METHOD OF ASSEMBLING A SOCKET WRENCH

FIG. 1

FIG. 3

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This invention relates to a multiple socket wrench and has for its primary object a method of assembly of a single instrument capable of engagement with nuts or bolts of different sizes so as to loosely or tighten them.

It is a principal object hereof to provide a multiple socket wrench which may be quickly and easily assembled whereby great economy in tool manufacture is effected.

It is another object to provide a method of assembly of a unitary multiple socket wrench having a plurality of concentric sockets of various graduated sizes nested within each other, thereby to eliminate the necessity of separate sockets which must be removed from and connected to a wrench for different size bolt or screw heads, the working end of said nested sockets normally being disposed on a level plane as to each other by a novel socket suspension system requiring no pins, snaps or the like.

In the prior art, socket wrenches have been assembled in the form of members nested within each other and adapted to be used by placing the wrench over a nut or bolt to be turned. However, such wrenches have been of complicated construction making their assembly difficult, thereby occasioning a concomitant increase in manufacturing costs.

Most of the prior art attempts have failed because of various additional difficulties, including a lack of strength in the wrench arrangement following assembly wherefore the wrench will break when subjected to a strong or abrupt turning force, and other faults. It is, accordingly, another object of the invention to provide a method of assembly which will produce a wrench which is simple in its design, while offering a sturdy construction capable of withstanding the forces to which such a tool is normally subjected.

It is yet another object to provide a method of assembly of a socket wrench of the type wherein any desired socket of a given size may be readily put into use, all sockets of smaller size being automatically retracted away from the operative plane.

Still another object is to provide a method of assembly of a multiple tool which will fit into small spaces and automatically fit the work without any affirmative adjustment.

As another significant feature worthy of particular notice, I provide a method of assembly of a socket wrench of the type requiring no external means for its automatic operation, and operate automatically in adapting to the proper size socket when operatively placed in position upon the work.

It is yet another object to provide a method of assembly of an automatically fitting socket wrench constituted by a series of concentric sockets located within the mouth of the wrench, each of the sockets being separately connected within a cylinder or container housing the sockets and being positionable by virtue of separate springs integral with each separate concentric socket. Upon application of the wrench to a bolt or nut, the sockets with smaller diameters are pushed upwardly against the tension in their respective springs, permitting only that particular socket which is of the correct diameter and size to remain in circumscibing position around the bolt or nut head.

These and other aims and objectives will be better understood from a consideration of the following detailed description forming a part of this specification, when read in conjunction with the illustrations in the accompanying drawings in which:

FIG. 1 is a view, in perspective, of a multiple socket wrench embodying the principles of the invention;
FIG. 2 is a view, in side elevation and partly in section, of the wrench of FIG. 1;
FIG. 3 is a view, in end elevation, taken on the line 3-3 of FIG. 2, with the handle means omitted;
FIG. 4 is a fragmentary view, in longitudinal section, of the wrench in operative position relative to a bolt head;
FIG. 5 is a greatly enlarged fragmentary view, in longitudinal section, of one end of one of the sockets of the invention; and
FIG. 6 is an enlarged fragmentary view, in longitudinal section, of the wrench of the invention.

With continued reference now to the drawings, which illustrate a typical and preferred embodiment of the invention for the purpose of disclosure and form a part of this specification, I have shown a multiple socket wrench of the so-called "screw-driver" type wherein a hand-engaging portion in the form of a handle 10 carries an operating portion generally indicated by 12, forwardly thereof, said operating portion being disposed upon the outer end of a shaft 14 fixed at its opposite end to handle 10.

It will, of course, be obvious that any suitable means may be employed for rotating operating portion 12, the invention not being restricted to the specific screw-driver type handle means illustrated.

Operating portion 12 includes a plurality of nested, concentrically-arranged sockets. Three such sockets are shown in the drawings, numeral 16 indicating the outermost or largest socket, 18 indicating the intermediate socket, and 20 indicating the innermost or smallest socket.

While the embodiment herein disclosed comprehends but three concentric sockets, it is envisioned that the various of the nested sockets may be other than three in number, and further, that while, as shown, six-sided sockets are employed, it is additionally envisioned that they might be otherwise sided, i.e., they may be eight sided or twelve sided or otherwise depending upon the specific purpose for which the wrench is to be put. For the purpose of the embodiment and for the sake of simplicity, only three separate socket wrenches are disclosed, and they are six-sided.

Operating portion 12 additionally includes an enclosing sleeve 22 of circular cross section and having a longitudinally-extending hexagonal bore 24 extending through one end thereof and a longitudinally-extending coaxially aligned hexagonal bore 26 opening through the opposite end thereof to define intermediate the outer ends of the sleeve a stop shoulder 28, having a conventional circular bore 30 extending longitudinally therethrough.

As shown in FIG. 2, a nut 32, brazed or otherwise fixed to the outer or forwardmost extremity of shaft 14, is slidable receivable in bore 26 of enclosing sleeve 22, and the shaft and nut are suitably secured to the sleeve as by a pin 34 extending transversely through suitably aligned openings in the sleeve, nut and shaft, whereby rotation of handle member 10 achieves rotation of operating portion 12.

