

June 30, 1931.

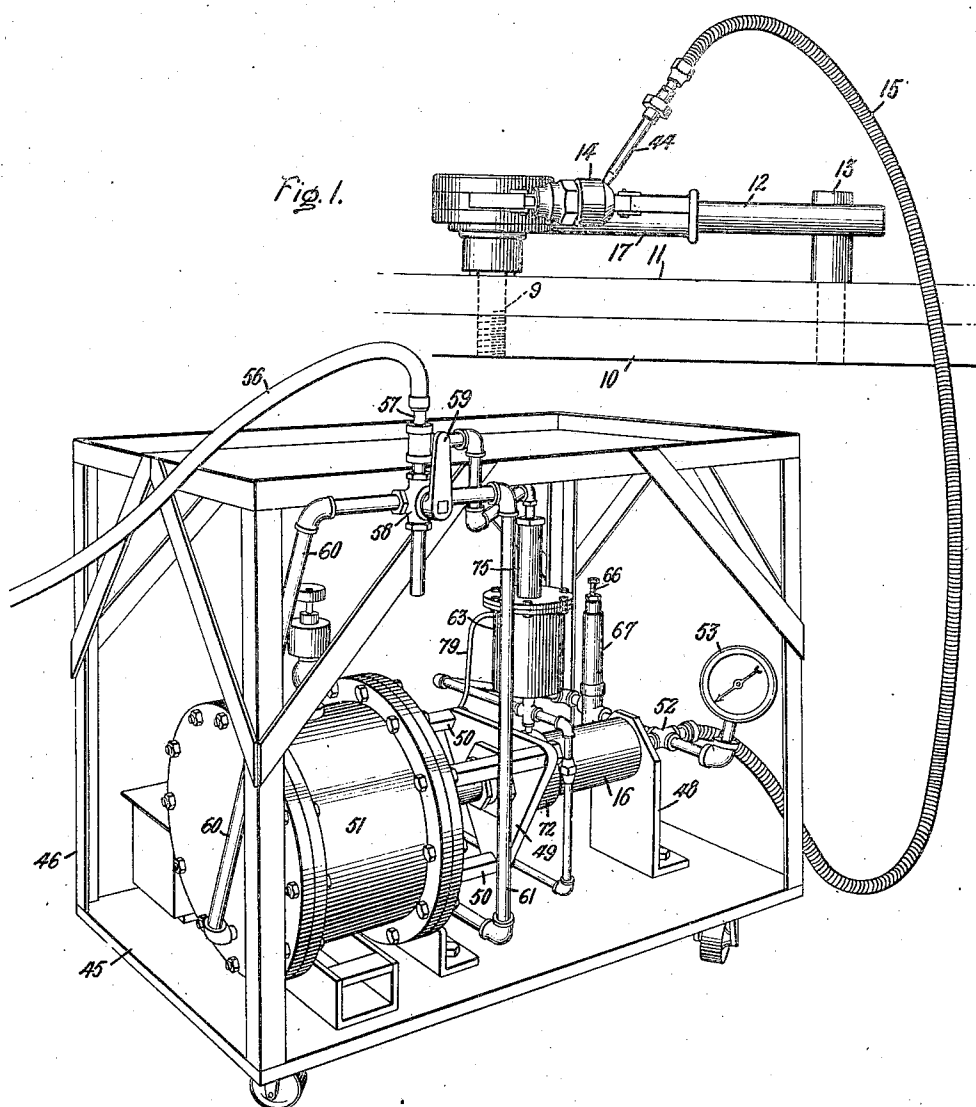
C. E. WEAVER

1,812,816

POWER WRENCH

Filed April 24, 1930

2 Sheets-Sheet 1



Inventor :
Caius E. Weaver ,
by *Charles V. Tuller*
His Attorney.

