

Nov. 12, 1957

S. D. PATERSON
MAGNETIC CONTROL MEANS FOR PREDETERMINED
TORQUE RELEASE WRENCH

2,812,677

Filed May 25, 1955

2 Sheets-Sheet 1

Fig. 1

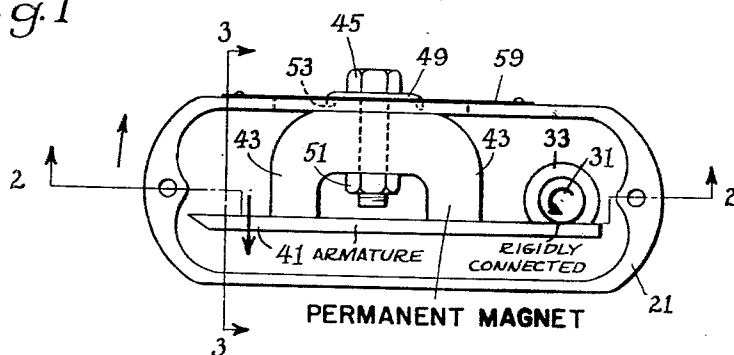


Fig. 3

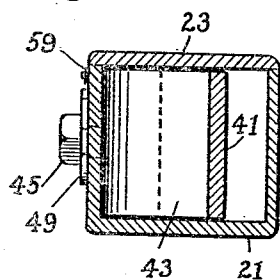


Fig. 2

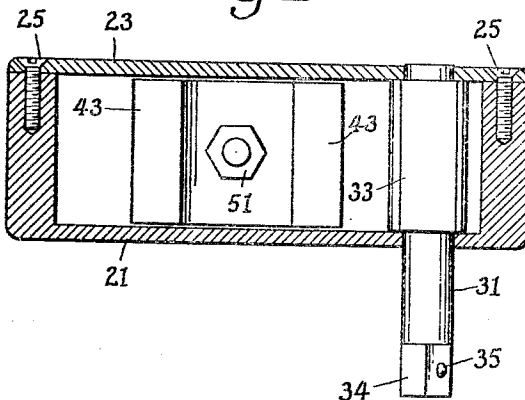
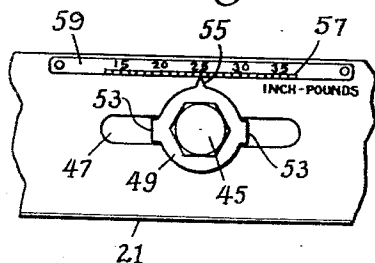


Fig. 4



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2 Sheets-Sheet 2

Fig. 5

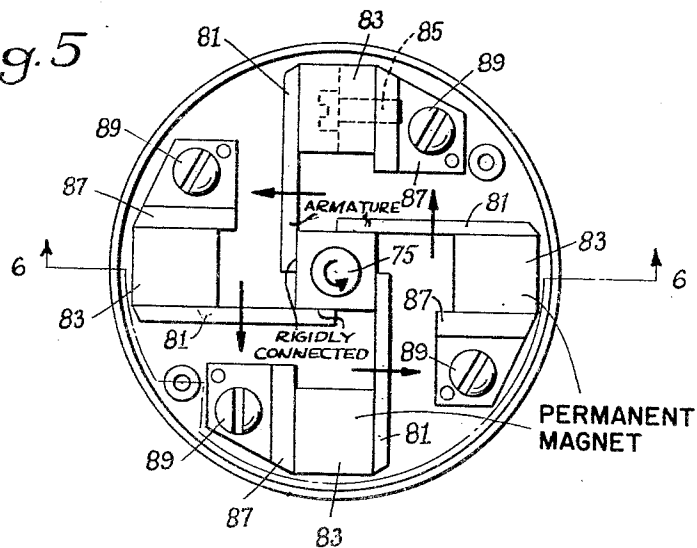
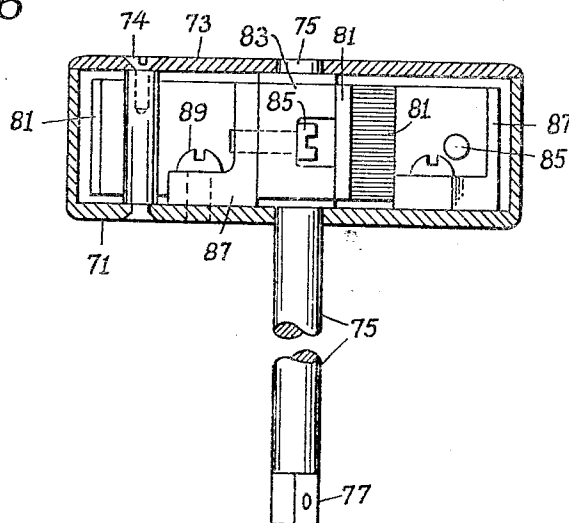


