

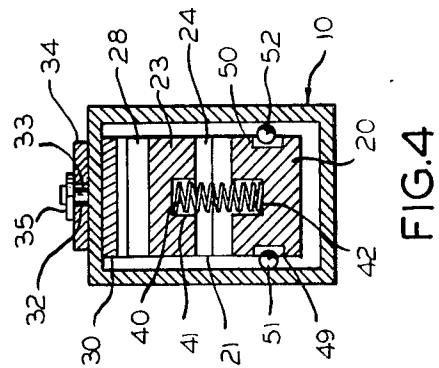
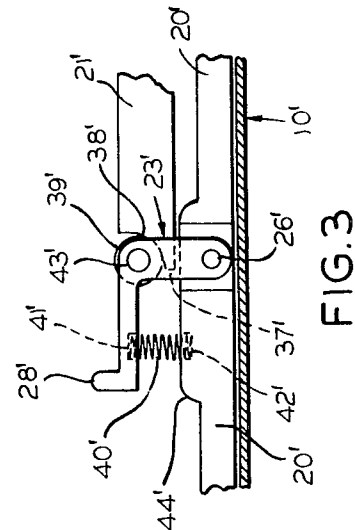
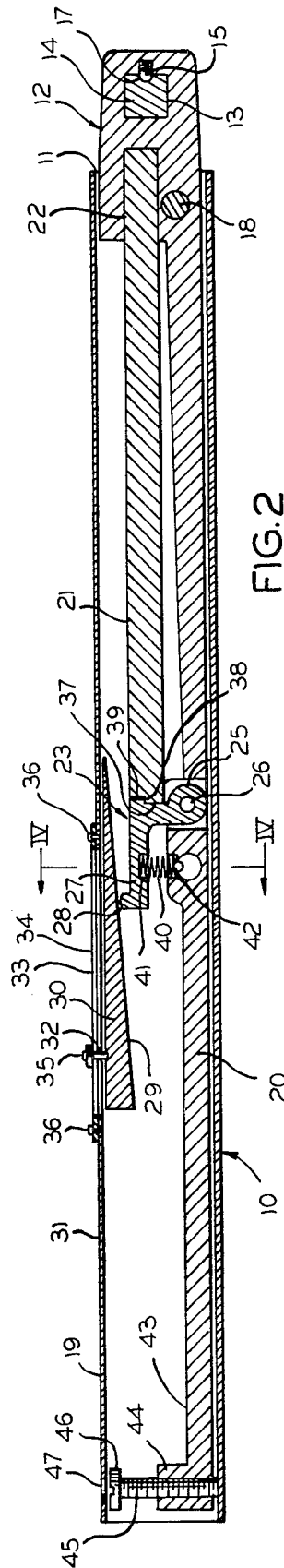
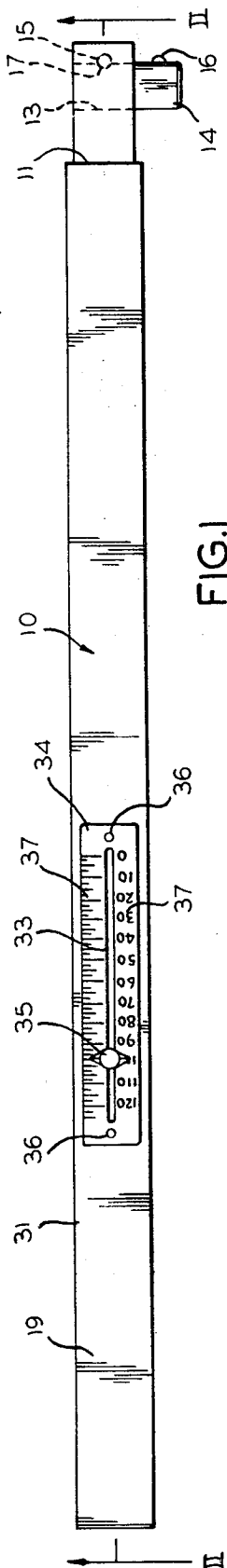
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AUTOMATIC TORQUE RELEASE WRENCH OF THE PRESET TYPE

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**AUTOMATIC TORQUE RELEASE WRENCH OF
THE PRESET TYPE**

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ABSTRACT OF THE DISCLOSURE

The structure embodies an elongated tubular handle member with a work engaging member projecting therefrom at one end to provide a transverse shank to which detachable sockets of various standard sizes are applied to turn fasteners to a predetermined torque load. Confronting primary and secondary flex beams are disposed in the tubular handle member for engagement with each other and the work engaging member. A spring urged trigger release is movably mounted to the primary flex beam in the region of its maximum flex responsive to resisting the torque load, and this trigger release is in the path of the secondary beam end to normally engage therewith until the trigger moves with the flex of both beams to engage the internal wall of the tubular handle member, thereby releasing its connection therewith when the load in the primary beam equals the combined bending load originally sustained by both primary and secondary beams.

