United States Patent [19]

Hertelendy et al.

[11] **3,906,822**

[45] **Sept. 23, 1975**

[54] **RATCHET WRENCHES**

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[21] Appl. No.: **356,938**

[52] **U.S. Cl.** ..... **81/91 R;** 81/179

[51] **Int. Cl.²** **B25B 13/18**

[58] **Field of Search** ..... 81/91 R, 91 A, 94, 95, 81/58.2

[56] **References Cited**

UNITED STATES PATENTS

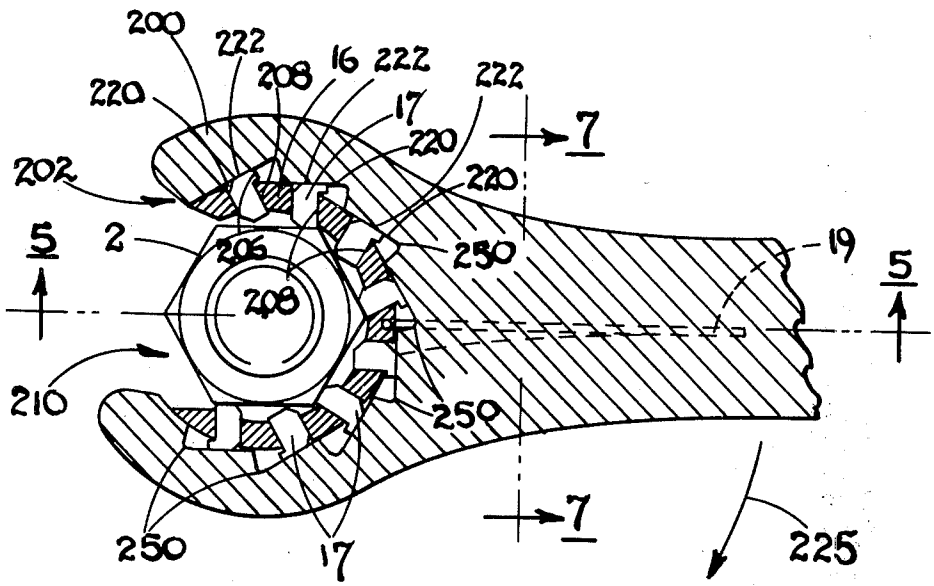
810,304	1/1906	Remion	81/179 X
1,387,866	8/1921	Reed	81/91 R
2,306,228	12/1942	Shaw	81/58.2 X
2,712,259	7/1955	Cowell	81/58.2 X
3,386,319	6/1968	Bloom	81/58.2 X
3,527,327	9/1970	McCreary	81/58.2 UX
3,621,739	11/1971	Seablom	81/63.1 X
3,664,213	5/1972	Anati	81/91 R

Primary Examiner—Al Lawrence Smith
Assistant Examiner—James G. Smith
Attorney, Agent, or Firm—Ernest L. Brown

[57] **ABSTRACT**

An open end one-direction wrench wherein turning of said wrench on a nut, pipe, tube or bar in one direction forces a plurality of gripping members to tighten, and turning in the other direction forces the gripping members away from the nut, pipe, tube or bar.

