

Feb. 8, 1955

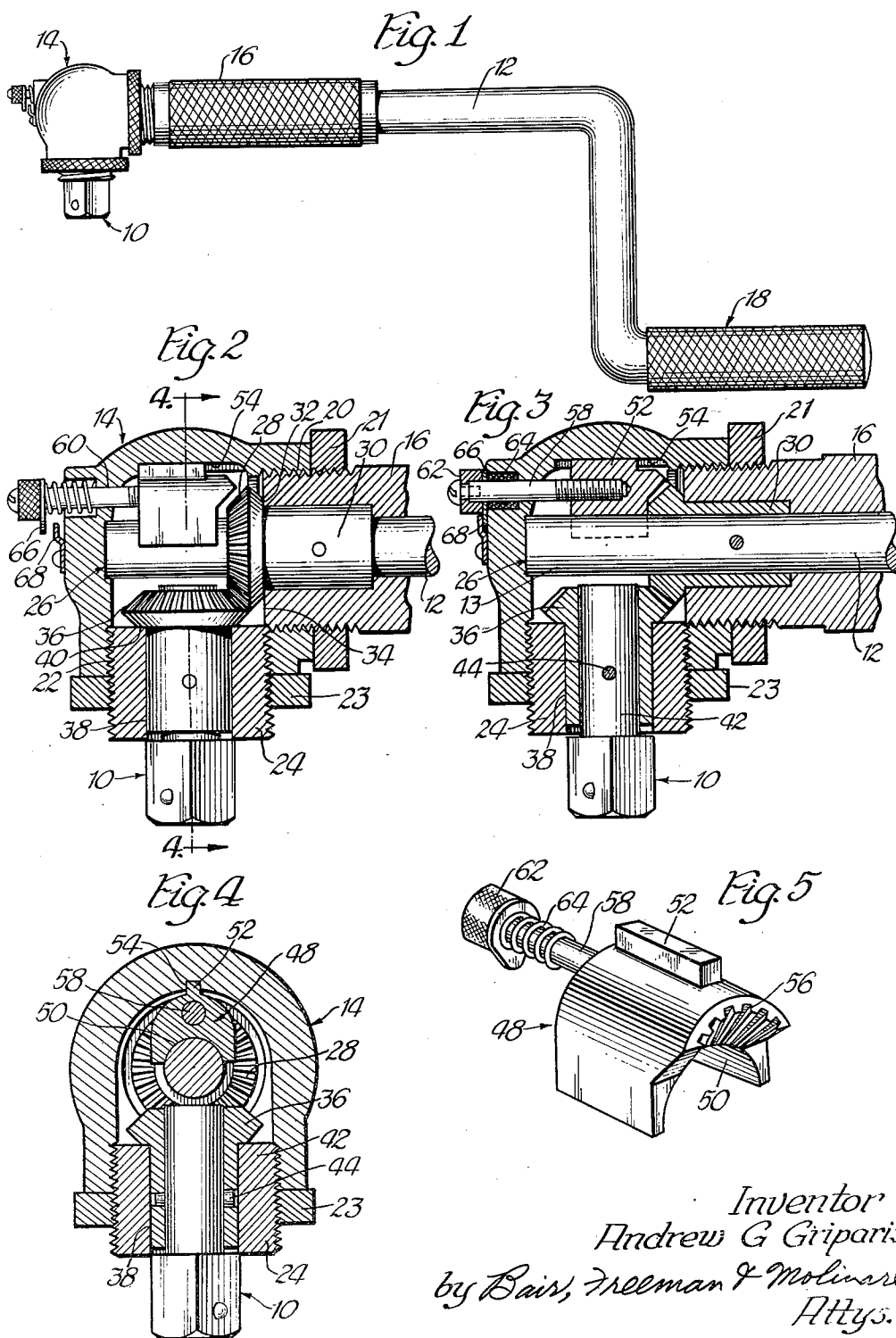
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GEAR OPERATED SOCKET WRENCH, WITH ALTERNATIVE DRIVE MEANS

