March 17, 1964 M. K. EMERZIAN 3,124,983

HAND WRENCH WITH CABLE AND SPOOL DRIVE MEANS

Filed Jan. 30, 1962

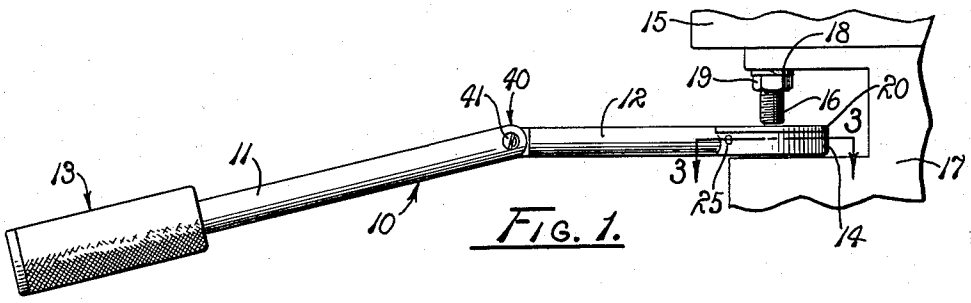


FIG. 1.

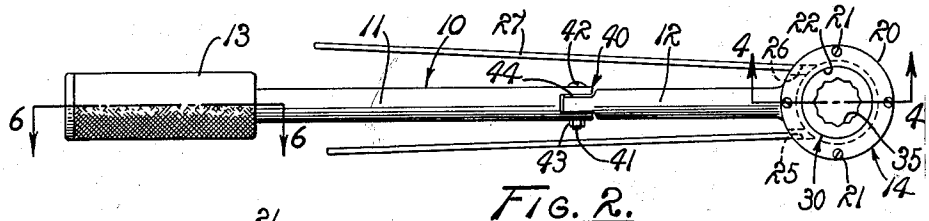


FIG. 2.

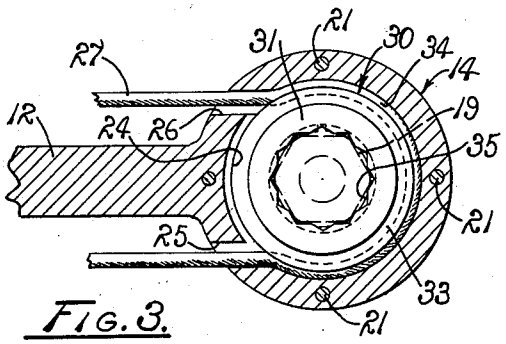


FIG. 3.

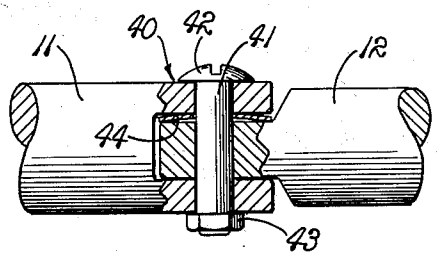


FIG. 5.

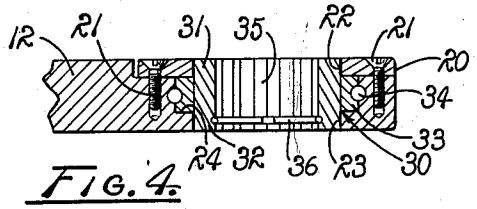


FIG. 4.

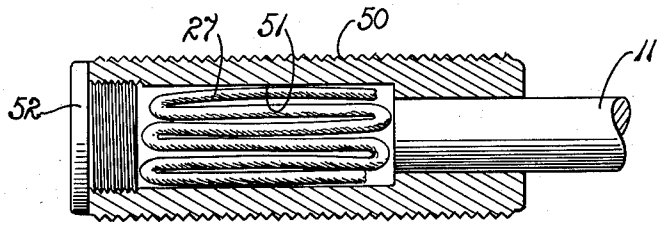


FIG. 6.