6 Claims, 12 Drawing Figures



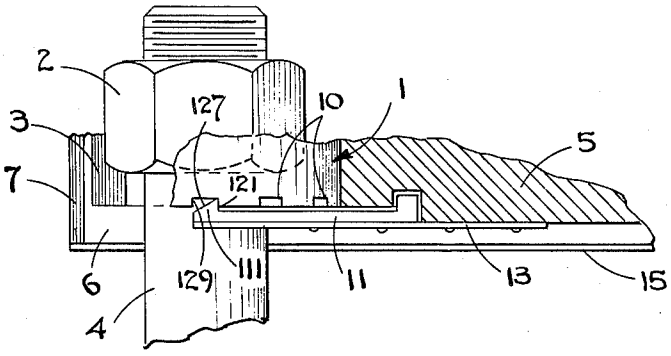


FIG. 1

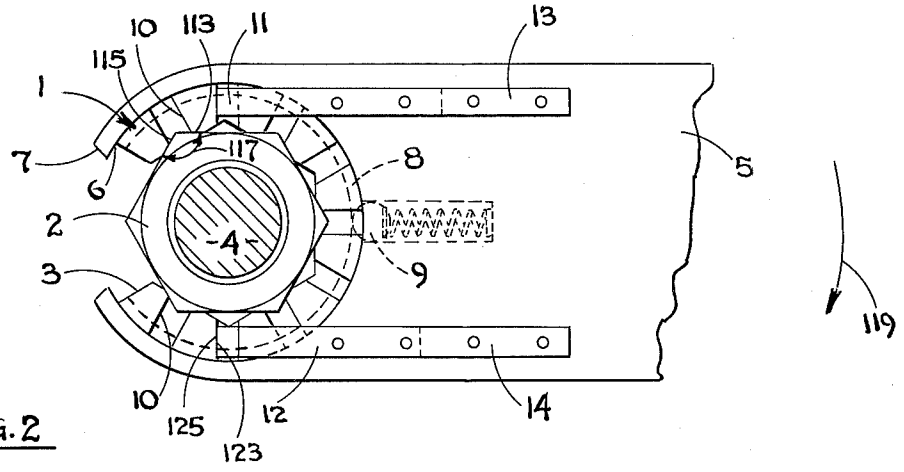


FIG. 2

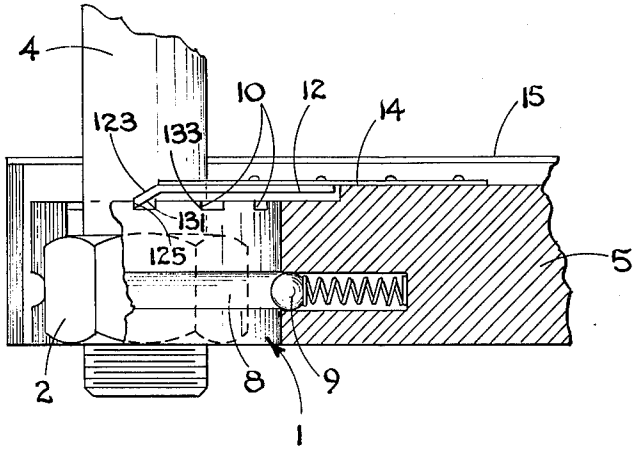


FIG. 3

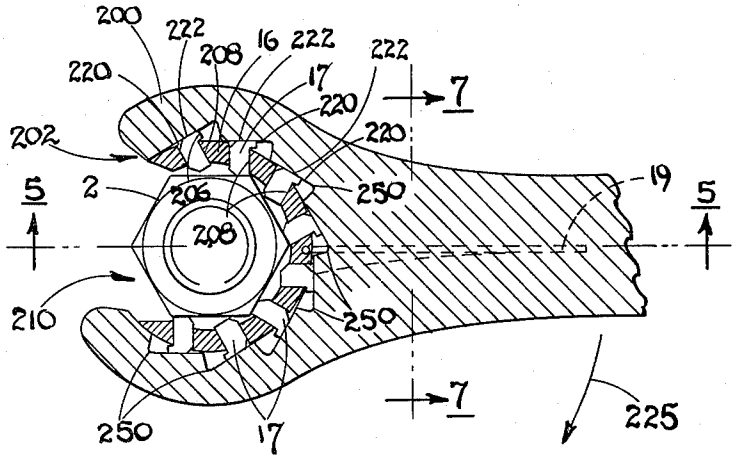


FIG. 4

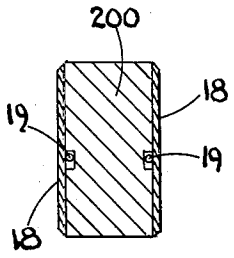


FIG. 7

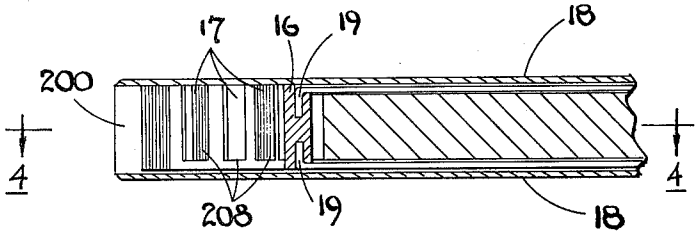


FIG. 5

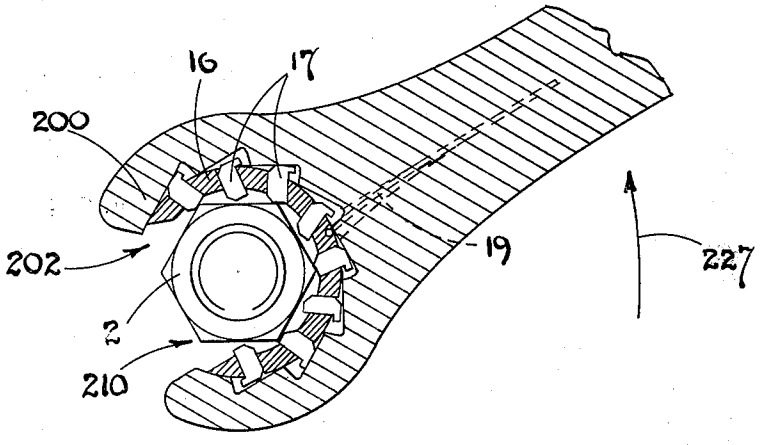


FIG. 6

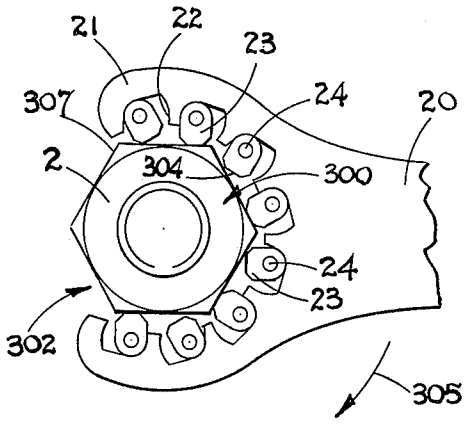


FIG. 8

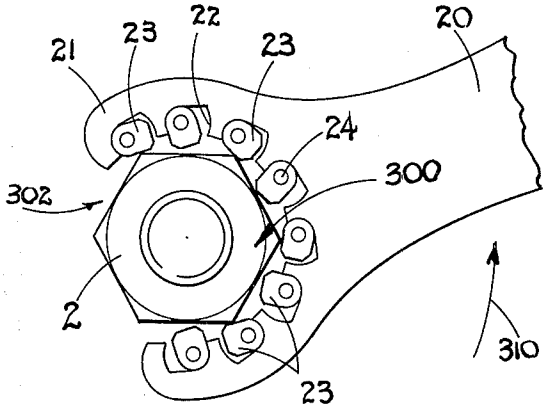


FIG. 9

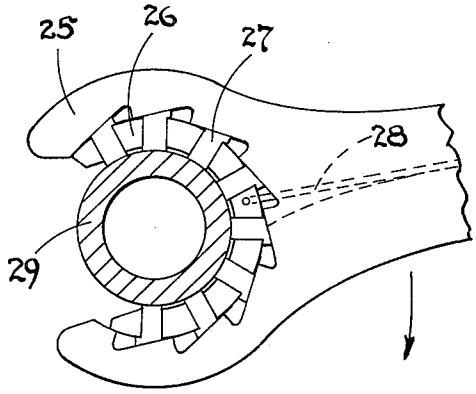


FIG. 10

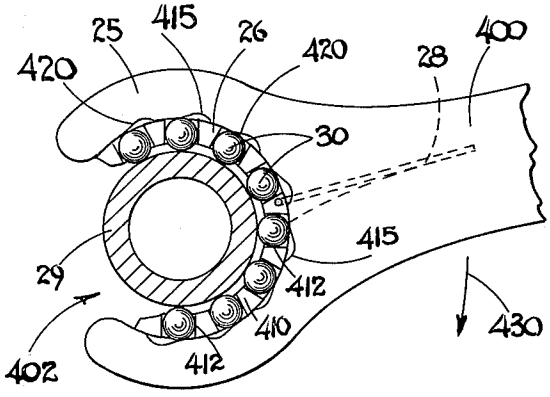


FIG. 11

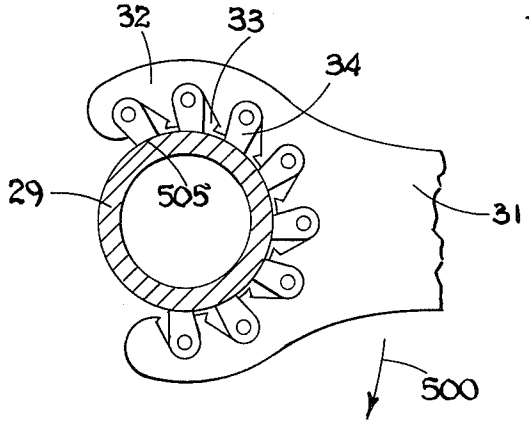


FIG. 12

RATCHET WRENCHES

BACKGROUND OF THE INVENTION

Various open-ended wrenches, some being ratched, have been invented.

For example, U.S. Pat. No. **1,387, 866** which issued in **1921** to C. E. Reed had pivoted gripping members which were tightened onto a pipe by a forcing ram.

U.S. Pat. No. **2,306,228** issued in **1942** to H. A. Shaw for an open-ended ratchet wrench for use on bicycle spokes. The ratchet was a conventional leaf spring engaging ratchet teeth.

U.S. Pat. No. **2,712,259** issued in **1955** to H. J. Cowell for a wrench having a plurality of gripping members, each separately spring-biased outward in a direction substantially tangential to the item to be torqued. Turning of the wrench in one direction caused the wrench to engage the torqued item, and turning of the wrench in the other direction caused the gripping members to be forced to retract against their individual springs and to disengage the torqued item.