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2 Sheets-Sheet 1



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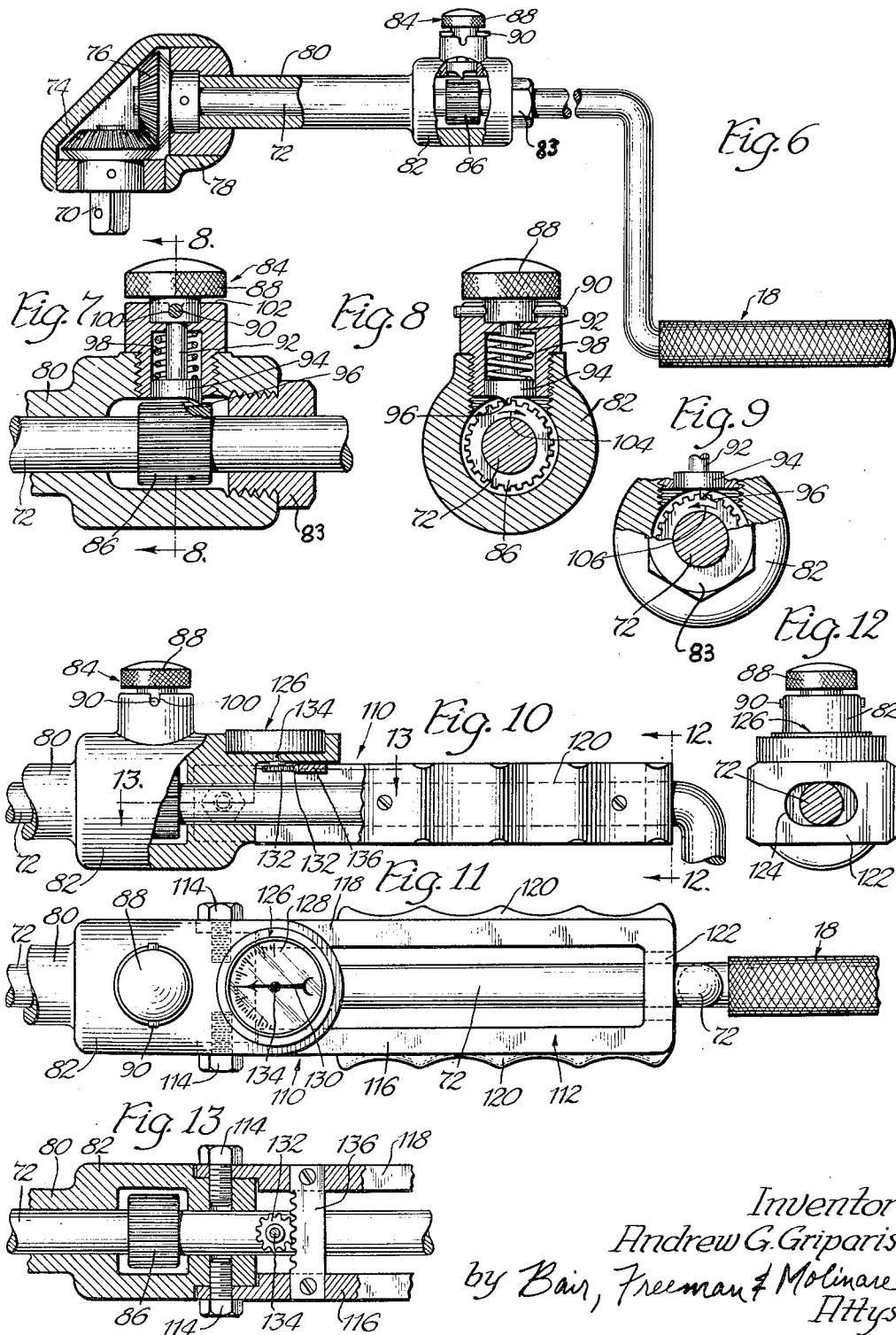
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GEAR OPERATED SOCKET WRENCH, WITH
ALTERNATIVE DRIVE MEANS

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Application July 14, 1951, Serial No. 236,780

1 Claim. (Cl. 81—57)

This invention relates to wrenches, and more specifically to a wrench which may be used selectively either as an angle speed wrench or a torque wrench.