When this occurs, the primary beam with its retained elasticity reserve, does not present a completely solid reaction should there be inadvertent over torqueing applied to the fastener or work engaging member after the trigger releases. The manual release of the handle member after the preset load has been applied, permits the spring to urge the trigger to again connect with the secondary beam for automatic resetting with the beams returning to their original straight line position relative to each other and the handle member. A calibrated wall sliding wedge provided on the handle member in the path of the trigger release member affords variable adjustment in the preset mechanism within a wide capacity range. An adjustment screw at the free end of the primary beam for engagement with the handle wall and accessible through an aperture therein, provides for accurate setting thereof by the user over an extended period of operation.

This invention relates to turning devices and more particularly to preset torque measuring wrenches of the type illustrated in U.S. Letters Pat. No. 2,682,796 issued July 6, 1954, although certain features thereof may be employed with equal advantage for other purposes.

It contemplates more especially the provision of a simple, dependable, accurate and compact torque measuring wrench that accurately designates the preset force to be applied and upon reaching this torque load will release and preclude any further nut turning and similar turning movements under all conditions.

Most torque wrenches measure the flex in a beam or the torsional twist in a shank which resists the turning force of a wrench in order to measure the amount of torque or force applied in nut turning and similar operations. Both types of torque wrenches have been adapted to the conventional handle or lever arm type for manual turning load application in fastener tightening operations as evidenced by Letters Patent Nos. 2,312,104 and 2,367,224; however it is now deemed more productive and effective to preset a wrench of the measuring type so that the desired nut or other fastener tightening load will be indicated and mechanically released during use to preclude

further tightening thereof and accomplish this with substantially immediate automatic resetting.

The desirability of utilizing the degree of twist in the shank or shaft or the flex beam principle as the measuring expedient in nut turning and similar operations, has been resorted to with success from the standpoint of measuring the applied turning load in relation to a calibrated meter that requires constant observations to reduce the error factor to a minimum as illustrated in the above referred to Letters Patents; however, it is now known that predetermined tightening loads can be imparted to fasteners by incorporating presetting control instrumentalities to preclude variations in fastener tightening application without jarring the sensitive measuring elements thereof and, further, without relying upon the over-reaction or under-reaction of the user whose responses are not always uniform.

The importance of accuracy in torque wrenches cannot be over-emphasized, and the degree of accuracy depending largely upon the elimination of or substantial reduction in friction, lag and free-play between relatively moving parts. This is also important in torque wrenches that embody the principle of flexing a torque resisting beam to provide the desired reading; however, better results have been found possible in torsion type wrenches embodying teachings of the present invention.

In accordance with the teachings of the present invention, the torsion measuring principle has been embodied in the conventional type lever arm wrench with minimum friction, lag, free play, and maximum translation of the relative twist of the load carrying member. This has been accomplished in conjunction with presetting torque load indicator instrumentalities which preclude errors and variations in reading and interpreting the usual indicators in all conditions of use. Torque measurements are possible, therefore, with a negligible error factor and nut turning operations are accurately measured under all conditions and capacities irrespective of human error and the position of applied force along the lever arm for effecting the turning operation.

It has been found in the actual use of torque wrenches, especially in repetitive production line operations, that the attendant may become weary and not too observant of the indicator dial or he may be working under tiring conditions to always be sufficiently observant or when using such a device in obscure or inconvenient positions, inaccurate readings result. Also, there is little opportunity to read the dial in normally inaccessible places and, therefore, the user of a torque wrench may not be in the position to determine with any great deal of accuracy the torque load that is being applied. Furthermore, human error may render otherwise accurate torque measuring instrumentalities so ineffectual so that the present invention contemplates the elimination of human error and the other noted difficulties by providing simple automatic mechanical disconnect and connect control features that will convey to the user the knowledge that the applied torque has reached the predetermined value at which the measuring instrumentalities have been preset prior to the application of the device. To this end, it has been found desirable to provide simple disconnect and connect instrumentalities that render it mechanically impossible for the user to apply more torque load to a fastener than is initially intended without any overt act.

