HYDRAULICALLY CONTROLLED, GEAR OPERATED WRENCH

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This invention relates to an automatic torque wrench. The wrench can be used to tighten a clamping fixture on a work piece to be machined, and can also be used to loosen a clamping fixture from a work piece after machining has been completed.

In one particular installation, each clamping fixture (not part of the present invention) is mounted for movement between a work-loading station, different work-machining stations and a work-unloading station. One or more "clamping" wrenches are positioned at the work-loading station, and a corresponding number of "loosening" wrenches are positioned at the work-unloading station. The number of wrenches employed at each station depends on the size of the work and the necessary dimensions of the fixtures. In order that the work can be easily loaded in and unloaded from each fixture, it is necessary that prior to the loading or unloading operation, the wrench be in a retracted position away from the path which the fixture takes as it approaches the loading and unloading stations. When the fixture is positioned at the station, a clutch element on the wrench is caused to advance rectilinearly toward the fixture and engage with a turnable fixture-moving element. Thereafter, the wrench clutch element is automatically turned so as to rotate the fixture-moving element and thereby loosen or tighten the work (depending on whether the particular wrench is employed at the loading or unloading station). Finally, the wrench clutch element is retracted rectilinearly away from the fixture to await the arrival of the succeeding fixture.

In most installations the work is loaded and unloaded at the same station. In such installations the wrench is employed both as a tightening mechanism and loosening mechanism.

One object of the present invention is to provide a torque wrench wherein a wrench clutch element may be (1) rectilinearly moved toward and into non-slip engagement with a work-clamping fixture, (2) turned to tighten and/or loosen the fixture on the work, and (3) retracted rectilinearly away from the fixture.

Another object is to provide a torque wrench having the above mentioned object and being of compact construction whereby it may be used in a variety of different installations with little if any structural additions or changes.

Another object is to provide a torque wrench for loosening or tightening a work-holding fixture wherein the wrench can be utilized whether the fixture-moving mechanism is turned in a clockwise or counterclockwise direction in order to effect the work-tightening or loosening action. This object is achieved by employing a fluid motor mechanism as a power source for the wrench. Fluid flow in one direction through said motor causes the wrench to turn in one direction, and fluid flow through said motor in the opposite direction causes reverse turning of the wrench.

Another object is to provide a relatively low cost wrench having good performance characteristics.
element and thereby tighten or loosen the fixture relative to a work piece (not shown).

Operation of the illustrated mechanism is such that initially shaft 9 is in a retracted position with piston 17 adjacent port 16. In this position clutch element 28 is out of the path of the traveling fixture. When the fixture reaches a position such that its “turnable fixture-moving element” 4 is in rectilinear registry with clutch element 28 fluid from a source (not shown) is caused to be introduced into cylinder 14 through port 16. Shaft 9 is thereby moved rectilinearly to its illustrated position. During or after this rectilinear movement fluid is passed through motor 21 so as to rotate shaft 23 and impart a rotation to shaft 9. This rotary movement of shaft 9 causes faces 31 of fingers 29 and 30 to pressuringly engage the “turnable fixture-moving element” and thereby tighten or loosen the fixture relative to a work piece.

The wrench may be used to tighten and/or loosen the fixture, according as the work is to be loaded and/or unloaded at the station serviced by the wrench. If the wrench is employed as both a tightening and loosening mechanism fluid will be alternately introduced into motor 21 through different ones of conduits 59 and 51, according to the different directions in which it is desired to rotate shaft 9.

When clutch element 28 strikes the turnable fixture-moving element during the latter portion of the shaft 9 rectilinear movement toward the fixture certain shock forces may be set up in the wrench. These forces would tend to displace the fixture away from the wrench and/or cause injury to the wrench. In order to provide a cushion against these forces there is provided between element 28 and shaft 9 a compression coil spring 35.

After the fixture has been tightened and/or loosened on the work piece fluid is introduced into cylinder 14 through port 15 so as to rotate clutch element 28 out of the path of the fixture. During this retracting movement shaft 9 need not rotate and motor 21 can therefore be in a deenergized condition.

