This invention relates to torque wrenches of the type having spring-loaded toggle mechanism and adapted to "break" or "trip" when the applied torque reaches a predetermined limit. A torque wrench of this general type is shown in the Livermont Patent 2,887,921 granted May 26, 1959. In each case a wrench head is provided with a laterally extending arm projecting into one end of a handle or housing for actuating a spring-loaded toggle link. One of the difficulties encountered with constructions of this type is that under very high spring loads, corresponding to the upper range of the tool, the lateral forces applied by the toggle link to the swinging end of the arm is great enough to spring or deform the housing containing the arm. Even for lower spring loading values the springiness of the metal housing under the lateral load applied by the toggle link to the arm is objectionable because it produces a different initial starting position with respect to the angularity of the toggle link, depending upon the force applied by the load spring. Accordingly, it is an important object of this invention to overcome these shortcomings and to provide a toggle mechanism for apparatus of the class described in which a shoulder is provided on the toggle link for engagement with an abutment provided on the swinging end of the arm, so that the shoulder and abutment meet in engagement to limit swinging movement of the arm. Another object is to provide an improved form of toggle mechanism which facilitates assembly of the arm, toggle link and block into the open end of the handle or housing.

Torque release wrenches which are set to "break" or "trip" at very low torque values commonly fail to produce the desired sharp signal when the torque load setting is reached. When the force supplied by the load spring is very small, in order to produce a "break" or "trip" at a low torque value, the rate of build-up of force in the spring is similar to the build-up in axial force applied by the toggle link to the block against which the spring acts. Under such conditions the toggle link does not instantaneously snap from its initial position to its final position and the result is that a very poor signal, or nap action, is delivered to the operator using the wrench. In order to overcome this soft breaking action at low torque load settings, I have provided a composite coil spring which includes a cylindrical portion and a conical portion flaring therefrom. The conical portion builds up pressure slowly when compressed by the toggle link action and the mechanical advantage of the toggle link builds up at a much faster rate than the increase in spring pressure. The result is that even for extremely low torque load settings a sharp click or break occurs when the toggle link moves.

Other and more detailed objects and advantages will appear hereinafter.

In the drawings:

FIGURE 1 is a top plan view partly broken away showing a preferred embodiment of this invention.

FIGURE 2 is a sectional elevation.

FIGURE 3 is a sectional view of a special tool used to turn the adjusting nut for changing the compression of the load spring.

Referring to the drawings, the torque release wrench assembly, generally designated 10, includes a tubular housing 11 which is open at both ends and which forms a handle. A torque transmitting arm 12 extends into one end of the housing 11 and is connected thereto by means of the transverse pivot pin 13. A wrench head 14 may be formed integral with the arm 12 or may be detachably connected thereto by means of the dove-tail joint 15. The dove-tail joint or connection may be similar to that shown in Reissue Patent 24,831, dated May 31, 1960, and is preferably of the particular construction shown in the co-pending application of Frank W. Livermont, Serial No. 852,379, filed November 12, 1959, now Patent No. 3,039,340. A toggle link 16 is pivotally connected to the arm 12 by the pivot pin 17 and is pivotally connected to the block 18 by means of the pivot pin 19. The toggle link 16 is formed of a stack of metal plates 20 each having aligned apertures 21 for reception of the pin 17 and aligned apertures 22 for reception of the pin 19. The block 18 is mounted for axial movement within the housing 11 and is provided with a roller 23 which contacts the surface 24 provided within the interior of the tubular housing 11.

The end of the housing 11 remote from the pivot 13 is provided with internal threads 25 and there are engaged by the external threads on the load screw 26. The coil spring 27 has a small end 28 seated on the screw 26 and a large end 29 seated on one end of the block 18. A grip sleeve 30 is mounted on the outer surface 31 of housing 11 and this grip sleeve has an end portion 32 which serves to close the opening in the threaded end of the housing 11. This end portion 32 has a central resilient end flange 33 having a transverse slit 34.

The special adjusting tool 40 shown in FIGURE 3 comprises a cylindrical shell 41 provided with an end wall 42 and a central axial post or stake 43. The projecting end 44 of the stake 43 is beveled and terminates within the interior of the shell 41. The stake 43 is non-circular in cross-section and is shaped to slide into the corresponding non-circular opening 45 provided in the load screw 26. The tool 40 may be brought into operative position by sliding the shell 41 in telescopic relation over the end of the housing 11 and over the grip sleeve 30. This causes the forward end of the stake 43 to pass through the resilient end flange 33 and to slide into the central opening 45 in the screw 26. The shell may then be manually gripped and rotated with respect to the housing 11 and grip sleeve 30 to cause the adjusting screw 26 to change the degree of compression of the coil spring 27.