In driving nuts and bolts or in the rotary driving of other similar members, a number of tools are often necessary. In running a nut or bolt rapidly, a speed wrench is desirable. Hand speed wrenches are usually crank type tools. In final tightening of nuts and bolts, torque wrenches are usually used. Torque wrenches usually consist of a driving socket or bit at the end of a lever arm. A ratchet type torque wrench permits repeated arcuate movement of the wrench without removing the driving bit from the member being driven. For rapidly driving a bolt and then for tightening the bolt, at least two separate tools are needed.

There are, also, many occasions when it is desirable to rapidly drive a nut or bolt where access to the driven member may be had from a region displaced laterally from the direction in which the member is driven. On such occasions, the usual crank type speed wrenches are useless and an end wrench must be used. In such situations, a ratchet type end wrench is a decided improvement over an ordinary end wrench, but even then not much speed is attained.

Thus, one of the objects of this invention is to provide a speed wrench having a driving bit which is driven by a shaft that is rotated about an axis transverse to the axis of the driving bit.

Another object of this invention is to provide an angle speed wrench for rapidly running nuts and bolts, wherein the driving shaft is rotated about an axis substantially normal to the axis of the nut or bolt.

A further object of this invention is to provide a single tool which may selectively be used as a speed wrench or a torque wrench.

Still another object of this invention is to provide a speed wrench having a driving shaft and driving bit positioned transverse to each other and means for locking the driving shaft with respect to the driving bit whereby said speed wrench is converted to a torque wrench.

And still a further object of this invention is to provide a speed wrench which may be locked so as to convert the speed wrench into a torque wrench and having means providing for ratcheting of the lever arm when used as a torque wrench.

And still another object of this invention is to provide a novel means for locking together a pair of transverse shafts which are interconnected in driving relation by means of bevel gears.

And still a further object of this invention is to provide an attachment to a wrench, which attachment will indicate a measure of the torque being applied.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claim annexed to and forming part of this specification.

A preferred embodiment of the invention is shown in the accompanying drawing, in which—

Figure 1 is a side elevation view of my speed and torque wrench;

Figure 2 is an enlarged cross-section view of the driving connection between the rotatable wrench shaft and the driving bit, and shows the driving connection unlocked for use of the tool as a speed wrench;

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Figure 3 is similar to Figure 2, but shows the driving connection locked for use of the tool as a torque wrench;

Figure 4 is a cross-section view taken on line 4—4 of Figure 2;

Figure 5 is an isomeric view of the member which is manipulable to lock or unlock the driving connection between the rotatable wrench shaft and the driving bit;

Figure 6 is a modified form of the speed and torque wrench and shows another type of clutch and ratchet member with the clutch in a neutral or non-ratcheting position;

Figure 7 is an enlarged cross section view of the clutch and ratchet arrangement shown in Figure 6, showing the ratchet in position to permit clockwise rotation of the shaft;

Figure 8 is a cross section view taken on line 8—8 of Figure 7;

Figure 9 is similar to Figure 8 but shows the ratchet in position to permit counterclockwise rotation of the shaft;

Figure 10 is a side elevation with portions broken away, showing the speed and torque wrench of Figure 6 equipped with a torque indicating attachment;

Figure 11 is a top plan view of the torque indicating attachment shown in Figure 10;

Figure 12 is a view taken on line 12—12 of Figure 10;

Figure 13 is a cross-section view taken substantially on line 13—13 of Figure 10.