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HAND WRENCH WITH CABLE AND SPOOL DRIVE MEANS

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This invention relates to an improved hand wrench adapted for speedily removing and mounting threaded fasteners. It particularly relates to a cable operated socket wrench for starting and completing bolted connections having special advantage in environments providing extremely limited access to such connections.

In many mechanical constructions, components are secured together by bolted connections. Many such bolted connections comprise a stud retained in one element of the structure on which is mounted a second element retained by a nut in screw-threaded relationship with the stud. Frequently, the axial clearance provided between the projecting end of the stud and one of the elements of the bolted connection does not permit the use of a conventional socket wrench in turning the nut, nor does it permit the starting of the nut on the stud by a manual method. Conventional ratchet wrenches of the box-end type cannot be used in such constructions due to the fact that the frictional resistance to rotation between the stud and the nut is insufficient to overcome the frictional drag of the ratchet mechanism. Consequently, great difficulty has been experienced in starting and completing bolted connections in such mechanical constructions.

Accordingly, it is an object of the present invention to provide a hand wrench adaptable for use in starting and completing bolted connections in which minimum axial clearance exists.

Another object is to provide a cable operated hand wrench which is adaptable for use with a variety of sizes of bolted connections and which has maximum versatility with respect to positions of operation.

Another object is to provide a cable operated hand wrench which may be operated in either direction by a single member and requires no ratchet mechanism.

A further object is to provide a hand wrench with a rotatable socket adapted to retain a nut therein to permit ready starting of the nut in forming a bolted connection.

A still further object is to provide a cable operated hand wrench which is extremely simple in design and durable in operation.

These, together with other objects, will become more fully apparent upon referenece to the following description and accompanying drawing.

In the drawing:

FIG. 1 is a view in side elevation showing the hand wrench of the present invention in an environment to which it is particularly adapted, elements of the mechanical structure forming the environment being shown fragmentarily for illustrative convenience.

FIG. 2 is a top plan view of the wrench of FIG. 1.

FIG. 3 is a view in horizontal, longitudinal section taken on line 3—3 of FIG. 1 and shows a fragmentary portion of the wrench, somewhat enlarged.

FIG. 4 is a horizontal, longitudinal section taken on line 4—4 of FIG. 2 and is similar in nature to FIG. 3.

FIG. 5 is an enlarged fragmentary view of the pivotal joint employed in the wrench of FIG. 1.

FIG. 6 is a fragmentary view, somewhat enlarged, of the handle of the wrench shown in FIGS. 1 and 2, and shows a stowage compartment in horizontal, longitudinal section taken on line 6—6 of FIG. 2.

Referring to FIGS. 1 and 2 of the drawing, the wrench

of the present invention is provided with a handle generally indicated at 10. The handle includes opposite ends 11 and 12, the one end terminating in a hand grip portion 13 and the other providing a cylindrical housing 14. The housing 14 is integral with the handle and disposed with its longitudinal axis normal to the longitudinal axis of the adjoining end of the handle 12. Since the purpose of the wrench is to start and to complete bolted connections in which a minimum clearance exists for starting the elements comprising the bolted connection, the cylindrical housing 14 is provided with a short axial dimension compatible with the clearances anticipated in such bolted connections.

An example of such a bolted connection is shown in FIG. 1 in which a frame member 15 has mounted therein a threaded stud 16. A machine element 17 is intended to be secured to the frame member and held thereon by means of a lock washer 18 and retaining nut 19 shown in an assembled condition. As can be readily seen, a minimum amount of clearance is provided between the projecting end of the stud and the machine element 17, which is to be joined to the frame member. Many similar bolted connections exist in present-day automobile design and are frequently encountered in attaching an element to a frame member by means of a mounting flange. Examples of such an environment are carburetors mounted on the inlet manifold of an internal combustion engine, the means employed for mounting certain components of torque converters, and other mounting means used to fasten accessories on various elements of an automobile or other type of mechanism. The environment forms no part of the invention as such, and is disclosed merely to illustrate the advantages of the present invention.