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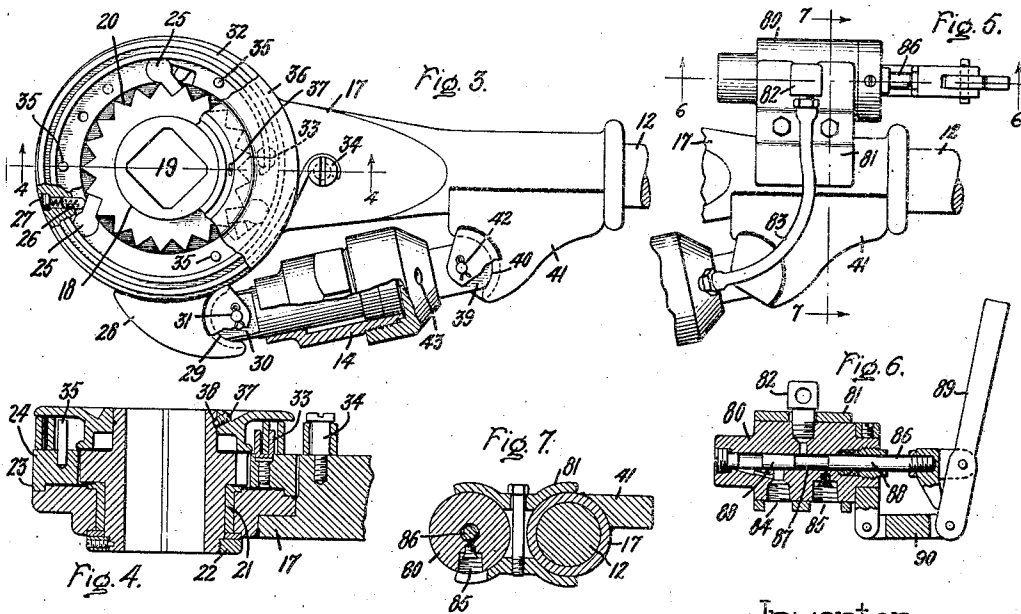
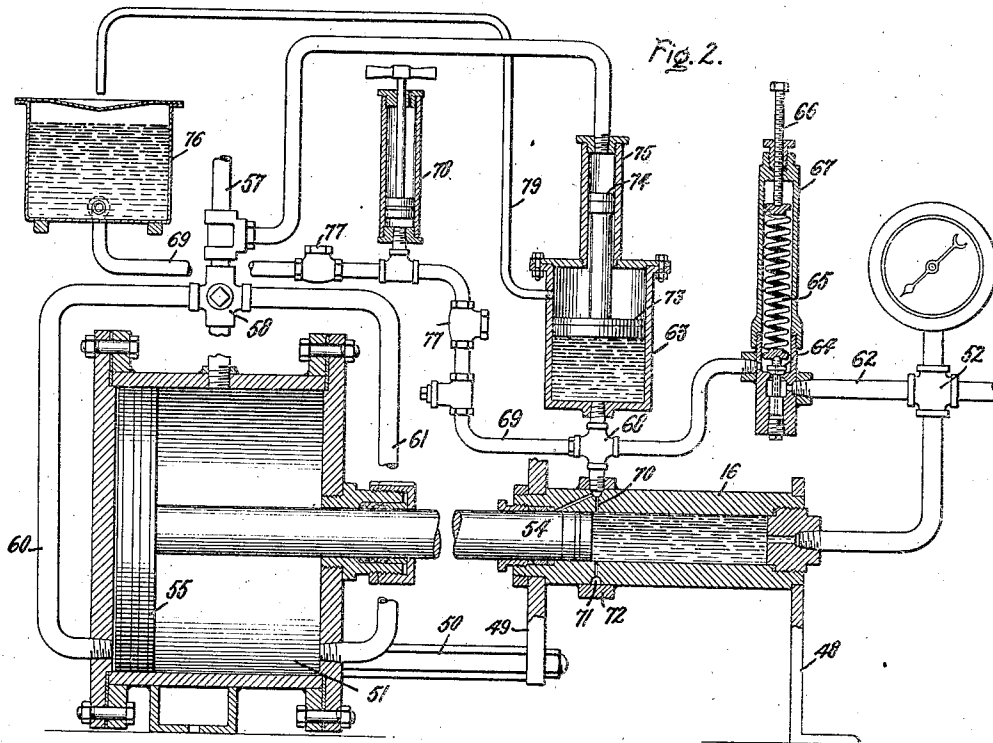
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UNITED STATES PATENT OFFICE

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POWER WRENCH

Application filed April 24, 1930. Serial No. 447,063.