The physical indicator preferably takes the form of a trigger release mechanism operating responsive to a flex beam which will provide an automatic disconnect at the preset load so that the handle 10 will be momentarily ineffectual to apply more force for the further application thereof in nut turning operations. This construction provides partial releasing, since the two beams 20-21 bend together after initial fractional loading of the primary

beam 20 to share the torque load. Thus, the wrench handle 10 travels a certain arc (degrees) to sustain the preset load when the secondary beam 21 releases by reason of the trigger 24 being displaced therewith to engage the obstruction which, in this instance, is the calibrated wedge 31 that causes a trigger 24 disconnect. Then the primary beam 20 must take over the full load and these occurrences cumulatively create a momentary interruption, a mild vibratory shock and some audible click due to the trigger disconnect serving as a signal to the user who becomes conscious of the desirability not to over-pull by continuing the application of force.

The effect of this is to cause a sudden relaxation of part of the applied torque at the drive end 12 as the user knows he must then stop as advised by the aforesaid cumulative release signals. Normal relation of all the instrumentalities then takes place due to the straight natural at rest attitude of the secondary beam 21 when the latter passes to its no stress point upon release of the trigger 24 which is then spring-urged to return to its initial position of engagement with the secondary beam 21. The free end 38-39 of the secondary beam 21 always maintains contact at some point with the unlatched trigger 24 even when the secondary beam 21 is released so that as it assumes its straight attitude re-latching of the spring urged trigger 24 is readily attained. This is aided by the fact that the primary beam 20 also assumes a straight attitude upon release and user relaxation to slightly displace the trigger 24 backwardly to assist in the re-latching trigger operation.

This would be true irrespective of the care exercised by the user or the position in which he was using the torque wrench or the inaccessibility of use which may preclude the direct vision to any calibrated indicator or measuring meter that has heretofore been used in devices of this character. These human failures have been entirely eliminated by utilizing mechanical disconnect instrumentalities that are responsive to the presetting instrumentalities when the torque load reaches the measurement for which the wrench is preset and the user receives the mechanical signal to relax his grip and stop applying further torque.

One object of the present invention is to simplify the construction and improve the operation of devices of the character mentioned.

Another object is to provide a simple and compact preset torque measuring device that is accurate, dependable in operation, and embodies presetting measuring means for accurately controlling the tightening load.

Still another object is to provide a torque measuring turning tool having improved trigger control disconnect means associated therewith that is self-restoring upon manual release thereof after the disconnect occurs.

A further object is to provide a torque measuring turning tool with simple and effective instrumentalities for connecting and disconnecting the load turning elements at any predetermined torque load within the capacity range of the device.

A still further object is to provide a torque wrench with a turning shank having trigger release and restoring control serving as a mechanical release at a preset load to insure accurate and rapid tightening of fasteners without human intervention except for applying the load until a disconnect occurs.

Still a further object is to provide an improved presetting and releasing torque wrench to mechanically interrupt the applied torque load without the user's involvement therein.

Other objects and advantages will appear from the following description of an illustrative embodiment of the present invention.

In the drawing:

FIG. 1 is a side view in elevation of the device embodying features of the present invention.

FIG. 2 is a sectional view in elevation of the device

shown in FIG. 1 taken substantially along line II—II of FIG. 1.

FIG. 3 is an enlarged fragmentary side view in elevation of a modified trigger release and connect mechanism, part of the handle member being shown in section to clarify the illustration.

FIG. 4 is an enlarged fragmentary sectional view in elevation of the trigger release mechanism showing the spring-urged actuator therefor in relation to its practically frictionless bearing and track taken substantially along line IV—IV of FIG. 2.

The structure selected for illustration is not intended to serve as a limitation upon the scope or teachings of the invention, but is merely illustrative thereof. There may be considerable variations and adaptations of all or part of the teachings depending upon the dictates of commercial practice. The present embodiment comprises an elongated tubular handle member 10, in this instance of rectangular cross-section, to also serve as a housing for instrumentalities to be hereinafter described. The forward end 11 has a projecting work engaging member 12 complementarily sized for closing the handle end 11 with minimum looseness to preclude interaction therebetween.

