seated in longitudinally extending recesses 88 formed in the inner surface of the body 10 so as to permit adjustment of the body 10 relative to the connecting member 78. The annular flange 82 of the connecting member 78 seats upon a shoulder 90 formed in the interior of the body 20.

Referring now to Figures 6 and 7 in particular, it will be seen that the male clutch member 66 is provided with external threads 92 at the upper end thereof. Intermeshed with the external threads 92 are internal threads 94 of an annular connecting member 96. The connecting member 96 is of the same general cross-section as the body portion 80 of the connecting member 78.

Formed on the underside of the connecting member 96 is a first cam assembly which is referred to in general by the reference numeral 98. The cam assembly 98 includes a plurality of depending cam members 100 which are separated by complementary-shaped recesses 102.

Formed on the upper end of the body portion 80 of the connecting member 78 is a second cam assembly which is referred to in general by the reference numeral 104. The second cam assembly 104 is complementary to the first cam assembly 98 and includes a plurality of upwardly projecting cam members 106 which are disposed in circumferentially spaced slots and which are separated by complementary-shaped recesses 108.

When the wrench is in its normal operating position, the male clutch member 66 is held in its down position by the spring 72. This results in the connecting member 96 being retained in its down position and the cams 100 thereon being meshed and interlocked with the cams 106 of the cam assembly 104. Therefore, the socket 60 is rotated through a suitable electric motor and chuck (not shown) to which the shank 16 is connected. The shank 16 in turn results in the rotation of the housing 24. The body 10 of the housing 24 is connected to the connecting member 78 to effect rotation thereof. The connecting member 96 engages the connecting member 96 which in turn rotates the male clutch member 66. The male clutch member 66 rotates the shank portion 42 which, in turn, results in the rotation of the socket 60.

When a nut or bolt is being applied and the desired torque is reached, there is a slight slippage between the male clutch member 66 and the female clutch member part of the shank portion 42. This results in the turning of the cam assembly 104 relative to the cam assembly 98 and the resultant riding of the cam assembly 98 upon the cam assembly 104. The cam assembly 98 moves the connecting member 96 upwardly on the connecting member 78 against the downward urging of the spring 72. When the connecting member 96 rides up on the connecting member 78, the male clutch member 66 is retained out of engagement with the surfaces of the recess 62 with the result that the shank 16 is disconnected from the socket 60 and rotation of the socket 60 is stopped.

When the socket 60 is pulled off a nut or a bolt, there is a slight tendency for the socket 60 to rotate due to the frictional engagement between the shank portion 42 and the body 20. Furthermore, this may be easily overcome by grasping the shank portion 42. The shank 60 may then be applied over a next nut or bolt. The wrench is then moved downwardly to cause slight upward movement of the shank portion 42 with the result that the surfaces of the recess 62 are again engaged with the friction members 70. This results in the relative turning of the connecting member 96 with respect to the connecting members 78 due to the impact of the quick making of the connection between the male clutch member 66 and the female clutch member part of the socket portion 42. The further operation of the torque wrench is then the same as that set forth above.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the appended claims.

What is claimed as new is as follows:

In a torque wrench, a tubular housing comprising first and second hollow bodies disposed in telescoped interlocked relation, a driving shank secured to said first body for rotating said housing, a driven tool receiving shank rotatably journaled in said first body and projecting therefrom in axial alignment with said driving shank, said driven tool receiving shank having an upper end disposed within said housing, an upwardly opening frusto-conical recess in the upper part of said driven tool receiving shank and opening through said upper end thereof, a male clutch member, said male clutch member having a frusto-conical lower portion generally complementary to said frusto-conical recess, friction elements carried by said male clutch member lower portion and seated in said frusto-conical recess, said friction element engaging that part of said driven tool receiving shank defining said recess to form a releasable driving connection between said male clutch member and said driven tool receiving shank, said male clutch member having a tubular upper portion terminating in an open upper end, a spring disposed within said tubular upper portion to project through said open upper end thereof into engagement with said first body, said spring being in a compressed state and normally urging said friction elements into driving engagement with said driven tool receiving shank, a tubular connector seated in said housing against downward movement, an interlock connection between said housing and said tubular connector connecting together
the two for rotation together, said male clutch member being journaled in said tubular connector and projecting thereabové, said tubular connector having an upper end in the form of circumferentially spaced alternating projections and depressions connected together by upwardly sloping cam surfaces, a connecting member secured to said male clutch member adjacent said upper end thereof for rotation therewith, said connecting member overlying said upper end of said tubular connection and having a lower part in the form of circumferentially spaced downwardly facing alternating projections and depressions connected together by downwardly sloping cam surfaces, said projections of said tubular connector being complementary to and normally seated in said depressions of said connecting member and said projections of said connecting member being complementary to and normally seated in said depressions of said tubular connector to releasably interlock said connecting member with said tubular connector, said upwardly sloping cam surfaces being engaged with said downwardly sloping cam surfaces whereby rotation between said male clutch member and said housing results in the riding of said connecting member up on said tubular connector against the resistance of said spring and the movement of said male clutch member and said friction inserts out of engagement with said driven tool receiving shank to release said driven tool receiving shank from rotation with said housing.

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