My invention relates to wrenches, and more particularly to power-operated wrenches of the ratchet type.

Much trouble is experienced in turning home and effectively tightening many of the big bolts, studs and cap screws used in the large structural assemblies and machinery of modern times. Heretofore it has been common practice to drill a hole axially through a bolt or cap screw, insert a heating element therein and expand the bolt or cap screw, then screw it home as tightly as possible, remove the heating element therefrom and depend upon the contraction of the bolt or screw as it cools to effect the requisite high tension. Another method has been to use a very large wrench having a long handle, and the power of several men to operate it. The above methods require much time and labor, and make it very difficult to obtain a uniformly high degree of tension on the screwed parts.

The object of my invention is to provide an improved power wrench which is portable, easy to operate, which may be adjusted to apply a predetermined torque, and which shall operate effectively to screw home the largest sized threaded assembly parts in use at the present time.

For a better understanding of my invention, attention is directed to the following description and accompanying drawings.

In the drawings which represent certain embodiments of my invention, the same reference numerals refer to similar parts in the several views.

Fig. 1 is a perspective view of my wrench and its hydraulic actuating means; Fig. 2 is a view, partly in section, of the compressor and auxiliary devices, certain of the parts being arranged diagrammatically to clearly bring out the relation thereof; Fig. 3 is a plan view, partly in section, of the power ratchet wrench shown in Fig. 1; Fig. 4 is a longitudinal section taken through line 4—4, Fig. 3; Fig. 5 is a plan view of a modified control valve attached to the wrench, a fragment of which is shown; Fig. 6 is a longitudinal section of the control valve taken through line 6—6, Fig. 5;

and Fig. 7 is a transverse section of the valve and wrench taken through line 7—7, Fig. 5.

As shown in Fig. 1 of the drawings, the wrench is disposed upon the square head of a socket upon a cap screw 9 to be screwed home in an engine frame 10 to secure a cover plate 11 thereto and the wrench lever 12 abuts against some fixed part, such as a stop plug 13, to prevent it from turning. The head of the wrench embodies a ratchet mechanism actuated by a piston and cylinder 14 to which fluid under pressure is supplied through a flexible pipe 15 from a hydraulic pressure device 16 supported for free movement about the work independent of the wrench.

The wrench comprises a cast yoke 17, Fig. 3, with the lever 12 extending at one end and having at the other end the means for engaging the part to be turned, and the ratchet mechanism therefor. The means for engaging the part to be turned consists of a rotary sleeve or member 18 provided with a square hole 19 adapted to receive the socket as shown in Fig. 1 and intermediate its ends is an integral ratchet wheel 20, while below the ratchet wheel it is made cylindrical and journaled in a bushed bearing block 21 fixed in the end of the yoke 17, the extreme end of which is threaded for the reception of a retaining ring 22 adapted to thrust against the lower side of the bearing block 21. The upper side of the yoke 17 has its outer edge recessed to provide an annular bearing for flange 23 of an oscillating member in the form of a pawl ring 24 mounted on the bearing block and in the plane of the ratchet wheel 20. Formed in the ring 24 are three inwardly opening bearing recesses for the reception of the pawls 25 which are yieldingly pressed inwardly into engagement with the teeth of the ratchet wheel 20 by spring plunger 26 seated in holes through the pawl ring 24 and adjustably retained by screw plugs 27 threaded in the outer ends of the holes. The pawl ring 24 has a peripheral lug 28 provided at one side with an arcuate thrust seat 29 for engagement of the rounded outer end of 100