The projecting work engaging member 12 has a square bore 13 therein extending in a vertical direction to slidably receive a correspondingly shaped wrench socket receiving shank 14. The shank 14 is preferably though not essentially fitted with properly spaced standard spring impelled ball detents 15-16. The bore 13 which receives the shank 14, has a minute recess 17 therein to cooperate with the ball detents 15-16 on the shank 14 to retain the latter in one of two extreme positions as will appear more fully hereinafter. This arrangement and construction allows the slidable shank 14 to be indexed to assume two extreme positions of use, one as illustrated in FIG. 1 of the drawing for clockwise tightening of fasteners, or in its extreme opposite displacement therein (not shown) for counterclockwise fastener turning so that opposed directions of fastener turning can be accomplished therewith. It should be noted that with the use of two ball detents 15-16 on the shank 14, one detent 15 serves as a position indexing expedient therefor while the exposed ball detent 16 will serve to retain the wrench socket thereon or vice versa depending upon the positioning thereof.

The work engaging head 12 is retained in the elongated handle 10 by means of a pivot pin 18 which also permits slight pivotal movement thereof responsive to applying turning force thereto by means of the handle 10 which is manually grasped at the other end region 19 thereof. As shown, the work engaging head 12 has, in this instance, an integral flex beam 20 extending rearwardly therefrom and inside of the elongated handle member 10 for substantially the entire length thereof. This beam 20 serves as the primary bending or flexing beam which resists the turning movement applied to the handle member 10 when the work engaging head 12 has a standard wrench socket (not shown) on its shank 14, in registry with a nut or other standard fastener.

A secondary and shorter bending beam 21 is press-fitted into a complemental recess or bore 22 provided in the work engaging head 12 so that both beams 20-21 ultimately resist the turning movement applied through the handle member 10 as the preset load is approached and both beams 20-21 flex as will appear more fully hereinafter. The secondary beam 21 is approximately one-half the length of the primary beam 20 which flexes first to carry a trigger release mechanism 23 into connecting operative relation to the secondary beam 21.

The trigger connecting and releasing mechanism 23 involves a trigger 24 that has a depending boss 25 pivotally connected to the primary beam 20 proximate to its midpoint by a pin 26. The trigger 24 of the upstanding trigger release 23 has a horizontal portion 27 having an upwardly projecting nib 28 thereon to contact any suitable trip means such as an inclined wedge member 30 slidably

mounted along the inner top wall 31 of the tubular handle member 10.

A suitable guide pin 32 extends upwardly from the wedge member 30 to register with an elongated slot 33 extending along a medium line of an elongated calibrated plate 34. A diamond shaped pointer and finger tip engaging button 35 is externally fixed to the wedge member guide pin 32 immediately above the calibrated plate 34 for positioning the internal wedge block 30 relative to the calibrated plate 34 which is fixed to the exterior wall 31 of the handle member 10. The calibrated plate 34 is attached by means of suitable fasteners 36 which extend therethrough and the handle member 10.

Now, then, the trigger 24 is notched as at 37 to present a stepped shoulder 38 complementary to the stepped edge 39 provided on the adjacent free end edge of the secondary beam 21 to connect therewith responsive to the clockwise urge imparted to the trigger 24 by a compression spring 40. The compression spring 40 is vertically disposed between a recess 41 provided in the underside of the horizontal lever portion 27 and an aperture 42 extending downwardly for a limited extent into the primary beam 20 to retain the spring 40 in operative assembled position along a longitudinal median line of the primary beam 20. Thus, the compression spring 40 will always provide a clockwise (viewed from FIG. 2) urge to the trigger 24.

This tends to latch the trigger's notch 37 against and onto the complementally stepped edge 39 of the secondary beam 21 whenever the latter is proximate thereto. This occurs during the initial flexing of the primary beam 20 say to one-half of the predetermined and preset load, and coincident thereto the secondary beam 21 will present its stepped edge 39 for registry with the trigger's complementary notch 37 to establish their connection. Therefore, further increasing the turning load will cause bending or flexing of both beams 20-21 and elevate the trigger 24 with its uppermost arcuate edge 28 until the latter is obstructed by the inclined surface or ramp edge 29 of the wedge 30. When this occurs, the latched connection 37-39 becomes disconnected because the trigger 24 is pivoted in a counterclockwise direction (viewed from FIG. 2), and a partial interruption to further turning the fastener takes place. This momentary interruption brings about a metal-to-metal contact between the secondary beam 21 and the upper inside wall of the tubular handle member 10 as the secondary beam 21 springs back from its curved loaded attitude to an unloaded straight attitude and the trigger 24 becomes unlatched by its contact with the wedge 29-30.