Fig. 6



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MAGNETIC CONTROL MEANS FOR PREDETERMINED TORQUE RELEASE WRENCH

Stuart D. Paterson, Irondequoit, N. Y.

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10 Claims. (Cl. 81—52.4)

This invention relates to a torque wrench for tightening a rotary fastening member, such as a nut, bolt, screw, or the like, to a predetermined torque.

An object of the invention is the provision of a generally improved and more satisfactory torque wrench.

Another object is the provision of a torque wrench of light, simple, compact, and inexpensive form.

Still another object is the provision of a torque wrench especially adapted for accurate torqueing within a relatively low range for which prior torque wrenches are not suitable.

A further object is the provision of a torque wrench so designed and constructed as to maintain a high degree of accuracy of torque force even after long continued use.

A still further object is the provision of a torque wrench having no parts subjected to severe wear.

A still further object is the provision of a torque wrench in which the torque force is produced magnetically, and may be adjusted within a reasonable range.

These and other desirable objects may be attained in the manner disclosed as an illustrative embodiment of the invention in the following description and in the accompanying drawings forming a part hereof, in which:

Fig. 1 is a top plan view of a torque wrench in accordance with a preferred embodiment of the invention, with the cover plate removed in order to show more clearly the interior construction;

Fig. 2 is a vertical section taken substantially on the line 2—2 of Fig. 1;

Fig. 3 is a transverse vertical section taken substantially on the line 3—3 of Fig. 1;

Fig. 4 is a side elevation of one side of the casing, illustrating the adjustment means;

Fig. 5 is a view similar to Fig. 1 showing a modified form of construction; and

Fig. 6 is a vertical section taken substantially on the line 6—6 of Fig. 5.

The same reference numerals throughout the several views indicate the same parts.

Referring first to the preferred form of the invention as shown in Figs. 1—4, there is provided a hollow casing indicated in general at 21, having a bottom wall, front and rear side walls, and end walls enclosing a hollow space closed by the removable cover plate 23 held in position by fastening means such as screws 25. The casing is elongated, as best seen in Fig. 1. Near one end of the casing is a vertical shaft 31 journaled in the bottom and top walls and having a portion 33 of enlarged diameter within the casing, forming shoulders fitting closely against the inner faces of the bottom and top walls to prevent axial movement to the shaft. The lower end of the shaft is squared as at 34 and is provided with a spring pressed ball detent 35 of the usual kind familiar to mechanics, which serves to retain frictionally on the squared end of the shaft any suitable tool which it is desired to mount thereon, such as any one of a series of socket wrenches of different sizes, or a screwdriver bit, or other suitable tools for engaging a nut, bolt, screw,

or other member which is to be tightened to a predetermined degree of torque.

The parts 21 to 34 inclusive are preferably made of some non-magnetic metal, such as brass or bronze.

Permanently secured to the enlarged part 33 of the shaft, as by brazing, is a soft iron armature 41 which extends laterally from the shaft almost to the opposite end of the free space within the casing, as well seen in Fig. 1. This soft iron armature cooperates with and is attracted to a permanent magnet 43 preferably of U-shape as seen, and preferably made of Alnico permanent magnet alloy so as to have a relatively high degree of magnetic strength for its size, and a high degree of permanence. The magnet 43 is adjustably held within the casing 21 by means of a bolt 45 passing laterally through the magnet substantially at its center line as shown, and out through a slot 47 extending longitudinally along the adjacent side wall of the casing, and through a washer 49 which is received under the head of the bolt 45 and which lies on the outside face of the casing. A nut 51 on the inner end of the bolt serves to draw the rear face of the magnet tight against the inner face of the wall of the casing 21, when the head of the nut is tightened, and at the same time the washer 49 is drawn tightly against the outer face of the casing wall.