the piston rod 30 of the actuating cylinder 14 and to which it is attached by a cotter held pin 31. In order to retract the pawl ring 24 upon completion of a power oscillation thereof, a spiral spring 32 is attached thereto at its inner end by a screw post 33 and to the yoke 17 at its outer end by a screw post 34. In order to retain the spring in position radially, the pawl ring 24 is provided with a circular row of vertical pins 35. The pawl ring 24, its retracting spring 32, and the pawls 25 are enclosed and held down by a cast washer 36 held in place by one or more diagonal set screws 37 engaging loosely in an annular groove 38 formed on the upper end of the wrench sleeve 18.

In case the wrench is to be used on a nut or other part of different shape or size, a socket adapted to fit over the nut or head of the bolt to be tightened can be substituted for the one used, as shown in Fig. 1.

The rear end of the actuating cylinder 14 is provided with a rounded projection 39 adapted to thrust against an arcuate seat 40 formed in a side lug 41 on the yoke 17 and to which it is attached by a cotter held pin 42. The arcuate seats 29 and 40 permit a certain cradling motion of the piston and cylinder 14 during the oscillatory movements of the pawl ring 24 and the cotter held pins 31 and 42 serve merely to prevent disconnection of the parts engaged by them.

The piston 30 and cylinder 14 are of the single stroke type having a single admission and exhaust port 43 for the pressure fluid and the stroke thereof corresponds substantially to the spacing of the teeth of the ratchet wheel 20. The flexible pipe 15 connects with the port 43 by means of a nozzle 44.

The intermittent hydraulic pressure creating and control means, as shown in Figs. 1 and 2, are mounted on a platform truck 45 with a guard frame 46 whereby movement about the work or from one place to another is facilitated. The intermittent pressure-creating means comprises a stout cylinder 16, Fig. 2, with moderate size bore and supported horizontally by a bracket 48 at one end and at the other by a thrust plate 49 connected by tie rods 50 to the compressed air cylinder 51. The flexible pipe 15 connects with the discharge end of the pressure cylinder 16 through a branch coupling 52 to which a pressure gage 53 is attached. The piston 54 of the pressure cylinder 16 is an extension of the piston rod of the compressed air cylinder 51 and is only a fraction of the diameter of the piston 55 of the latter cylinder.

Compressed air or other gaseous fluid is supplied from any convenient source through the flexible hose 56 and a pipe connection 57 to a two-way valve 58 of ordinary construction provided with an oper-

ating handle 59. A pipe 60 connects one way of the valve 58 to the outer end of the air cylinder 51, a second pipe 61 connects the opposite valve way to the inner end of that cylinder and the third way serves as exhaust from both ends of the cylinder. When the handle 59 is vertical the supply of air through pipe connection 57 is cut off and both ends of the cylinder 51 exhausted; when turned to one side the compressed air is admitted, for instance, to the outer or left hand end of the cylinder 51 and causes its piston 55 and pressure piston 54 to travel to the right and force the hydraulic liquid in the pressure cylinder 16 through the pipe connection 52 and flexible pipe 15 into the actuating cylinder 14 of the wrench and causing the pawl ring 24 to oscillate forwardly and carry with it the ratchet wheel 20. Upon turning the operating handle 59 from its present position to its opposite position, the exhaust is opened for the escape of air from the left end of the air cylinder 51 and upon the handle reaching its opposite position compressed air is admitted to the right end of cylinder 51 and the pistons 55 and 54 retracted toward the left and causing the pressure liquid to withdraw from the wrench-actuating cylinder 14 and permitting the spiral spring 32 to oscillate the pawl ring 24 backwardly. This cycle of operations is repeated until the intermittent pressures and releases of the liquid effect a sufficient movement of the pawl ring 24 to turn home the nut or cap screw 9 under the requisite torque which is indicated by the pressure gage 53.