The user immediately is alerted by the mechanical disconnect constituting a definite audible metal-to-metal impingement signal that the preset load has been reached and the user must then release his applied force in order to allow the primary beam 20 to also return to its original shape or attitude so that the trigger 24 may again latch itself to the stepped end 38-39 of the secondary beam 21 responsive to the urge of the trigger spring 40. The instrumentalities are restored to their initial position for repeating the torque load applying cycle merely by the user's momentary release of the applied force when the audible and physical signals evidence that the preset turning load has been reached. This is accomplished by the fingertip displacement of the external pointer button 35 that enables the slidable positioning of the wedge 30 along the slot 33 which is calibrated and readily observed for pre-setting purposes. By shifting the wedge 30 with the pointer stud 32 to which the button 35 is anchored, the inclined surface 29 is brought toward the trigger edge 28 for smaller preset loads and shifted away therefrom for larger present loads as the calibrations 37 denote. When this interruption occurs at the time that the preset load has been reached and the release of the trigger 24 has been negotiated, the beam 20 does not remain solid but it retains a marked reserve of elasticity. This reduces the amount of over-torque to fasteners even though the user

inadvertently pulls through a greater arc than the preset load calls for upon release.

In order to provide for adjustment when error or inaccuracies appear as established by testers or testing techniques, the free end 43 of the primary beam 20 is provided with an upraised boss 44 through which a long threaded stud 45 extends to present an enlarged slotted screw head 46. The enlarged screw head 46 is interiorly aligned with the comparatively smaller screw driver aperture 47 which enables access therethrough with a thin screw driver blade (not shown) for registry with the slotter stud head 46 for rotating it one way or another to provide the required adjustment. The stud head 46 abuts against the inner surface of the upper handle wall 31 over the opening 47 when the torque load is first applied for fastener turning, and this occurs sooner or later depending upon whether or not the stud is turned out or in relative to the beam boss 44, and thus the reading will be effected to conform with the results indicated while being under test with a special tester such as but not limited to the type illustrated in U.S. Letters Patent No. 3,255,624 issued May 31, 1966.

Torque loading by turning fasteners tight to a preset degree of tightness, is not always accomplished manually in a plane normal to the axis of the work engaging head shank 14, but mechanics inadvertently apply turning force to the handle end 19 at abnormal angles and this causes or tends to cause the beams 20-21 with the trigger 24 to contact and rub against the side walls of the handle 10 serving as a housing therefor. This friction would reflect upon the accuracy of the preset release and it is desirable to minimize such friction by keeping the beams 20-21 in longitudinal alignment in the housing handle 10 even under such abnormal conditions of abnormal turning angles. This is accomplished in the present embodiment by providing circular depressions 49-50 in the parallel sides of the beam 20 (FIG. 4) to receive a ball bearing 51 and 52 in each for confinement therein by the side walls of the handle housing 10. It should be understood that the beams 20-21 and trigger latch 23 are not as wide as the interior horizontal spread between the side walls of the handle housing 10 for complete freedom in flexing; however, when the beams 20-21 are inclined to distort somewhat when abnormal angles of turning force are applied, the alignment of the beams 20-21 are maintained by the ball bearings 51-52 that provide lateral support and guidance with minimum or negligible friction and still preclude abnormal distortion even though the turning force applied to the handle end 19 is abnormally directed.

In the modified trigger latch and release 23' illustrated in FIG. 3, the secondary beam 21' terminates in an arcuately curved end 38' concentric with a roller 39'. The roller 39' is journaled to idle on a pin 43' anchored in the trigger latch 23'. A spring 40' is mounted in confronting apertures 41'-42' in the trigger latch arm 27' and the upraised portion 44' of the beam 20'. Because the curved secondary beam end 38' extends downwardly and laterally to terminate in a sharp secondary beam edge 37', the roller 39' on the latch 23' rides up and latches with the secondary beam end 39'. This affords practically frictionless release therefrom as well, since the roller 39' rides up and down therealong without any appreciable friction. As in the first described embodiment, the release is effected as the flexing in the beams 20'-21' elevates the latch trigger 23' until the preset torque load is applied.