Opposite sides of the washer 49 are provided with inwardly bent ears 53 which extend into the slot 47 so as to hold the washer always in a predetermined position of orientation with respect to the slot, in spite of any tendency of the washer to turn when the bolt head 45 is tightened or loosened. A projection 55 at the top of the washer serves as an index mark or pointer to cooperate with a graduated scale 57 which may be either engraved directly of the outer face of the casing or, preferably, may be formed on a separate scale strip 59 suitably fastened by rivets or screws to the casing.

In use, a suitable screwdriver bit or socket wrench of the proper size is placed on the squared end 34 of the shaft, and is engaged with the nut, bolt head, screw head, or other part which is to be tightened to a determined degree of torque. The casing 21 itself is grasped by the operator's hand and serves as the wrench handle. The casing is then turned in the direction of the arrow in Fig. 1, that is, in a clockwise direction when viewed from above, the turning motion being, of course, about the vertical axis of the shaft 31 as a center of rotation. Until the predetermined degree of torque is reached, the magnet 43 holds the armature 41 tight against the two pole pieces or faces of the magnet, so that the shaft 31 turns with the turning movement of the casing 21. The cooperating or contacting magnet pole faces and armature face are of the plane form, and lie in a plane parallel to the axis of rotation of the shaft 31.

During the turning or tightening operation, the shaft 31 offers an increasing resistance to turning as the nut, bolt, screw, etc., is tightened more and more. Finally the point is reached at which the magnet 43 can no longer hold the armature 41 in contact with the magnet, in view of the increasing resistance to turning the shaft, and then the armature suddenly pulls away from the magnet 43 as the operator attempts to turn the casing 21 somewhat further, and hits against the opposite wall of the casing with a loud clacking noise. This noise, plus the sudden feeling of release transmitted to the operator's hand, clearly signals to the operator that the predetermined degree of torque force has been reached.

If the operator lets go the casing 21, or if he turns it slightly in a counterclockwise direction, the torque wrench immediately resets itself automatically, the armature 41 being drawn back into contact with the face of the magnet 43.

By loosening the bolt head 45 so that the bolt and the

entire magnet assembly can be moved longitudinally along the slot 47, the torque wrench may be set to different degrees of torque, within the limited range available. The farther the magnet is placed from the shaft 31, the greater will be the torque setting of the wrench, because the effective lever arm of the armature 41 (from the center of rotation of the shaft to the center of force of the magnet) will be greater. Conversely, as the magnet is adjusted closer to the shaft 31, it will snap or release at a lower torque. The bottom of the magnet lies close to the bottom wall of the casing, as well seen in Fig. 2, which circumstance serves to prevent accidental tilting or tipping of the magnet within the casing when the bolt 45 is tightened or loosened.

It is seen that there are no moving parts subjected to wear, to any appreciable degree. These are no catches or latches likely to wear at sharp corners and thereby become inaccurate, as is the case with certain types of prior torque wrenches. The wear of the shaft 31 in its bearings in the casing is insignificant, as there is only a slight fraction of a turn at each operation. The flat face of the armature abuts squarely against the flat faces of the magnet, and the faces come against each other and leave each other in a perpendicular direction without sliding or rubbing, so that there is no appreciable wear at these points.

This construction has been used with great success and is found to be extremely accurate and uniform, even after long use. It is especially adapted to low degrees of torque, such as torque in the range of, for example, 15 inch pounds up to about 35 inch pounds, which range is not satisfactorily handled by prior torque wrenches. For such a range, the casing 21 may be about 4 inches long and 1½ inches wide, so that it forms a convenient handle easily grasped in one hand.

Referring now to the alternative construction shown in Figs. 5 and 6, the same principles are employed in a slightly different form. The casing 71 in this instance is of circular form, likewise made of non-magnetic material as before, and the casing itself serves as the handle of the wrench, being conveniently of a diameter of about 4 or 5 inches. It has a removable cover plate 73, held by screws 74. The shaft 75 rotatable in the casing approximately at the center thereof has the same squared lower end 77 as described in connection with the first embodiment, to which squared end any suitable wrench socket or screw-driver bit may be attached.