U.S. Pat. No. **3,386,319** issued in **1968** to J. W. Bloom for a wrench using spheres as gripping members which are power-oscillated between a radially inward gripping position and a radially outward non-gripping position. The balls are forced outward, and the wrench head is turned to apply torque. The balls are then retracted radially outward and the head is re-positioned for another indexing of the torqued item.

U.S. Pat. No. **3,527,327** issued in **1970** to C. H. McCreary teaches a closed wrench having eccentric pivoted gripping elements which grip and transmit torque when the frame is turned in one direction and which is dis-engaged or free-running when the frame is turned in the other direction.

U.S. Pat. No. **3,664,213** issued in **1972** to R. Anati teaches another closed wrench having pivoted members which are guided by guides to engage a nut, pipe, or shaft when turned in one direction and to disengage when turned in the other direction.

BRIEF DESCRIPTION OF THE INVENTION

Our invention is a new kind of ratchet wrench which unites the advantages of a ratchet wrench and an open-end wrench. It is an open-end ratchet wrench.

This invention is a wrench which has one open side large enough that it can be slipped from the side onto a nut or over a pipe, tube or bar, and it has a ratchet mechanism which makes the tightening or loosening of the nut fast and easy.

It is therefore an object of this invention to apply a torque to an object in one rotation direction.

It is a more specific object of this invention to provide a mechanism which delivers torque when turned in one direction and which slips when turned in the other direction.

It is still a more specific object of this invention to provide an open-ended one-direction wrench.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects will become apparent from the following description, taken in connection with the accompanying drawings:

FIG. **1** is a partial right-side view, partly in section, of a first embodiment of the invention, in which the outside shell of the wrench is omitted.

FIG. **2** is a bottom view of the embodiment of FIG. **1** in which the coverplate of the wrench is omitted.

FIG. **3** is a left-side view of the embodiment of FIGS. **1** and **2** in which the outside shell of the wrench is omitted.

A second embodiment of the invention is shown in FIGS. **4, 5, 6** and **7.**

FIG. **4** is a view, partly in section, of the second embodiment of the invention in engaged, driving position.

FIG. **5** is a sectional view, taken at **5—5** in FIG. **4,** with the driven nut omitted.

FIG. **6** is a view, similar to FIG. **4,** but with the wrench disengaged from the nut.

FIG. **7** is a sectional view, taken at **7—7** in FIG. **4.**

A third embodiment of the invention is shown in FIGS. **8** and **9.**

FIG. **8** is a view of the third embodiment of the invention with the gripping members in driving position.