At that time, the latch arm upper projecting nib 28' abuts against the inclined wedge surface 29 (FIG. 2) and displaces the trigger 23' in a counter-clockwise direction against the normal urge of the spring 40'. This causes the roller 39' to ride downwardly along and off of the curved secondary beam end 38' to release the secondary beam 21' from any further flex. At this occurs, the elasticity in the primary beam 20' permits the primary beam to return smoothly to a no load initial straight position as the user relaxes his handle grip to permit the straightened

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primary beam 20 to move the roller latch 23'-39' away from the secondary beam's curved edge 37' so that the trigger spring 40' will displace the roller 39' thereover for re-latching and again provide a solid beam between the handle end 19 and the work engaging head 12. The successive cycle of flexing is repeated on another fastener by application thereto and again a turning force is applied thereto. Should a different degree of tightness be desired, the button pointer nib 35 is manually displaced for positioning along the calibrated plate 34 to the desired indicated turning load.

Various changes may be made in the embodiment of the invention herein specifically described without departing from or sacrificing any of the advantages of the invention or any features thereof, and nothing herein shall be construed as limitations upon the invention, its concept or structural embodiment as to the whole or any part thereof except as defined in the appended claims.

I claim:

1. A preset torque wrench comprising a rigid elongated handle member, a pair of superposed flex beams disposed along said elongated handle member, a work engaging head member anchored to both of said flex beams and projecting from said handle member, a trigger latch and release mechanism on one of said flex beams to engage the other flex beam which shares the torque load after a partial load is impressed upon said first named flex beam to displace said trigger latch therewith for detachable engagement with the second named flex beam when the preset load has been applied so that both beams flex to carry the preset load beyond the initial load sustained alone by said first named flex beam, whereby the further application of a turning load continues until said trigger latch is deflected by an obstruction in the path thereof to release the last named flex beam from the first named flex beam in order to signal and momentarily arrest the further effective turning of the fastener by said work engaging member.

2. A preset torque wrench defined in claim 1 wherein a spring is disposed between said trigger latch and the flex beam mount to normally urge said trigger latch toward the other flex beam for connection therewith when said flex beams approach each other responsive to an initial load on said trigger latch beam.

3. A preset torque wrench defined in claim 1 wherein an adjustable obstruction is disposed in the path of said trigger latch to release the latter and disconnect said flex beams upon applying a preset torque turning load through said work engaging member.

4. A preset torque wrench defined in claim 2 wherein said superposed flex beams are laterally guided by said handle member with ball bearing raceways therebetween to encounter minimum friction.

5. A preset torque wrench defined in claim 2 wherein an adjustable obstruction is disposed in the path of said

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trigger latch to release the latter and disconnect said flex beams upon applying a preset torque turning load through said work engaging member.

6. A preset torque wrench defined in claim 3 wherein said trigger latch obstruction comprises a linearly adjustable wedge on said handle member to present an inclined surface obstruction.

7. A preset torque wrench defined in claim 6 wherein said wedge is suspended from a stud that is guided linearly in an elongated slot and said slot is calibrated to provide preset load settings therealong to position said wedge relative thereto.

8. A preset torque wrench defined in claim 7 wherein the first named beam is adjustably supported at its free end relative to said handle member for accuracy test control.

9. A preset torque wrench defined in claim 8 wherein said superposed flex beams are laterally guided by said handle member with ball bearing guides therebetween to encounter minimum friction.

10. A preset torque wrench defined in claim 1 wherein one of said superposed flex beams is shorter than the other to provide a long primary beam and a short secondary beam, and said trigger latch is pivotally mounted on said primary beam in the path of the free end of said secondary beam for connection and release relative thereto.

11. A preset torque wrench or the like comprising a rigid elongated handle member, a pair of superposed flex beams disposed along said elongated handle member, a work engaging head member anchored to both of said flex beams and projecting from said handle member, means for detachably connecting said flex beams together to share the torque load after a partial load is impressed upon said first named flex beam to displace said detachable connecting means therewith for disengaging said second named flex beam when the preset load has been applied so that both beams flex to carry the preset load beyond the initial load sustained alone by said first named flex beam, whereby the further application of the torque load continues until said detachable connecting means is actuated by trip means in the path thereof to release the last named flex beam from the first named flex beam to signal and momentarily arrest any further torque load turning of said work engaging member.

12. A preset torque wrench defined in claim 11 including calibrated means operatively connected to the trip means for positioning the latter to adjust the preset load limit.

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