A better understanding of the invention may be had from the following detailed description thereof, taken in connection with the annexed drawings, wherein:

Fig. 1 is a perspective view of the present wrench;
Fig. 2 is an enlarged longitudinal section through the wrench showing the wrench parts in the positions they occupy during the application of a torque load on the handle;
Fig. 3 is a section taken along line 3—3 of Fig. 2;
Fig. 4 is an enlargement of the area encircled by the arrow 4 in Fig. 2, showing the illustrated parts prior to as well as at the instant of release of the wrench;
Fig. 5 is a view similar to Fig. 4 showing the parts in the positions they occupy during resetting of the wrench after the latter is disengaged from the work;
Fig. 6 is an enlarged section taken along line 6—6 of Fig. 2; and
Fig. 7 is a section taken along line 7—7 of Fig. 5.

Referring now to these drawings, the illustrated wrench will be seen to comprise a wrench handle 10 of generally tubular form. The left-hand or forward end of this handle is flattened as illustrated most clearly in Fig. 3. This flattening of the handle provides, at the forward end thereof, a pair of parallel walls 12. Pivoting mounted in these parallel walls 12, for turning on a transverse axis of the handle perpendicular to the walls, is a torque applying member 14. This member has a squared portion 15 projecting from the handle to receive a replaceable wrench socket. Swingably received within the flattened forward end of the wrench handle is a lever 16 which extends longitudinally of the handle. The forward end of this lever is press-fitted on the portion of the torque applying member 14 located within the handle 10 between the side walls 12. The lever is, therefore, operatively connected with the torque applying member 14 in such a way as to swing in a counterclockwise direction with respect to the wrench handle, as the latter is viewed in Fig. 2, when the handle turns in a clockwise direction with respect to the torque applying member 14. Generally indicated at 18 are releasable latching means which act between the wrench handle and rear end of the lever 16 to restrain the latter against the such counterclockwise swinging with respect to the handle until a preset torque load is attained. It will be apparent that when the detent means 18 are engaged, the lever 16 and handle 10 are rigidly connected for turning of member 14 by handle 10 in a clockwise direction on its axis to tighten a nut on a bolt, for example.

Detent means 18 comprise a transverse shoulder means 20 rigid on the wrench handle to the rear of the lever 16. Shoulder means 20 illustratively comprises a collar which is held in a fixed position within the wrench handle by set screws 22. These set screws also provide a calibration adjustment to be presently discussed.

At its forward side, collar 20 has a transverse slot 24 in the plane of the lever 16. The rear end of the lever extends into and moves along this slot laterally of the wrench handle, when the lever 16 swings on the handle. Extending axially through the collar 20 is a central bore 26. The forward end of this bore opens through the bottom wall of the slot 24. The rear end of the bore 26 opens through the rear side of the collar.

Collar 20 also has a transverse hole or bore 28 extending perpendicular to the plane of the collar slot 24. The transverse bore 28 intersects the forward end of the axial bore 26. As shown most clearly in Figs. 4, 5 and 7, the transverse bore 28 also intersects the collar slot 24 so that the forward circular wall portions of the bore 28, at opposite sides of the collar slot 24, are located forwardly of the bottom wall of the slot.

Received in the transverse bore 28 of the collar 20 is
a hardened, square pin 30. As shown, the diagonal dimensions of this pin are somewhat less than the diameter of the transverse collar bore 28. Pin 30, therefore, is capable of limited fore and aft movement in the bore 28.

Generally indicated at 32 is a plunger which has a reduced portion 34 slidably fitted with the wrench handle 10 at the rear side of the collar 20. Extending forwardly from this rear enlarged portion is a reduced diameter portion or stem 36 of the plunger 32. This stem has a sliding fit in the axial bore 26 of the collar 20. Formed in the forward end of the plunger stem 36 is a transverse, Y-shaped notch or groove 38 in which the square pin 30 seats. The engaging side faces of the groove 38 and pin 30 restrain the latter against turning on its longitudinal axis.

Acting between the rear end of the plunger 32 and the forward end of a cylindrical slug 40, slidably fitted in the rear end of the wrench handle 10, is a compression spring 42. This spring acts to urge the plunger 32 forwardly against the pin 30. The spring pressure urges the pin toward a forward limiting position wherein its forward corner edge 44 bears against the circular wall of the transverse collar bore 28, at opposite sides of the forward collar slot 24. In this forward limiting position of the pin, its forward corner edge 44 is located somewhat forwardly of the bottom or rear wall of the collar slot. It will be observed that in the forward limiting position of the pin 30, the forward side of the rear enlarged portion 34 of the plunger 32 is spaced from the rear side of the collar 20. The plunger can, therefore, normally hold the pin 30 against the forward wall of the transverse collar bore 28, as just mentioned.