The cylindrical housing 14 includes a removable retaining annulus 20 which is detachably secured to the housing by means of a plurality of screws 21. The housing is provided with an axial bore extended therethrough which thereby forms bearing surfaces 22 and 23. A counterbore 24 is formed intermediate the bearing surfaces and constitutes an annular recess in the housing. A pair of ports 25 and 26 is provided in the housing in communication with the annular recess formed by the counterbore 24. For descriptive purposes only, the port 25 is designated an inlet port and port 26 as an outlet. Threaded through the ports and received within a major circumferential portion of the counterbore is a cable 27. The cable may be a light rope, or cord, the peripheral surface of which has a moderate coefficient of friction. The cable may be of any material so long as it constitutes a flexible tension member adapted for frictional engagement with a circular, rigid member.

As shown in FIG. 4, a spool 30 having axially opposed trunnions 31 and 32 is rotatably mounted within the housing by means of the bearing surfaces 22 and 23. The spool includes a radially outwardly extended flange 33 intermediate the trunnions and received within the counterbore 24. The radial and axial dimensions of the flange 33 relative to the counterbore 24 are such that an annular chamber 34 is defined between the periphery of the flange and counterbore. It is to be noted that the diameter in cross-section of the annular chamber 34 is less than the cross-sectional diameter of the cable 27, so that the cable is lightly compressed between the radial flange 33 and the housing 14. To facilitate insertion of the cable into the housing, the annular chamber 34 is formed by radially opposed grooves respectively provided in the periphery of the flange 33 and the housing. The periphery of the flange is preferably knurled or otherwise roughened, to enhance frictional engagement with the cable 27.

The spool is provided with a cavity axially extended therethrough, the cavity having a configuration conforming to the type of nut which it is intended to be used. The axially extended cavity constitutes a socket to receive the nut and is shown in the configuration of a conventional "twelve point" socket. With such configuration, it is primarily adapted to receive a hexagonal nut indicated at 19 in dashed lines. A snap ring 36 is retained within an annular groove provided in the socket of the spool to limit the axial movement of the nut and to retain the nut in the socket during the starting of the bolted connection. The wrench is adaptable to a variety of sizes and nuts by permitting the ready exchange of spools having graduated sizes of sockets. If desired, a universal spool may be formed by using bushings, not shown, of graduated radial dimensions retained within the axial cavity 35 of the spool.

To permit the wrench to be employed in a variety of environments, a pivotal joint 40 is provided intermediate the opposite ends. The joint comprises a pin 41 having a slotted head 42 retained within suitable aligned bores provided in the adjacent ends of the wrench handle. As shown in FIG. 5, each end is formed as a respective element of a conventional fork and blade joint. Axial pressure is exerted on the pivotal joint by means of a nut 43 screw-threadably connected to the pin 41. A friction washer 44 is interposed the ends 11 and 12, and is shown in the form of a Belleville spring. The axial pressure exerted by the pin may be adjusted to facilitate manipulation and adjustment of the wrench and to maintain the ends 11 and 12 in their adjusted relative positions.

The end 11 includes a hand grip 50 provided with a stowage compartment 51 of a sufficient size to accommodate the desired length of the cable 27. The compartment is closed by a cap 52 screw-threadably retained on the hand grip portion of the handle.

Operation

The operation of the described embodiment of the subject invention is believed to be readily apparent and is briefly summarized at this point. One end of the cable 27 is initially threaded through the inlet port 25. Rotation of the spool 30 effects a threading of the cable around the radial flange 33 and out of the opposite port 26. Assuming that the nut 19 and the stud 16 are both provided with a conventional right-hand thread, the spool is rotated in a counterclockwise direction, as viewed in FIGS. 2 and 3, until the cable 27 extends from outlet port 26. This procedure is used to minimize time required to thread the cable into the wrench. Accordingly, a sufficient length of the cable 27 should extend from port 25, used as the inlet port, to permit rotation of the spool through the number of revolutions required to thread the nut onto the stud the full axial dimension of the nut. Although the cable is intended for manual operation in the form of wrench shown, the cable could be adapted to a closed circuit and power driven by any suitable means, such as a pre-wound spring, not shown.