In accordance with one aspect of my invention I provide a shoulder 50 on the toggle link 16 which engages an abutment 51 provided on the swinging end of the arm 12. The shoulder 50 is formed by aligned edges of the plates 20 which make up the toggle link 16. The force applied by the coil spring 27 acts to hold the shoulder 50 and abutment 51 in engagement. In the initial position before application of torque load, the arm 12 does not contact the interior of the housing 11. Instead, lateral swinging movement of the arm is limited by engagement of the shoulder 50 and abutment 51. When the wrench head 14 is engaged with a nut (not shown) and increased torque load applied manually to the grip sleeve 30 in a direction to tighten the load screw, the load eventually causes the housing 11 to turn clockwise with respect to the arm 12, as viewed in FIGURE 2. This in turn causes the toggle link 16 to move the block 18 toward the right, thereby compressing the coil spring 27. The relative pivotal movement of the housing 11 and arm 12 is arrested when the boss 52 strikes the inner surface of the housing 11.

The individual plates 20 forming the toggle link 16 distribute the high unit stresses along the length of the
pivot pins 17 and 19 and thus enable toggle link 16 to transmit heavier loads than would otherwise be possible.

Assembly of the arm 12, toggle link 16, pivot pin 17 and 19, and block 18 into the housing 11 is facilitated by the fact that these parts may be lowered into the open end of the housing as a unitary assembly. This is a distinct advantage over the construction disclosed in said Patent No. 2,887,921 in which the toggle link is not pin-connected to the arm and block, and hence cannot be assembled in the manner stated.

The toggle link mechanism includes the shoulder 59 and abutment 51 and is applicable to torque release wrenches of all sizes and is not limited to use with wrenches constructed for low torque release settings.

In order to preserve a sharp and definite breaking action of the toggle link 16 even under very low torque load settings, I provide a coil spring 27 which has a cylindrical portion 60 and a conical portion 61 flaring therefrom. Several helical coils are present in the cylindrical portion 60 and several spiral-helical coils are provided in the conical portion 61. When the nut 26 is adjusted for high load settings the coils in the conical section 61 “bottom out” or seat in metal-to-metal closed relationship while the smaller diameter coils in the cylindrical portion 60 remain spaced apart. This occurs because the small diameter coils are stiffer than the larger diameter coils although they are all constructed of the same size of wire.

When the position of the load screw 26 is such as to allow almost full expansion of the coil spring 27, for low torque load settings, a sharp tripping action of the toggle link 16 is preserved because the mechanical advantage of the toggle link builds up at a much faster rate than the increase in build-up in spring pressure. The conical section 61 of the coil spring 27 builds up pressure slowly when compared to the action of the toggle link 16, as would occur with a very long spring. The toggle link therefore “breaks” more easily once the action starts and the result is a sharp signal or “click” delivered to the hand of the operator.

Having fully described my invention it is to be understood that I do not wish to be limited to the details set forth herein but my invention is of the full scope of the appended claims.

I claim:

1. In a torque release tool of the class described, the combination of: a tubular housing, a torque transmitting arm, pivot means connecting said housing and said arm, a block mounted for axial movement within the housing, a toggle link having a shoulder, pivot means connecting said toggle link to said block and to said arm, said arm having an abutment engaged by said shoulder to limit pivotal movement of the toggle link relative to the arm, in one direction, and a compression spring within the housing acting to move the block axially and to maintain said shoulder and abutment in contact.

2. The combination defined in claim 1 wherein the toggle link comprises a stack of plates having aligned edge surfaces defining said shoulder.

3. In a torque wrench assembly, the combination of: a tubular housing, a torque transmitting arm having a wrench head mounted on an outer end thereof, pivot means connecting said housing and said arm, a block mounted for axial movement within the housing, a toggle link having a shoulder, a first pivot pin connecting said toggle link to said block, a second pivot pin connecting said link to an inner end of said arm, said arm having an abutment engaged by said shoulder to limit pivotal movement of the toggle link relative to the arm in one direction, a compression spring within the housing acting to move the block axially and to maintain said shoulder and abutment in contact, and a screw threaded within the housing and acting to compress the spring.

4. The combination defined in claim 3 wherein the toggle link comprises a stack of plates containing aligned apertures for reception of said pivot pins, said plates also having aligned edge surfaces defining said shoulder.

5. In a torque wrench assembly, the combination of: a tubular housing having an open end, a torque transmitting arm projecting into the open end of said housing, pivot means for connecting said housing to said arm, a block mounted for axial movement within the housing, a toggle link having a shoulder, a first pivot pin connecting said toggle link to said block, a second pivot pin connecting said toggle link to said arm, said arm having an abutment engaged by said shoulder to limit pivotal movement of the toggle link relative to the arm, in one direction, and a compression spring positioned within the housing acting to move the block axially and to maintain said shoulder and abutment in contact, the arm, toggle link and block being insertable axially into the housing through the open end thereof as a unitary assembly prior to installation of said pivot means.

6. In a torque wrench assembly, the combination of: a tubular housing, a torque transmitting arm, pivot means connecting said housing and said arm, a block mounted for axial movement within the housing, a toggle link pivotally connected to said arm and to said block, the toggle link having a shoulder, the arm having an abutment engaged by the shoulder to limit pivotal movement of the toggle link relative to the arm in one direction, an element mounted within the housing, a coil spring having a cylindrical portion and a conical portion flaring from the cylindrical portion, the coil spring being mounted within the housing and interposed between said block and said element and acting to maintain the shoulder and abutment in contact.

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