This invention relates to chain driven wrenches particularly adapted for working on nuts in the interior of diesel type engines where the nuts are inaccessible or difficult to reach by the use of prior art tools, and require great torque to loosen or tighten them.

The main object of the invention is to produce a wrench efficient for its intended purposes, wherein the nut engaging socket and power output end of the wrench are removed from the input end and said output end is of minimum size for operation in restricted spaces. The construction is designed so the input end is accessible for actuation of the manually operable lever connected to the input shaft, while the output end is in operative relationship to the work interiorly of the engine housing.

To achieve these and other objects, we have provided a wrench comprising either one or two main units. When two units are used one is a gear or chain driven mechanism including power input means and the other a chain driven transmission device, adapted to be operatively connected together for transmitting rotary motion to a socket member removably mounted on one end of the transmission device.

An important advantage of the invention lies in the fact that the chain driven transmission devices may be made of different lengths to suit different environments, and the wrench as a whole may be made of one or two units of selected length to suit the environment in which it is to be employed.

Another feature of the invention lies in the provision of back lash controlling means associated with the power input mechanism for controlling lost motion in the power transmitting means between the input shaft and the nut engaging socket.

These and other objects and advantages will appear from the following specification.

In the drawings:

Fig. 1 is an elevational side view of a wrench embodying our invention, in operative position relatively to a nut on an engine main bearing; part of the wrench being indicated diagrammatically in dotted lines.

Fig. 2 is a sectional view taken in the horizontal plane indicated by the line 2—2 on Fig. 1, looking downwardly as indicated by the arrows.

Fig. 3 is a longitudinal vertical sectional view of the power input end of the wrench.

Fig. 4 is a sectional view of a detail of construction, namely, the back lash mechanism; the section being taken in the horizontal plane indicated by the line 4—4 of Fig. 3.

Fig. 5 is an elevational side view showing a modified form of wrench embodying our invention, the chain driven unit being partly broken away.

Fig. 6 is a horizontal sectional view of another modification, showing a single unit embodiment of the invention.

Fig. 7 is a vertical sectional view taken in the plane of the dotted lines 1—1 of Fig. 6.

Referring to one embodiment of our invention, as shown in Figs. 1 to 4 inclusive, a gear driven mechanism indicated as a whole at 10, is provided with a manually operable lever 11 drivingly engaging the input shaft 12. The shaft 12, through gears 13, 14, 15, 16, drives the output shaft 17.

The shaft 17 transmits rotary motion to a nut engaging socket 18 through a chain driven transmission device indicated as a whole at 19. The device 19 may be made as long as desired to span the distance between the shaft 17 of the gear driven member of the wrench and the nut, such as the nut 20 engaged by the socket 18. Fig. 21 indicates a fixed end of the bolt on which the nut 20 is mounted. The ready adaptability of the transmission device 19 of our invention to different tasks is an important advantage of our invention.

Said transmission device 19 comprises a housing 22 which is rigidly secured to or integral with an interior frame 23. A bracket 24 projects from one end of the housing 22 to provide anchoring and supporting means for the base of the unit 10. This unit preferably has legs or other straddling means 25 adapted to cooperate with the bracket 24 for mounting the unit 10 on the transmission device 19.

Between the ends of the frame 23 and the housing 22 are sprocket wheels 26, 27, respectively, operatively connected by the chain 28 mounted thereon. The sprocket wheel 26 is keyed to a shaft 29 as indicated at 30; said shaft 29 being journaled in the housing 22 and provided with a square recess in its upper end for drivingly engaging the power output shaft 17 of the unit 10. The sprocket wheel 27 is keyed to a shaft 31 as indicated at 32; said shaft 31 being journaled in the housing 22 at the end opposite the shaft 29, and provided with a hex or square recess in its upper end for drivingly engaging the shaft 33 of the socket 18.