In this form of the invention, the upper end of the shaft within the casing is square, and is brazed or otherwise secured to several different soft iron armatures 81 angularly spaced from each other, four being here shown. Each armature cooperates with its own separate magnet 83 secured by a screw 85 to a bracket 87 which in turn is secured by a screw 89 to the bottom wall of the casing. The magnets are so arranged that the armatures engage the faces of all of the magnets simultaneously or break away from all of them simultaneously.

This wrench is capable of satisfactory torquing to a higher degree of force than is possible with the first embodiment, because of the several different magnets employed. It is also capable of satisfactory use with less than the four magnets shown, so that if a relatively low degree of torque is desired, one or two or three of the magnets may be taken out, thereby reducing the holding power and lowering the torque force at which the wrench will operate. As before, the reaching of the predetermined torque is signalled to the operator both by his sense of feel and by the audible clacking noise plainly heard when the armatures pull away from the magnets and hit suddenly against other metal parts of the wrench.

It is seen from the foregoing disclosure that the above mentioned objects of the invention as well fulfilled. It is to be understood that the foregoing disclosure is given by way of illustrative example only, rather than by way of limitation, and that without departing from the invention,

the details may be varied within the scope of the appended claims.

What is claimed is:

1. A torque wrench comprising a handle member, a wrench shaft mounted for limited rotation with respect to said handle member and having a portion adapted to be operatively connected in torque transmitting relation to a fastening member to be tightened, a magnet supported from said handle members in a position offset laterally from said shaft, said magnet having at least one flat face, and an arm fixed to said shaft to turn therewith and projecting laterally from said shaft to the vicinity of said magnet, at least a portion of said arm in the vicinity of said magnet being of magnetic material constituting an armature attracted by said magnet and having a flat portion normally lying in direct contact against said flat face of said magnet, the magnetic attraction between said magnet and said armature constituting an operative driving connection between said handle member and said shaft to turn the shaft with the handle member until the resistance to turning the shaft becomes so great as to separate the magnet from the armature upon continued turning motion of the handle member.

2. A construction as defined in claim 1, in which said magnet is adjustably mounted on said handle member to different positions at different distances from the axis of rotation of said shaft.

3. A construction as defined in claim 2, further including a graduated scale associated with said magnet for indicating the torque force for which the wrench is set when the magnet is in any given position of adjustment.

4. A torque wrench comprising a handle member, a wrench shaft mounted for limited rotation with respect to said handle member and having a portion adapted to be operatively connected in torque transmitting relation to a fastening member to be tightened, a magnet supported from said handle member in a position offset laterally from said shaft, and an arm fixed to said shaft to turn therewith and projecting laterally from said shaft to the vicinity of said magnet, at least a portion of said arm in the vicinity of said magnet being of magnetic material constituting an armature attracted by said magnet, the magnetic attraction between said magnet and said armature constituting an operative driving connection between said handle member and said shaft to turn the shaft with the handle member until the resistance to turning the shaft becomes so great as to separate the magnet from the armature upon continued turning motion of the handle member, said handle member being substantially in the form of an elongated hollow casing with said shaft located near one end thereof.

5. A construction as defined in claim 4, in which said casing and said shaft are of non-magnetic material and in which said arm is of soft iron and extends laterally from said shaft in a direction along said elongated casing.

6. A construction as defined in claim 5, in which said casing includes a longitudinally extending side wall provided with an elongated slot, and in which said magnet is adjustably held within said casing by screw threaded fastening means passing through said slot and capable of being moved to different positions of adjustment along said slot when said fastening means is loosened.

7. A construction as defined in claim 1, in which said handle member is substantially in the form of a hollow casing of circular cylindrical form and said shaft is located approximately at the center thereof.

8. A construction as defined in claim 7, further including a plurality of armature arms extending radially from said shaft in angularly spaced relation to each other, and a plurality of magnets mounted in said casing, one cooperating with each armature arm.

9. A construction as defined in claim 8, in which each of said magnets is detachably mounted within said casing so that one or more magnets may be removed to alter the total magnetic torque force produced by the wrench.

2,812,677

5

10. A construction as defined in claim 1, in which said armature normally lies in contact with said magnet along a contact face which is substantially in a plane parallel to the axis of rotation of said shaft.

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