FIG. **9** is a view of the third embodiment of the invention with the gripping members disengaged.

FIG. **10** shows a modification of the wrench of FIGS. **4–7** for use as a pipe wrench.

FIG. **11** is a view of a fourth embodiment of the invention.

FIG. **12** is a fifth embodiment of the invention modified to accommodate a pipe.

DETAILED DESCRIPTION OF THE INVENTION

The first embodiment of FIGS. **1–3** comprises an arm **5** with the ratcheting mechanism **11** and **12,** and the exchangable socket member **1,** which is broached through to the size of the nut **2.** The socket member **1** has a longitudinal slit or opening **3** wide enough, that the pipe, tube or rod **4** can slip through it. The arm **5** has on the end a cylindrical opening or socket **6,** into which the socket fits. On the end of the cylindrical wall or socket **6** is a longitudinal slit **7** or opening of about the same size as the slit or opening **3** on the socket member **1.** The socket member **1** will be pushed into the opening or socket **6** so that the slits or openings **3** and **7** are lined up. The socket member **1** has a groove **8** on its outer periphery, which is engaged with spring loaded retainers **9** (only one is shown). The retainers **9** keep the socket member **1** from falling out of the socket **6.** The upper face of the socket member **1** has a plurality of radial slits **10,** into which the ratchets **11** and **12** extend. They are kept engaged with the socket by the springs **13** and **14** respectively. To tighten the nut **2** the arm **5** will be turned clockwise (FIG. **2**) around the nut. The dog **111** of the ratchet **11** is pulling and the end of the leaf spring ratchet **12** is pushing the socket member **1** and with it the nut **2** clockwise. By turning the arm **5** counterclockwise, the ratchets **11** and **12** disengage from the socket member **1,** which will stand still, and the arm **5** with the ratchets **11** and **12** move alone until the arm **5** is turned again clockwise. During the tightening of the nut **2** the socket member **1** is indexed relative to the arm **5** and socket **6.** So the ratchet **11** eventually comes over the slit **3** and is disengaged. The ratchet **12** alone then pushes the socket member **1** with the nut **2.** The ratchets **11** and **12** are so far apart that before the ratchet **12** comes over the slit **3** and disengages, the ratchet **11** is already engaged again, and it alone will pull the socket member **1** with the nut **2.** The ratchet mechanism is covered with a coverplate **15.** To remove a nut with this ratchet wrench one has to turn the tool upside down. Then it

engages the torqued item when it is turned counter-clockwise, and it disengages when turned clockwise.

The embodiment shown in FIGS. 1–3 is adapted to engage a nexagon-shaped nut whose outer surfaces are 120° apart. The wrench, therefore, has gripping surfaces extending from one face to the other of the socket member 1 to match the faces of the hexagon-shaped nut. For example, the face 113 is 120° from the face 115. That is, the angle 117 is 120°.

When the arm 5 is turned in the direction of the arrow 119, the dog 111 of the ratchet 11 pulls on the face 121 while the end 123 of the ratchet 12 pushes against the face 123.

When the arm 5 is turned opposite to the arrow 119, the dog face 127 rides over the face 129, and the surface 131 rides over the surface 113, whereby the arm 5 and socket 6 turns relative to the socket member 1.

A second embodiment of the wrench of this invention is shown in FIGS. 4–7.

The embodiment of FIGS. 4–7 comprises an outer body or wrench frame 200, with the larger end of the frame partly open at 202 to receive an item 2 to be torqued. The cage 16 fits into a substantially cylindrical opening in the region of 202 of the body 200, the cage being substantially circularly cylindrical. The cage has slots 30° apart. In every slot is a sliding member 17, which has a shoulder 206 on one end to prevent it from falling out of the slots 208. Two sideplates 18 hold the assembly together. The inside periphery of the opening 210 in the outer body 15 has cam surfaces 220, the surfaces 220 being smooth surfaces which are substantially 30° apart for grasping a hexagonal nut. The sliding members 17 are cam followers which ride by their end surfaces 222 on the cam surfaces 220. The surfaces 220, and hence the gauge of the serration match the sliding members 17. The cage 16 can turn relative to the outer body 15 about 10° to 15° and is biased by light springs, for example, by leaf or cantilevered springs 19 toward its position where the sliders 17 are forced radially inward by the cam surfaces 222.