Referring now to the drawings, there is shown in Figure 1 my speed and torque wrench. This wrench includes a driving bit generally indicated at 10, and a driving shaft 12, substantially at right angles to the axis of the driving bit 10. The region of intersection of the axis of the driving bit 10 and the axis of drive shaft 12 is enclosed in a lubricant filled housing generally indicated at 14, wherein is housed the means for interconnecting the drive shaft 12 and the driving bit 10. Extending from the housing at substantially right angles to the axis of the driving bit 10 is a handle 16 through which the rotatable drive shaft 12 extends concentrically. The drive shaft 12 is provided with a crank indicated at 18.

Referring specifically to Figures 2, 3, and 4, the housing 14 is generally in the form of a tubular elbow. The stubs of the housing 14 are threaded at 20 and 22. Handle 16, threaded at one end for engagement with threads 20, is fixed with respect to the housing 14. The other stub, having threads 22, has a collar 24 screwed therein. Lock nuts 21 and 23, respectively, maintain handle 16 and collar 24 fixed in housing 14.

The drive shaft 12 is coaxially journaled within handle 16. Drive shaft 12 also includes a stub portion 13 which extends within housing 14 and is journaled at one end thereof in the wall of housing 14 as shown at 26. Concentrically mounted on drive 12 is a bevel gear 28. Bevel gear 28 has a hub 30 which is journaled within handle 16. A shoulder 32 on bevel gear 28 engages the face 34 of handle 16 to fix bevel gear 28 in position on shaft 12.

Rotatably journaled in collar 24 is a second bevel gear 36. Bevel gear 36 has a hub 38 and a shoulder 40, which shoulder engages one end of collar 24 to fix gear 36 in position. The bevel gears 28 and 36 are intermeshed.

A driven shaft 42 is concentrically positioned within bevel gear 36 and hub 38, and has formed on the extended end thereof the driving bit 10. A pin 44 fixes shaft 42 within the hub 38 of bevel gear 36.

Also positioned in the housing 14 is a locking member generally indicated at 48, which locking member is shown in isomeric view in Figure 5. This locking member has an arcuate surface 50 adapted to fit over the stub portion 13 of the drive shaft 12. Positioned opposite the curved surface 50 of locking member 48 is a key 52, which is fitted into a keyway 54 in housing 14. The keyway 54 extends parallel to the axis of drive shaft 12, and thus axial movement of the locking member 48, with respect to the stub portion 13, is provided. The locking member 48 also has formed therein a plurality of beveled dental elements 56 which are adapted to mesh with the teeth of bevel gear 28. When this occurs, the bevel

gear 28 is locked with respect to the housing, and, therefore, the bevel gear 36 is also locked.

Attached to locking member 48 is a stem 58 which extends through bore 60 in housing 14. An enlarged cap 62 is mounted on the extended end of stem 58 and a spring 64 is mounted concentrically on stem 58 between the cap 62 and the housing 14. This spring normally biases the stem 58 outwardly and maintains the lock member 48 in the retracted position shown in Figure 2.

In order to make the locking member 48 mesh with the teeth of bevel gear 28, it is necessary to press on the cap 62, thus depressing spring 64. A catch arrangement consisting of disc 66, rotatably mounted on the stem 58, and lip 68, mounted on housing 14, is provided for maintaining the locking member in meshing position as shown in Figure 3. The use of these members 66 and 68 is optional, and only when the wrench is to be used solely as a torque wrench will such an arrangement be used.

In the operation of the speed and torque wrench herein described, an appropriate size socket is snapped onto the driving bit 10. The socket is then engaged with the nut or bolt to be driven, and by rotating the crank 18 about the axis of shaft 12, the bolt is quickly run up. During the operation as a speed wrench, one hand grasps the handle 16 to steady the wrench while the other hand operates crank 18. After the bolt is initially run up, it may be desired to put large torque on the bolt so as to securely tighten the bolt. In such case, the cap member 62 is depressed, locking the bevel gears with respect to each other, and changing the speed wrench into a torque wrench. The cap 62 may be manipulated by one of the fingers while the hand still grasps the handle 16.