Hexagonal bore 24 in sleeve 22 is of appropriate diameter so as to slidably receive therewith an intermediate socket 16. Intermediate socket 18 is slidable receivable within outer socket 16, and inner socket 20 is slidable receivable within intermediate socket 18.

As will appear, each of the sockets 16, 18 and 20 is spring-loaded and is provided with integral stop means,
for limiting the extent of its respective movement in either longitudinal direction (i.e. to the left or to the right relative to sleeve 22 as seen in the drawings), and for insuring that the working ends of the nested sockets are disposed on a level plane when the tool is in use.

Each socket is the substantial counterpart of the other and each includes a forwardmost socket portion of hexagonal cross section having a longitudinally-extending hexagonal bore, and a rearwardmost extension of circular cross section having a longitudinally-extending circular bore extending rearwardly from said socket portion and defining cooperatively with said socket portion a first stop shoulder, said rearwardmost extension being peripherally grooved and flared at its rearwardmost end to provide a radially outwardly-extending annular lip of flange defining a second stop shoulder.

The sockets are so related as to each other that the stop portions of one are engageable with the stop portions of another so as to limit longitudinal movement of the sockets, as will appear.

The external contour of each socket conforms to the internal contour of the next adjacent socket circumscribing same so as to establish turning movement between the sockets one with the other while permitting relative longitudinal movement of said sockets.

More specifically and with reference to FIG. 6, outermost socket 16 will be observed to include, additionally to a forwardmost socket portion of hexagonal cross section having a longitudinally-extending hexagonal bore, a rearwardmost tube-like socket extension 36 of circular cross section having a longitudinally-extending circular bore 38 extending rearwardly from and axially aligned with the socket portion and separated therefrom as by an outermost socket base wall 40 extending transversely to and inwardly from the rearwardmost extremity of outermost socket 16.

Extension 36 has an outside diameter complemental to circular bore 30 of stop shoulder 28 extending inwardly from the interior wall of sleeve 22 wherefore extension 36 is slidable receivable therethrough.

Extension 36 is provided with an outer annular groove or notch 42 adjacent its rearwardmost or innermost end to facilitate the flaring of the rearwardmost end as by swelling or the like whereby to provide a radially outwardly extending annular lip or flange 44 adapted to engage the rearwardly-facing face 46 of stop shoulder 28 thereby to limit longitudinal movement of outermost socket 16 to the left (as viewed in FIGS. 2, 4, 5 and 6) within the enclosing sleeve.

A compression spring 48 circumscribes extension 36 and is confined between stop shoulder 28 and the rearwardly facing face 50 of base wall 40 of socket 16, it being understood that said extension 36 is formed with an outside diameter which is less than the outside diameter of socket 16 and/or orless than the inside diameter of enclosing sleeve 22 so as to allow a clearance 52 between the extension and the sleeve for the snug accommodation of said compression spring.

Said compression spring 48 serves to maintain outermost socket 16 in a normal position with its forwardmost end terminating in a plane defined by the forwardmost end of sleeve 22 with drop out of the outermost socket relative to the sleeve being precluded by annular lip or flange 44.

The depth of outer annular groove or notch 42 may be varied, as desired, in order to control the depth of the suspension of the socket.

The swaging serves to insure that the socket will hang properly as respects concentricity and will hang, in rest position, with its forwardmost end in the aforesaid plane defined by the forwardmost end of sleeve 22.

Intermediate socket 18 concentrically nested within outermost socket 16 additionally includes a rearwardmost tube-like socket extension 56 axially aligned therewith and extending rearwardly from a base wall 58 thereof, said extension being of a diameter complemental to that of an annular opening 60 provided in base wall 40 of outermost socket 16.

Extension 56 is peripherally grooved or notched as at 62 adjacent its innermost or rearwardmost end to facilitate the flaring of said rearwardmost end as by swelling or the like to provide a radially outwardly extending lip or flange 64 adapted to engage the rearwardly facing face 50 of base wall 40 of socket 16 to limit longitudinal movement of socket 18 to the left as viewed in FIG. 4 within and relative to socket 16.

A compression spring 68 circumscribes extension 56 and is confined between base wall 40 of socket 16 and base wall 58 of socket 18.

Inner socket 20 is slidable disposed within intermediate socket 18, and includes a rearwardly-extending tube-like extension 76 axially aligned therewith and extending rearwardly from a base wall 78 thereof, said extension being of a diameter complemental to that of an annular opening 80 provided in base wall 58 of intermediate socket 18.

Extension 76 is peripherally grooved or notched as at 82 adjacent its innermost or rearwardmost end to facilitate the flaring of said rearwardmost end as by swelling or the like to provide a radially outwardly extending lip or flange 84 adapted to engage the rearwardly facing face 70 of base wall 58 of socket 18 to limit longitudinal movement of socket 20 to the left as viewed in FIG. 4 within and relative to socket 18.

A compression spring 88 circumscribes extension 76 and is disposed forwardly of base wall 58 of socket 18 so as to be confined between said base wall and base wall 78 of socket 20.