In the nut-engaging position shown on FIG. 4, with torque applied as shown by arrow 225, the outer body 200 presses against the sliding members 17 at the cam interface 220, 222. Due to the radial component of the face 222, the members 17 are pressed against the nut 2. When the handle is turned in the direction shown by arrow 225, the whole assembly with the nut 2 turns. Turning the handle in the direction shown by the arrow 227, the outer body or frame 200 moves alone till the deep cavities 250 are aligned with the sliding members 17. By turning the whole assembly further, the sliding members 17 will be pushed by the corners of the nut 2 into the cavities 250 and a new grip can be taken. The tool ratchets directly on the nut. It is an open-end ratchet wrench. The opening 202 of this tool is so big, that it can be slipped from the side onto the nut 2 as an open-ended wrench.

Thus, the embodiment of FIGS. 4–7 uses a cage fitting into the open end of a crescent-like wrench. In a substantially cylindrical opening of the wrench fits a substantially cylindrical cage member. The opening in the frame is formed with a plurality of cam surfaces on its inner periphery, giving the general impression of a saw-toothed surfaces. However, each of the cam-surfaces is precisely formed and positioned to match cam followers which are attached to the cage member. Slots are formed in the cage member, and into those slots are positioned the cam followers. The cam followers are also the grasping members for the wrench, and the radial position of the grasping members depends upon the relative circumferential position of the wrench body and the cage member. Typically, a cantilevered spring is positioned substantially along the handle of the wrench, and it is attached to the cage member, and it biases the cage member relative to the frame into a position where the cam follower grasping members are forced by the cam surfaces radially inward toward the member to be torqued. Turning of the wrench in one direction causes the grasping members to be pushed into solid contact with the item to be torqued. Turning of the wrench in the other direction causes the cage and wrench body to move relative to each other toward a position where the grasping members can move radially outward and slip over the surface of the torqued item.

Another embodiment of the invention is shown on FIGS. 8 and 9. Both figures are top-views with removed coverplate to show the gripping members in FIG. 8 in driving (gripping) position, and in FIG. 9 in resetting position.

On the end of the tool 20 is a substantially cylindrical head 21 with a substantially cylindrical hole 300, and it has an opening 302 on the end of it big enough that the wrench can be slipped from the side onto the nut 2. The diameter of the hole 300 is slightly bigger than the diagonal distance between opposite corners of the nut 2. On the inside of the head 21 there are substantially identically formed cavities 22 broached 30° apart. In the cavities 22 are little turnable elements 23 which turn around their shafts 24 which, in turn, are embedded in the side coverplates (not shown). The elements 23 are biased by light springs (not shown) about the shafts 24 toward the position shown in FIG. 8. The elements 23 intrude into the central opening of the tool, and every second one of them lies against a flat of the hexagonal nut 2. Turning the tool in the direction of the arrow 305 presses the elements 23 against the flats of the nut 2 whereby the nut is turned with the handle 20. Turning the tool 20 in the direction of arrow 310 causes the elements to disengage and to be pushed by the corners of the nut 2 into the cavities 22.

To get the nut off, the tool is turned around it length axis. The elements 23 then engage with the nut by turning the tool counter-clockwise and disengage by turning the tool clockwise.

The wrenches which are shown in FIG. 4 and FIG. 8 are easily modified for gripping and tightening threaded piping.

FIG. 10 shows a pipe-wrench with sliding members similar to the wrench in FIG. 4. The pipe-wrench comprises the outer body 25, with the handle partly broken away, the cage 26, which has substantially equally spaced slots. In every slot is a sliding member 27, which has a shoulder to prevent it from falling out. Two sideplates (not shown) hold the assembly together. The inside of the outer body 25 has as many substantially identical cavities as there are sliding members. The cage 26 can turn slightly relative to the outer body 25 and is biased by light springs, such as cantilevered springs 28, toward its extreme counterclock position. In this position the outer body 25 holds the sliding members 27 pressing against the pipe 29. The ratcheting pipe-wrench of FIG. 10 operates in a fashion similar

to the ratchet wrench shown and described in connection with FIG. 4.