Where the torque wrench is to be operated by repeated swinging through a small arc, it is not necessary that the driving bit 10 and attached socket be removed from the bolt being driven. By merely releasing the crank 18, and by releasing the cap 62, it is then possible to swing the wrench backwardly through the arc in which the torque wrench has moved, by simply holding the handle 16 and pivoting it around the axis of driving bit 10. What will happen is that the bolt tension will maintain the driving bit 10 in fixed position, and the shaft 12 and crank 18 will be rotated because the position of the bevel gears will be changed with respect to each other. After the wrench has been swung backward through an arc, the crank may again be grasped and by depressing the cap 62, the wrench is then in a position for another application of torque to the bolt being driven. Such an operation is a ratcheting operation.

It will be evident that the entire operation described herein may be reversed for loosening tight members and rapidly spinning them out.

While it has been shown that the locking member 48 cooperates with the stub portion 13 of driving shaft 12, it will be evident that the driven shaft 42 may equally be extended within the housing, and the locking member 48 may just as simply cooperate with this extended shaft. Furthermore, although the driving shaft 12 and driving bit 10 are shown substantially at right angles to each other, it will be apparent that different angles may be included without departing from the scope of this invention.

Although a manually operated ratcheting means has been described, it will be evident that suitable automatic ratcheting means may also be incorporated without departing from the spirit and scope of my development.

A modified form of my speed and torque wrench is shown in Figures 6 to 9. This modified form includes driving bit 70 and a drive shaft 72 which are interconnected by means of bevel gears 74 and 76. The bevel gears 74 and 76 are enclosed in a housing 78, wherein said gears are suitably journaled. A handle 80 is suitably connected to housing 78; and shaft 72 extends concentrically therethrough.

The handle 80 has formed integrally therewith a clutch housing 82. A locking or clutch member generally indicated at 84 is mounted in said housing. The clutch member 84 is one of a pair of ratcheting members. The other ratcheting member is a gear 86 which is fixed concentrically on shaft 72 and positioned within housing 82. In assembling the shaft 72 and gear 86 within handle 80 and housing 82, an aperture must be provided in housing 82 to permit entrance of the gear 86. A clutch member for this aperture, illustrated in Figures 6 and 7 as

a nut 83, is secured to housing 82 to fully enclose the gear 86.

The locking or clutching member 84 includes a manipulable head 88, a cross pin 90, a stem 92 and a base member 94. A depending tooth 96 is formed on base 94 and is adapted to cooperate with gear 86. A spring 98, concentric with stem 92, acts on base 94 to bias clutch member 84 toward the gear 86.

The clutch housing 82 is provided with notches 100 adapted to receive cross pin 90. By gripping head 88 and pulling outwardly, the cross pin 90 is withdrawn from notches 100. The clutch member 84 may then be rotated to the neutral or non-ratcheting position shown in Figure 6, wherein the cross pin 90 is positioned on shoulders 102 of housing 82. When the clutch member 84 is in the position shown in Figure 6, the wrench is to be used as a speed wrench.

When the cross pin 90 is seated in notch 100, then the clutch member 84 is in the ratcheting position. The tooth 96 is so shaped that it is adapted to lock shaft 72 when it is attempted to rotate shaft 72 in one direction but to permit ratcheting of the shaft 72 when rotated in the opposite direction. When the tooth 96 is in the position shown in Figure 8, it permits ratcheting of the shaft 72 in the clockwise direction, as indicated by the arrow 104. The clutch member 84 may be drawn upwardly to release cross pin 90 from notch 100 and then rotated 180° so that tooth 96 may be positioned as shown in Figure 9. When tooth 96 is in the position shown in Figure 9, ratcheting of the shaft 72 is permitted in the counterclockwise direction as indicated by arrow 106.