The chain driven transmission device 19 is a portable unit preferably embodying a one piece rigidly formed casting comprising the frame 23 and housing 22, of any desired length, in which are mounted the shafts, the sprocket wheels and
The unit may be made to occupy very limited space between its upper and lower surfaces, which is an important advantage when the space above or below the nut to be worked on is restricted. Since the unit 19 may be made as long as desired without impairing the efficiency of the chain drive mechanism, it is possible to employ a gear driven unit in combination with the chain driven transmission unit, and to mount the manually operable unit 10 outside of the engine housing or in other convenient places easily accessible for the application of power, without interference by or danger of injury to oil lines, water lines, wiring, or other parts of the engine interior adjacent the nuts intended to be worked on by the socket end of the mechanism.

It will be understood that, in practice, the manually operable lever 11 sometimes cannot be used to impart continuous rotary motion to the input shaft 12, and that the operator moves the lever through an arc of approximately 150 degrees and then releases the hold to reposition the lever 11 for a successive operation. When it is necessary to reposition the manually operated input lever for another pull, lost motion is provided in the chain and gear driven mechanisms. This lost motion is caused by the elastic stretch of the chain drive, or by play in the socket, and/or the backlash in the gear driven mechanism. The lost motion is multiplied through the gear train. In order to control this lost motion a backlash ratchet is provided on the input pinion of the geared wrench unit to take up any lost motion picked up at each pull.

The back lash controlling means comprises a ratchet 34, keyed at 35 to a spindle 33 in a cylindrical housing 31 positioned in the unit housing 10 adjacent the lever 13 on input shaft 12. The relative positions of the ratchet 34 and gear 13 are clearly shown in Fig. 4. An operating handle 35 is fixed on the spindle 33 and is accessible at the top of the unit 13 as shown in Figs. 1 and 3. A tooth 39 is spring pressed by a spring 48 in an auxiliary housing 41, for engaging one of the ratchet teeth. When it is desired to hold or control the back lash, the operator turns the handle 35 in the appropriate direction to move the ratchet into either of the dotted line positions wherein the ratchet tooth 39 or 43 will be in engagement with the gear 13 for the purpose of preventing reverse movement of the power transmitting mechanisms between the input shaft 12 and the socket 18, when the operator interrupts his manual rotation of the input shaft 12.

Referring now to the modification shown in Fig. 5, the unit indicated as a whole at 59 may be gear or chain driven and need not be described in detail. It embodies an input shaft 51, output or transmitting shaft 52, and a manually operated lever 53 for actuating the input shaft 51. Back lash controlling means similar to that heretofore described is indicated as a whole at 54.

The unit 59 is designed to cooperate with a chain driven unit 55 which is similar to the one heretofore described in connection with Figs. 1 to 4, inclusive. Similar numbering has been used to indicate similar parts of said unit 19.

Figs. 6 and 7 illustrate that embodiment of the invention in which the wrench consists of a single unit indicated as a whole at 55, and gear or chain driven units such as those indicated at 16 and 58 have been dispensed with. The unit 55 comprises two rotatable shafts 56, 57, the shaft 56 being recessed to receive a manually operated shaft 58. The shaft 57 is the output shaft provided with a socket 59 for receiving the shank of a wrench socket (not shown) similar to the one indicated at 18 in other views. A large sprocket wheel 60 is keyed to the shaft 56, as indicated at 62, and a smaller sprocket wheel 61 is similarly keyed to the shaft 57, by key 62. Said sprocket wheels are operated by a endless chain 63. The parts described are mounted in a housing 64 provided with a frame 65 similar to the parts 22 and 23 of Figs. 1 to 4, inclusive, but shaped to accommodate the different sized sprocket wheels and other members.

In this embodiment the back lash controlling mechanism 67 is mounted adjacent the larger sprocket wheel 60 or input side of the wrench. Said mechanism 67 may be of any desired form but as shown it consists of a shaft 68 on which is axially mounted a ratchet or dog 69 which engages one of the teeth 10 of the large sprocket 60, in the manner and for the purposes described in connection with the back lash controlling means of Figs. 1 to 4, inclusive. The said mechanism is manually controlled by the handle 71. A spring pressed tooth 72 prevents the ratchet or dog 69 from turning except when operated by the handle 71.

From the foregoing it will be understood that the chain driven unit 55 differs from the unit 19 in that the former is designed to be actuated by the direct application of manual power to the input shaft 56, and that due to the different sized sprocket wheels on the shafts 56 and 57, multiplication of power is achieved and transmitted through the chain to the socket shaft 59. Further, said unit 55 includes its own back lash controlling mechanism. Therefore the unit 55 may be used in certain environments where a single unit is preferred to the two unit devices of Figs. 1 to 5, inclusive.