FIG. 11 teaches the use of balls or rollers 30 as gripping members. FIG. 11 teaches an open-ended crescent-type wrench 400 which has a substantially circularly cylindrical opening 402 on one end and an opened portion for receiving a pipe 29 to be torqued. A substantially circular U-shaped cage member 410 is positioned within the opening 402. A plurality of balls or rollers 30 are positioned within slots 412 in the cage 410. In the well of the opening 402 are a plurality of recesses 415, equal in number to the number of balls or rollers 30. The recesses 415 have an inclined ramp on one side thereof. The ramp is shown exaggerated at 420. As the wrench is turned in the direction of the arrow 430, the spring 28 and the friction between the balls or rollers and the wrench causes the balls 30 to walk up the incline 420 and to tighten on the pipe 29. When the wrench is turned the other way, friction between the balls or rollers 30 and the pipe 29 causes the balls or rollers to move into position where they can return into the cavities 415, loosening the pipe 29.

FIG. 12 shows a ratcheting pipe-wrench, which is substantially identical in structure and operation to the ratchet wrench shown and described in connection with FIG. 8. On the end of the tool 31 is a cylindrical head 32 with a cylindrical hole slightly bigger than the pipe 29 and an opening big enough that it can be slipped from the side onto the pipe 29 and an opening big enough that it can be slipped from the side onto the pipe 29. On the inside of the head 32 there are substantially identical and substantially equally spaced cavities 33. In this cavities are little turntable gripping elements 34, which are biased by light springs (not shown) toward a position shown in FIG. 12 so that they intrude into the central opening of the wrench and press against the pipe 29. Turning the tool in the direction of arrow 500 causes turnable gripping elements 34 to wedge between the pipe 29 and the wrench, turning the wrench counter-clockwise the gripping elements 34 recede into the cavities and release the pipe, so a new grip can be taken. The difference between the wrench of FIG. 12 and that of FIG. 8 is that the faces 505 of FIG. 12 match the contour of pipe 29 while the faces 304 of FIG. 8 match the surface 307 of the hex nut 2.

While the invention has been described in connection with present, preferred embodiments thereof, it is to be understood that this description is illustrative only and not intended to limit the invention, the scope of which is defined by the appended claims.

1. A wrench comprising a wrench handle having:
a socket on one end:
a common socket frame positioned within said socket and carrying slidable gripping members, including slots within said frame to accommodate said gripping members;
a plurality of cammed surfaces upon the periphery of said socket to guide said gripping members and limit their travel;
spring means between said handle and said frame to bias said frame toward a direction wherein said gripping members are forced radially inward against an item to be torqued.

2. Apparatus as recited in claim 1 in which said spring means comprises a cantilevered spring, cantilevered from said handle and attached to said frame to bias said frame in a preferred direction, said camming surfaces being directed inwardly radially in said preferred direction.

3. Apparatus as recited in claim 2 in which the inner surfaces of said gripping members are shaped to conform to an item to be torqued.

4. Apparatus as recited in claim 2 in which said socket and said frame each have an opening in their peripheries to form a crescent-type wrench.

5. Apparatus as recited in claim 2 and further comprising stops on said gripping members to prevent their falling out of said slots.

6. A wrench comprising:
a wrench handle having a crescent-shaped opening at one end;
a plurality of camming surfaces around the periphery of said opening;
a socket positioned within said opening, said socket having a plurality of generally radially directed slots therein;
a plurality of cam-following wrench-grippers, positioned within said slots adjacent said camming surfaces, each said gripper having a stop thereon and being slidable in its respective slot between said camming surfaces and said stops;
and a cantilevered spring, positioned wiithin said handle, attached between said handle and said socket to bias said socket toward a position wherein the said grippers are forced against said camming surfaces; and
said grippers being generally shaped to conform to the shape of an item to be torqued;
whereby when said handle is turned in one direction, said camming surfaces force said grippers radially inward, and when said handle is turned in the other direction, said grippers are free to loosen from a torqued item against the bias of said spring.

* * * * *