In this normal limiting position of the pin 30, the latter is located in the path of swinging movement of a device or means comprising a pawl 46 on the rear end of the lever.

Pawl 46 comprises a flat, generally square part which is slidably received in a diagonal slot 48 extending into the rear end of the lever in the plane of the latter. The pawl is pivoted on the lever by means of a pin 50 which passes through the approximate center of the pawl.

As may be observed most clearly in Fig. 4, when the wrench is used to apply a torque to a workpiece, the rear end of the lever 16 tends to swing in a counterclockwise direction past the pin 30, so that one rear inclined edge surface or face 52 on the pawl is presented against one forward inclined edge surface or face 54 on the pin 30. A torque is thereby exerted on the pawl tending to pivot the latter in a clockwise direction on the lever 16. Such counterclockwise pivoting of the pawl, however, is prevented by abutment of a forward edge face 56 on the pawl with the bottom or forward wall 58 of the lever slot 48.

With the wrench parts in their solid line positions of Fig. 4, therefore, the lever 16, and hence the torque applying member 14, are locked to the wrench handle 10 for turning of the member in a clockwise direction with the handle, as the latter is viewed from the top (Fig. 2) to apply a torque load to a workpiece. The face 54 on the pin 30 is inclined to the axis of the plunger 32, so that the pressure exerted on this face by the pawl 46 creates a rearward camming action or force on the pin tending to move the latter and the plunger 32 rearwardly in the wrench handle against the action of the spring 42. As mentioned earlier, and as may be readily observed in the drawings, the pin 30 has limited freedom of movement in the fore and aft direction of the wrench handle. This freedom of movement allows the pin 30 to be moved rearwardly by the aforementioned action to its phantom line, rear retracted position of Fig. 4. In this position, the forward corner edge 44 of the pin is located out of the path of swinging movement of the pawl 46.

Thus, during use of the wrench to apply a torque load to a workpiece, the lever 16 and torque applying member 14 remain locked to the wrench handle 10, for turning in the clockwise direction with the latter, until the rearward camming force on the pin 30, which is proportional to the applied torque load, becomes sufficient to cam the pin to its rear retracted position of the lever, in which the camming means 18 are released to permit limited clockwise turning of the wrench handle 10 with respect to the lever 16 and torque applying member 14.

The sudden release of the camming means 18 results in the rear end of the lever 16 moving into impact with the upper wall of the wrench handle 10, as indicated in dashed lines in Fig. 4. This impact produces an audible click which furnishes an indication to the user of the tool that the torque setting of the wrench has been reached. An additional indication for this purpose is furnished by the slight pivotal movement which occurs between the handle and torque applying member when the detent means 18 release.

When the lever 16 is in its dashed line released position of Fig. 4, the pin 30 is held in its forward limiting position against the forward side of the transverse collar bore 28. The forward edge 44 of the pin then located in the path of return swinging movement of the pawl 46 with the rear end of the lever to its dashed line normal position of Fig. 5 against the lower wall of the wrench handle. In order to permit the lever to return to its normal position, after disengagement of the wrench from the workpiece, one corner of the pawl 46 is relieved, as indicated at 60. This permits limited counterclockwise pivoting of the pawl on the lever to its solid line position of Fig. 5 wherein the pawl can move past the forward corner edge 44 of the pin 30. A spring 62, acting between the lever 16 and pawl 46, serves to resiliently retain the latter in its normal limiting position of Fig. 4. Thus, when the pawl 46 engages the pin 30, during return of the lever 16 from its released position to its normal position, the pawl pivots in a counterclockwise direction against the action of the spring 62 to clear the pin as shown in Fig. 5. Upon movement of the pawl past the pin, it is returned to its normal limiting position by spring 62. The lever is returned to its normal position by means of a return spring 64 which acts between the wrench handle and lever. Thus, the detent means on the lever, comprising the pawl 46 and spring 62, acts as a rigid detent when the lever pivots in one direction and as a yieldable detent when the lever pivots in the other direction.

In order to permit adjustment or presetting of the torque release value of the wrench, provision is made for longitudinal adjustment of the slug 40 in the wrench handle to increase or decrease the tension in the spring 42. The means for adjusting the slug 40 in this way comprises a sleeve handle 66 threaded on the rear end of the wrench handle 10. Threaded in the rear end of this sleeve handle beyond the rear end of the wrench handle is a nipple 68. A generally hexagonally shaped ring or grip 70 is threaded on the rear end of this nipple, at the rear end of the slot of the inner elongated sleeve handle 66 and ring 70 are firmly tightened on the nipple 68 so that these parts form, in effect, a single integral member.