In the two unit embodiments, the manually operated and power multiplying units 16 and 59 may be driven by gears, chain, or other means or operatively connecting the input and transmitting shafts for the purpose of transmitting rotary motion to the chain driven unit.

It will be understood that the extension or support 24 on the chain driven unit cooperates with the 22 on the 10 or 50 to support the latter and anchor it in operative position on the chain driven unit 19.

Changes may be made in the form of the parts, in the power transmitting means employed and in details of construction without departing from the scope of our invention as set forth in the appended claims.

We claim:
1. A wrench comprising a frame, an input shaft and an output shaft rotatably mounted in the frame, means drivingly connecting said shafts, means for rotating the input shaft, a gear on the input shaft, a socket operatively connected to the output shaft, and back lash controlling means independent of the means drivingly connecting said input and output shafts, and operable independently of the means for rotating the said shaft, said controlling means comprising a pinion parallel to the input shaft, a ratchet fixed on said pinion for operative engagement with said gear on the input shaft, means restraining the rotation of the ratchet, and manually operable means for rotating said spindle and ratchet in either direction.
2. A wrench comprising two separable units,
one unit comprising a housing, an input shaft and an output shaft rotatably mounted therein, means drivingly connecting said shafts, means for rotating the input shaft, and backlash controlling means in operative engagement with the input shaft, said backlash controlling means being independent of the means for drivingly connecting said input and output shafts, and operable independently of the means for rotating the input shaft, the other unit comprising a frame, a pair of spaced apart rotatable shafts mounted in the frame, a sprocket wheel fixed on each of said shafts, and an endless chain drivingly connecting said sprocket wheels, one of said shafts being adapted for operative connection to the output shaft of the first unit, and a socket on the other of said shafts of the chain driven unit.

3. A wrench comprising a housing, an input shaft and a power output shaft rotatably mounted therein, means drivingly connecting said shafts, means for rotating the input shaft, backlash controlling means in operative engagement with the input shaft, said backlash controlling means being independent of the means for drivingly connecting said input and output shafts, and operable independently of the means for rotating the input shaft, an elongated frame, a rotatable shaft journalled in each end of the frame, a sprocket wheel fixed on each of said rotatable shafts, an endless chain drivingly connecting said sprocket wheels, one of said shafts being aligned with and operatively connected to the power output shaft, and a socket operatively connected to the other of said rotatable shafts.

4. A chain driven wrench comprising an elongated frame, an input shaft and an output shaft rotatably mounted in opposite ends of the frame, a sprocket wheel fixed on each of said shafts, an endless chain drivingly connecting said sprocket wheels, means for rotating the input shaft, a socket operatively connected to the output shaft, and backlash controlling means independent of the means for drivingly connecting said input and output shafts, and operable independently of the means for rotating said input shaft, said backlash controlling means comprising a spindle parallel to the input shaft, a ratchet fixed on said spindle for operative engagement with said sprocket on the input shaft, means restraining the rotation of the ratchet, and manually operable means for rotating said spindle and ratchet in either direction.

5. A wrench comprising a housing, an input shaft and a power output shaft rotatably mounted therein, a gear on the input shaft, means drivingly connecting said shafts, a manually operable removable handle on the input shaft for rotating said shaft, backlash controlling means independent of the means for drivingly connecting said input and output shafts, an elongated frame, a rotatable sprocket wheel shaft journalled in each end of the frame, a sprocket wheel fixed on each of said rotatable shafts, an endless chain drivingly connecting said sprocket wheels, one of said sprocket wheel shafts being aligned with and operatively connected to the power output shaft, and a socket operatively connected to the other of said sprocket wheel shafts, said backlash controlling means comprising a spindle mounted in the housing adjacent and parallel to the input shaft, a ratchet fixed on said spindle for operative engagement with said gear on the input shaft, means restraining the rotation of the ratchet, and a manually operable handle on the spindle for rotating the spindle and ratchet independently of the rotation of the input shaft.

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