Control of the fluid motor and fluid cylinder is preferably effected by timer and solenoid valve means, but since these means form no part of the present invention they have not been illustrated. A limit switch 32 may be employed in conjunction with the timer means. This switch can be actuated by a spring-urged trigger 33 and a trip ring 34 fixedly secured on rod 18.

With the arrangement of motor 21 and housing 2 shown in Fig. 1 motor 21 and/or the condit means therefore may in some installations project into the way of the wrench operator. In such event it is desirable that the motor be repositioned in a location remote from the area occupied by the wrench operator. In this connection it will be noted that housing 2 is provided with two similar bores 41, 52 and two similar bores 53, 54. These sets of similar bores are symmetrical about axis 43 so as to permit interchange of cover plate 40 and motor 21. Plate 40 is provided with an extension 44 which fixedly mounts the outer race 45 of a bearing assembly 46.

The inner race 47 of said assembly is fixedly and supportingly secured to shaft section 25. To cooperate with bearing assembly 46 in the rotatable support of shaft 23 there is provided another bearing assembly 55. Bearing assembly 55 includes an inner race 56 fixedly secured on shaft section 25 and an outer race 57 fixedly secured in bore 53. Spacer sleeves 58 and 59 are provided on shaft section 25 in order to prevent axial movement of worm 26. A sleeve 60 positions race 57 in bore 53.

It will be noted that power mechanisms 14 and 21 are both mounted solely on housing 2 and so as to provide a compact construction which may be installed as a unit in small and difficulty accessible areas. The relative positions of motors 21 and cylinder 14 are such that a minimum number of drive-transmitting elements are required, whereby to reduce the cost of the wrench.

I claim:

1. A torque wrench comprising a housing; a sleeve rotatably mounted within said housing; a first shaft mounted in said sleeve and restricted to reciprocal axial motion relative thereto; means for effecting said axial motion; said housing having a bore therethrough at right angles to the shaft axis; a rotary motor releasably mounted on the housing and having a second shaft extended into said bore; a cover plate releasably mounted on the housing and having an extension received in said bore; bearing means in said extension and supporting the second shaft for rotatable movement; and means between said shafts for translating rotary movement of said second shaft into rotary movement of the first shaft; said bore and cover plate construction permitting the positions of the motor and cover plate to be reversed.

2. A torque wrench comprising a housing having two openings at right angles to each other; a fluid cylinder secured on said housing and having a piston rod extending therefrom through one of the openings; two bearing assemblies in registry with said openings; said openings being each of a reduced size and each being axially fixedly secured to the inner race of said assemblies, the outer races thereof being secured in said housing; a shaft in said sleeve and housing and having an end portion connected to said piston rod; a clutch on the other end portion of the shaft; slide-guide means between said sleeve and shaft for restricting said shaft to axial movement relative to said sleeve; a rotary motor secured on said housing and having a second shaft extending through the other opening; and gear means between said second shaft and sleeve for translating rotary movement of said second shaft into rotary movement of the first shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Date</th>
<th>Inventor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,648,944</td>
<td>Nov 15, 1927</td>
<td>Hofstetter</td>
</tr>
<tr>
<td>2,180,488</td>
<td>Nov 21, 1939</td>
<td>Hamersveld</td>
</tr>
<tr>
<td>2,605,792</td>
<td>Aug 5, 1952</td>
<td>Havener</td>
</tr>
<tr>
<td>2,616,323</td>
<td>Nov 4, 1952</td>
<td>Leifer</td>
</tr>
<tr>
<td>2,627,770</td>
<td>Feb 10, 1953</td>
<td>Hautau et al.</td>
</tr>
<tr>
<td>2,691,314</td>
<td>Oct 12, 1954</td>
<td>Stevens et al.</td>
</tr>
<tr>
<td>2,700,443</td>
<td>Jan 25, 1955</td>
<td>Boice</td>
</tr>
<tr>
<td>2,707,892</td>
<td>May 10, 1955</td>
<td>Holmes</td>
</tr>
</tbody>
</table>