The rear end of the slug 40 has a reduced, cylindrical extension 72 which fits rotatably within an axial bore 74 in the nipple 68. This extension 72 slides within a bore 76 to receive a set screw 78, carried by the nipple. The slug 40 itself is slidable keyed to the wrench handle by means of a key 80 on the handle fitting in a key way 83 in the slug.

From this description, it will be clear that when the sleeve handle 66 is turned in one direction, the slug 40 is moved forwardly in the wrench handle to increase the compression of the spring 42 and thereby increase the torque release setting of the wrench. Similarly,
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when the sleeve handle 66 is turned in the opposite direction, the slug 40 is retracted to the rear in the wrench handle, thereby decreasing the tension of the spring 42 and the torque release setting of the wrench. The wrench is calibrated in any suitable way at the time of its manufacture and provided with a torque scale 84 to indicate the torque release values for various settings of the sleeve handle 66.

The sleeve handle is retained in a given adjusted position, to retain a desired torque setting, by a lock screw 88. This lock screw has a threaded stem 90, threaded in the rear end of the slug 40. At the rear end of the stem 90, the lock screw has an enlarged head 92 which fits rotationally in a counterbore 94 in the nipple 68 at the rear end of its axial bore 74. When the clamp screw 88 is tightened, the nipple 68 is firmly clamped between the rear face of the slug 40 and the forward face of the clamp screw head 92. This, of course, locks the sleeve handle against turning with respect to the slug 40, and, therefore, with respect to the wrench handle 10.

This arrangement, the set screws 22 provide a calibration adjustment. Referring to the enlarged details of Figs. 4 and 5, it will be observed that the screws 22 have conical outer ends 96 which engage in diametrically opposed, coaxial bores 98 in the handle 10. It is apparent that when the lever 16 is in its dashed line normal position of Fig. 5, the spring 42 acts through the contact between the edge 44 on pin 30 and the wall of the transverse collar bore 28 to press the conical ends 96 on the screws 22 against the forward edges of the handle bores 98. These edges then act as stops to limit forward movement of the collar and pin and, therefore, the amount of overlap of the pin and pawl 46 in their solid line positions of Fig. 4. It is further evident that by adjusting the set screws 22, the forward limiting position of the collar and pin, and hence the overlap of the pin and pawl in Fig. 4, may be adjusted.

This adjustment, in turn, changes the rearward travel of the pin 30, and hence the applied torque load, necessary to cause the latching means 18 to release. Thus, the wrench can be adjusted during initial calibration by setting the sleeve handle 66 at a particular torque setting on scale 84 and then adjusting the set screws 22 until the wrench releases at the indicated torque load.

It is apparent, therefore, that the wrench hereinbefore described is fully capable of retaining the several objects and advantages preliminarily set forth. While a present preferred form of the wrench has been disclosed for illustrative purposes, it should be understood that this form of wrench is intended to be purely illustrative rather than limiting in nature, since it will be obvious that various modifications in the design and arrangement of parts of the wrench are possible within the scope of the following claims:

1. A predetermined torque release wrench comprising a handle, a torque applying member pivoted on a given axis on the handle, a pivot lever on the handle operatively connected with said member so as to swing on the handle when the latter turns on said axis relative to the member, and means to releasably restrain the lever against swinging in one direction on the handle including a plunger on the handle having one end located opposite one end of the lever and a transverse groove in said one end, the lever, a hardened pin seated in said groove and having a portion projecting beyond the plunger, means to retain the pin in the groove, said pin and groove having engaging faces to prevent turning of the pin in the groove, means yieldably urging said plunger toward the lever to a position wherein a portion of said pin is located in the path of swinging movement of said lever, whereby the latter contacts said projecting portion of the pin during swinging of said lever in said one direction as well as in the opposite direction past the pin, said detent means being yieldable to permit said lever to swing past the pin in said opposite direction only, said projecting portion having a face against which said detent means is urged under the action of a torque tending to swing said lever in said one direction, and said face being inclined to the axis of the plunger to create a camming action on the plunger proportional to said torque and tending to retract the plunger to a position where said lever is released to swing in said one direction past the pin.