If the nut 19 were to be threaded onto the stud 16 an axial distance less than the axial dimension of the nut, it would be impossible to remove the wrench. Such a condition exists in using conventional box-end ratchet wrenches wherein the frictional resistance between the stud and the nut is insufficient to overcome the drag resulting from the ratchet mechanism of such wrenches.

A nut 19 is then positioned within the socket provided by the axial cavity 35 of the spool 30. A snap ring 36 supports the nut within the socket and permits the use of the wrench in the position shown in FIG. 1. The pivotal joint 40 permits the adjustment of the wrench, as shown, and insures sufficient resistance to further pivotal movement to permit alignment of the nut with the stud. Extension of the cable 27 by movement in a longitudinal direction from the outlet port 26 causes counterclockwise rotation of the spool 30, as viewed in FIGS. 2 and 3. Looking endwardly upwardly toward the stud 16, the rotation is clockwise. The nut 19 is likewise rotated and is threaded upon the stud 16. Since the relative dimensions between the stud and the nut in such bolted connections are such to permit free turning of the nut on the stud, the nut may be speedily mounted with a minimum of tension exerted in the cable 27. Upon reaching the position shown in dashed lines in FIG. 1, the bolted connection may be completed by the use of conventional open end wrenches or other suitable tools.

Thus, it can be seen that a cable operated hand wrench is provided which permits the completion of bolted connections having a minimum axial clearance between the elements forming such a connection. In a reverse operation, the wrench is used in disconnecting such connections. Although such connections are not readily accessible to the human hand or to other types of wrenches, the hand wrench of the present invention successfully initiates and completes such bolted connections or disconnections.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and apparatus.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a hand wrench having an elongated handle presenting opposed ends, a cylindrical housing secured to one end of the handle, the housing having an axial bore providing spaced bearing surfaces therealong and having an annular recess of predetermined radial and axial dimensions intermediate said bearing surfaces; an annular spool having an axial cavity adapted to receive a nut and having a centrally located radially outwardly extended flange and a pair of bearing trunnions embracing said flange, the flange being received in said annular recess and being of a relative dimension to provide an annular chamber therein; means to retain said trunnions in said bore for rotatable support on said bearing surfaces, the housing having an inlet and an outlet port circumferentially spaced and in communication with said annular chamber; and an elongated flexible cable encircling said flange and threaded through said ports, the diametrical dimension of said cable being slightly greater than that of said annular chamber so that the cable is urged into frictional engagement with said flange whereby longitudinal movement of the cable effects rotation of said spool.

2. The hand wrench of claim 1 wherein means are carried by the housing to limit the axial movement of a nut within the bore of said spool.

3. The hand wrench of claim 1 wherein said handle is provided with a pivotal joint intermediate said opposed ends, said joint including adjustable frictional means to resist pivotal movement thereof.

4. A hand wrench comprising an elongated handle having opposed ends and a pivotal joint intermediate the ends, one end having a stowage compartment therein; a cylindrical housing secured to the other end of the handle, the housing having a longitudinal axis normal to the longitudinal axis of said other end of the handle and being of a predetermined axial dimension, said housing also having an axial bore extended therethrough providing spaced bearing surfaces therealong and having an annular recess of predetermined radial and axial dimensions intermediate said bearing surfaces; an annular spool having a cavity axially extended therethrough and adapt-

ed to receive a nut; means carried by the spool within said cavity to limit the axial movement of the nut; said spool having a centrally located radially outwardly extended flange and a pair of bearing trunnions embracing said flange, the flange being received in said annular recess and being of a relative dimension to provide an annular chamber therein; means to retain said trunnions in said bore for rotatable support on said bearing surfaces, the housing having an inlet and an outlet port circumferentially spaced and in communication with said annular chamber; and an elongated flexible cable encircling said flange and threaded through said ports, the diametrical dimensions of said cable being slightly greater than that of said annular chamber so that the cable is urged into frictional engagement with said flange whereby horizontal movement of the cable effects rotation of said spool.

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