Figures 10 to 13 illustrate a torque measuring attachment generally indicated at 110, which is shown adapted for use with the wrench shown in Figures 6 to 9 and described hereinbelow. This torque measuring attachment is not limited to the specific adaptation shown herein and may obviously be used with other wrenches.

As shown in Figure 10, the attachment 110 is for use with a torque wrench. The portion of the wrench, which is illustrated in Figures 6 to 9, and which is reproduced in Figures 10 to 13, shows the clutch member 84 in a position to lock the drive shaft 72 so as to convert the wrench into a torque wrench.

The torque measuring attachment 110 comprises a U-shaped handle 112 secured by means of bolts 114 to a clutch housing 82. The legs 116 and 118 of U-shaped handle 112 are formed with or have mounted thereon finger grips 120.

The connecting leg 122 of U-shaped handle 112 has a hole 124 therein for passage therethrough of drive shaft 72. The hole 124 is laterally elongated to accommodate relative movement of handle 112 with respect to shaft 72.

The handle 112 is formed of steel or some other material which will bend and accurately return to its original position. Handle 112 is more readily bendable than are handle 80 and housing 82 attached thereto. For all intents and purposes, handle 80 and housing 82 are rigid and non-deformable. The measurement of torque is accomplished by measuring the relative deformation of handle 112 with respect to housing 82, the handle 112 being more readily deformable than housing 82.

The torque measuring attachment 110 includes an indicator 126 which is mounted on rigid housing 82. The indicator 126 includes a graduated dial 128 and a pointer 130. The pointer 130 is interconnected to a transmission member, in this case a pinion 132 mounted on shaft 134, for measuring the relative deformation of the handle 112 with respect to a fixed point, in this case the center of shaft 134.

A rack 136 is positioned between legs 116 and 118 of handle 112 and cooperates with pinion 132 to measure the relative deformation of the handle 112 with respect to the relatively rigid handle 80 and housing 82. The relative deformation is usually measured in terms of length but may be indicated in terms of torque if the dimensions of the tool and the modulus of elasticity of tool material are known.

It is desirable to measure the relative deformation at the center line of the instrument and, therefore, the fixed point, the center of shaft 134, is positioned substantially in the vertical plane extending through the axis of drive shaft 72 and the axis of driving bit 70.

Other means may be employed to measure the relative deformation of the handle 112 with respect to the rela-

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tively non-deformable handle 80, and this particular means, including the rack 136 and pinion 132, is merely exemplary.

The U-type or form of handle 112 is the most desirable, because the legs 116 and 118 substantially form the walls of a box beam. Box beam construction is most economical, in that for a given strength, the least amount of material is used; and consequently in this device, for a given torque applied to the wrench, the material is located where it will do the most good from the standpoint of being highly stressed and so as to indicate relative deformation of the torque measuring attachment 110 with respect to the remainder of the wrench.

While there has been shown and described a particularly embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore, it is intended in the appended claim to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is:

A speed and torque wrench comprising a driving shaft adapted to be rotated, a driven shaft transverse to said driving shaft, intermeshing bevel gears on said driving shaft and driven shaft, a housing journalling said bevel gears, one of said shafts extending beyond the gear face of the bevel gear mounted thereon to form a supporting stub, the extended end of said supporting stub being jour-

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nalled in said housing, a locking member having teeth adapted to be selectively meshed with one of said bevel gears to prevent rotation of said bevel gears, said locking member having a cylindrical recess therein through which said supporting stub extends, said locking member and said housing having cooperating portions which define a keyway, running parallel to the axis of said supporting stub, and a key therein, whereby said locking member is restricted to reciprocal movements in directions parallel to the axis of said supporting stub, means normally biasing said locking member to a non-locking position, and a stem attached to said locking member and extending outside the housing to provide for manual manipulation of the locking member in a direction axial of said supporting stub to a locking position.

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