The annular grooves or notches 42, 62 and 82, will be so positioned relative to the ends of the extensions 36, 56 and 76 of sockets 16, 18 and 20 respectively that following swaging the working ends of the sockets will be disposed in a level plane coincident with the plane defined by the forwardmost end of the enclosing sleeve.

A bell-like outer cap or shell member 90 circumscribing and rotatably disposed upon the rearwardmost end of sleeve 22 includes an integral hub 92 sleeving shaft 14 in freely rotatable manner, the outer cap or shell member offering a convenient finger gripping means for holding the lower end of the wrench in desired operating position as handle member 10 is rotated. A cylindrical sleeve 94 is rotatably disposed on shaft 14 between hub 92 and handle member 10 for similar purposes.

In assembling the tool, the sockets and springs are first assembled into sleeve 22.

Outer socket 16, carrying compression spring 48 on its extension 36, is inserted through the forward or outer end of the sleeve (from the left as viewed in FIG. 4) and is moved longitudinally inwardly until the spring contacts stop shoulder 28. A swaging tool is now inserted longitudinally through the opposite end of the sleeve and the rear end of extension 36 is flared outwardly to form lip 44 in manner to abut stop shoulder 28.

Intermediate socket 18, carrying compression spring 68 on its extension 56, is inserted through the forward or outer end of socket 16 and is moved longitudinally inwardly until the spring contacts base wall 40 of socket 16. A swaging tool is now inserted longitudinally through the opposite end of the sleeve and the extension 36 of socket 16 until it contacts extension 56 of socket 18 whereupon the lip 64 may be formed rearwardly of base wall 40 of socket 16.

The same procedure is followed in assembling inner socket 20 and spring 88 to intermediate socket 18, with the swaging tool forming the lip 84 on extension 76 rearwardly of base wall 58 of intermediate socket 18.

The sockets having been assembled within sleeve 22, shaft 14 with its integral nut 32 is now positioned in the
rear end of the sleeve and the shaft and nut are pinned thereto by pin 34. Cap member 90 is now slid along shaft 14 onto the rear end of sleeve 22 and the cylindrical sleeve 94 is slid onto the shaft and on either side of the cap member.

Finally, handle 10 is secured to the rear end of the shaft to secure all of the components in place.

In operational use, the assembly is placed over the head of a bolt. For the purpose of illustration, I have shown, in FIG. 4, the wrench as disposed over a bolt head B which is of a size and diameter complementary to the outermost socket 16. Immediately, in pressing operating portion 12 over bolt head B, pressure is exerted upon sockets 18 and 20 to motivate them rearwardly and to compress their respective springs accordingly, with extension 56 of intermediate socket 18 sliding freely in the opening 60 of base wall 40 of outer socket 16.

Obviously, as the device is advanced toward a bolt head or nut of a size larger than socket 20, it will be received in the hexagonal portion of socket 18, while socket member 20 telescopes into socket 18 against the effort of spring 88. As larger nuts are encountered, sockets 20 and 18 may be telescoped into the next adjacent socket 16 until the bolt head or nut is suitably accommodated.

When sockets 18 and 20 have been motivated rearwardly sufficient distances so as to be displaced into out-of-position locations, with their bottoms resting upon the top of the bolt head, bolt head B is found to be firmly gripped by outer socket 16, whereupon the wrench may be rotated by manipulation of handle 10. When the wrench is removed from the bolt head, springs 68 and 88 return their respective sockets 18 and 20 to normal or rest position ready for reuse, with the flared lip of each socket extension insuring that the operating faces of the sockets are disposed in a level plane.

From the foregoing, it will be appreciated that I provide a novel method of assembly of a compact, well-balanced multiple socket wrench wherein all components are at all times maintained in joined or assembled relationship, but wherein each socket member may be readily actuated by telescoping movement between operating and non-operating positions.

It will also be noted that the components of my wrench may be quickly and easily assembled, greatly reducing manufacturing costs, and when once assembled cannot easily be tampered with to destroy their working efficiency.

On the other hand, the tool is not so intricately assembled that its components cannot be reached for repair or replacement purposes.

It should be appreciated that the invention as shown and described is capable of mechanical variation or modification without departing from the spirit and scope of the appended claim.

I claim:

The method of forming a wrench by telescopically assembling a plurality of progressively smaller sockets within a sleeve having an internal stop shoulder, each socket having a socket portion and a tubular extension integral with the socket portion, each tubular extension being slidable within the tubular extension of the next adjacent socket, comprising the sequential steps of slewing a compression spring on the tubular extension of the largest socket, inserting the largest socket into the sleeve and swaging the end of its tubular extension to form a radial flange thereon abutting the stop shoulder, slewing compression springs on the tubular extensions of the progressively smaller sockets, inserting the progressively smaller sockets within said largest socket and within each other and swaging the ends of the tubular extensions of each of said progressively smaller sockets to form a radial flange on each tubular extension abutting the socket portion on the next adjacent socket, slewing a cap upon the sleeve and securing a handle to the sleeve, the cap being freely rotatable relative to the sleeve and handle to facilitate rotation of the wrench.

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