2. The subject matter of claim 1 wherein the pin is rectangular in cross-section and said groove is V-shaped.

3. A predetermined torque release wrench comprising a generally tubular handle, a torque applying member pivoted on the forward end of the handle on a transverse axis of the handle, a pivot lever within and extending lengthwise of the handle and operatively connected to said member so as to swing on said axis relative to the member, and means to releasably restrain said lever against swinging in one direction on the handle including a plunger slidably in the handle having one end located opposite one end of said lever and a transverse groove in said one end, said detent means on said one end of the lever, a hardened pin seated in said groove having a portion projecting axially beyond the plunger toward said one end of the lever, said pin and plunger having engaging faces to restrain said pin against turning in said groove, means to retain the pin in said groove, means yieldably urging the plunger toward said lever to a position where said projecting portion of the pin lies in the path of swinging movement of said detent means, whereby the latter contacts said projecting portion of the pin during swinging of said lever in said one direction as well as in the opposite direction past the pin, said detent means being yieldable to permit said lever to swing past the pin in said opposite direction only, said pin having a face against which said detent means is urged by a torque tending to swing said lever in said one direction, and said face being inclined to the axis of the plunger so as to create a camming action on the plunger proportional to said torque and tending to retract the plunger to a position where said lever is released to swing in said one direction past the pin.

4. A predetermined torque release wrench comprising a generally tubular handle, a torque applying member pivoted on the forward end of the handle on a transverse axis of the handle, a pivot lever on the rear of the handle and operatively connected with said member within and extending longitudinally of the handle and operatively connected at its front end to said member so that the rear end of the lever swings laterally of the handle when the latter turns on said axis relative to the member, and means to releasably restrain the lever against swinging in one direction including a hardened pin within the handle at the rear of said lever and extending perpendicular to the plane of swinging movement of the rear end of the lever, detent means on the rear end of the lever, means slidably mounting said pin in the handle for transverse movement of the pin longitudinally of the handle between a forward limiting position wherein a portion of the pin lies in the path of swinging movement of the detent means, whereby the latter contacts said portion of the pin during swinging of said lever in said one direction as well as in the opposite direction past the pin, said detent means being yieldable to permit said lever to swing past the pin in said opposite direction only, said pin being movable to a rearward extended position wherein the pin clears said path, means to yieldably urge the pin to its forward limiting position, means to restrain the pin against turning on its longitudinal axis, said pin having a face against which said detent means is urged by a torque which tends to swing the lever in said one direction, and said face being inclined to the longitudinal axis of the handle so as to create a camming action.
action on the pin proportional to said torque and tending to move the pin to its rear retracted position.

5. The subject matter of claim 4 wherein said means for urging the pin to its forward limiting position comprises a spring biased plunger in the handle to the rear of the pin and pressing forwardly against the pin.

6. A predetermined torque release wrench comprising a generally tubular handle, a torque applying member pivoted on the forward end of the handle on a transverse axis of the handle, a pivoted lever to the rear of the member within and extending longitudinally of the handle and operatively connected at its front end to said member so that the rear end of the lever swings laterally of the handle when the latter turns on said axis relative to the member, and means to releasably restrain the lever against swinging in one direction including detent means on the rear end of the lever, a transverse shoulder means in the handle to the rear of the lever having a slot in its forward side in which the rear end of the lever and said detent means thereon move when the lever pivots, said shoulder means having an axial bore opening to said slot and through the rear side of the shoulder means, said shoulder means also having a transverse hole extending perpendicular to and intersecting said slot and bore, a hardened pin loosely received in said hole for transverse movement in the hole lengthwise of the handle between a forward limiting position against the forward side of the hole wherein a portion of the pin lies in the path of swinging movement of the detent means, whereby the latter contacts said portion of the pin during swinging of said lever in said one direction as well as in the opposite direction past the pin, said detent means being yieldable to permit said lever to swing past the pin in said opposite direction only, said pin being movable to a rearward retracted position wherein the pin clears said path, a plunger slideable in the handle to the rear of said shoulder means, said plunger including a forward end slidable received in said axial bore of the shoulder means and engaging said pin, a spring acting between the handle and plunger to urge the latter and pin forwardly in the handle to its forward limiting position, means to restrain the pin against turning on its longitudinal axis, said pin having a face against which said detent means is pressed by a torque acting to swing said lever in said one direction, and said face being inclined to the axis of the plunger to create a camming action proportional to said torque which tends to move the pin to its retracted position.

7. The subject matter of claim 6 wherein said pin is square and fits in a V-shaped transverse groove in the forward end of the plunger, the engaging faces of said pin and groove providing said means to keep the pin from turning.

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