In order to definitely limit the liquid pressure for the maximum torque to be applied to a particular size of nut or cap screw, a bypass 62, Fig. 2, is provided between the branch coupling 52 and a liquid tank 63 and in this bypass is a regulating pop valve 64 held to its seat by a spring 65, the tension of which is adjustable by a screw 66 threaded in the upper end of the valve casing 67.

The bypass 62 joins the tank 63 through a cross-connection 68 which also joins the pressure cylinder 16 and a liquid supply pipe 69. The cross-connection 68 communicates with a distributed series of port holes 70 disposed radially through the cylinder walls near the left-hand end thereof, from an annular groove 71 enclosed by a hoop 72. The port holes 70 are closed by the pressure piston 54 at all times except when in extreme retracted or left-hand position and without pressure on the liquid. Any deficiency in the volume of the pressure liquid in the cylinder 16 due either to leakage or discharge through the bypass 62 is restored thereto from the tank 63 which is provided with a piston 73 having a reduced head 74 operating in a cylindrical extension 75 at the top of the tank 63 by compressed air from

the pipe connection 57 whereby sufficient pressure is maintained in the tank to cause liquid to flow quickly therefrom in case of any deficiency in the pressure cylinder 16.

5 A reservoir 76 supplies liquid through pipe 69 in which are disposed check valves 77 and a hand pump 78 whereby the liquid may be forced into the tank 63 against the compressed air acting therein. An over-
10 flow pipe 79 leads from the upper portion of the tank back to the reservoir 76.

My wrench driven by the hydraulic actuating means above described has been used with much satisfaction in turning home of
15 nuts, bolts and cap screws of the largest sizes in use today. Where the parts to be turned home are of moderate sizes, it is practicable in localities having city water supply at high pressure to operate my
20 wrench directly therefrom and dispense with the pressure-actuating means above described. In order that my wrench may be so directly actuated from a municipal water supply, I employ the valve mechanism and
25 connections shown in Figs. 5, 6 and 7 of the drawings, and consisting of a three-way valve cylinder 80 fixed by brackets 81 to the wrench yoke 17 with its delivery part
30 82 connected by a flexible pipe 83 to the wrench-actuating cylinder 14, the supply port 84 being directly connected by any suitable pipe means to the municipal water supply, while the exhaust port 85 is connected to a convenient drain. The valve rod
35 86 has a reduced central section 87 and the end sections 88 are adapted to fit snugly in the bore of the valve so that when the valve rod 86 is moved into its extreme left-hand position the liquid from the city mains flows
40 through port 84 to delivery port 82 to the actuating cylinder 14 and upon completion of the wrench stroke a movement of the valve rod 86 into extreme right-hand position closes the supply port 84 and opens the
45 exhaust port 85 so that the pawl ring 24 oscillates backward under the recoil of its spring 32. The valve rod 86 is manually operated by a hand lever 89 pivotally connected thereto and fulcrumed upon a float-
50 ing link 90 attached to the right-hand end of the valve cylinder 80.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A power wrench comprising a lever, a
55 rotary ratchet member mounted thereon, an oscillating member movable about said ratchet member, pawls mounted on said oscillating member and adapted to engage said ratchet member, and a hydraulic cylinder and piston pivotally connected respec-
60 tively at their outer ends to said lever and to said oscillating member to actuate the latter.

2. A power wrench comprising a lever, a
65 rotary ratchet member mounted thereon, an

oscillating member movable about said ratchet member, pawls mounted on said oscillating member and adapted to move said ratchet member in one direction, a
70 spring connected to said oscillating member to move it in the opposite direction, and a hydraulic cylinder and piston pivotally connected respectively at their outer ends to said lever and tangentially to said oscillat-
75 ing member.

3. A power wrench comprising a lever, a rotary ratchet member mounted thereon, an oscillating member surrounding said ratchet member, pawls mounted on said oscillating member and engaging said ratchet member, a
80 spring disposed about said oscillating member and connected respectively to said member and said lever and normally acting to hold said oscillating member retracted, a fluid-pressure cylinder and piston pivotally
85 connected to said lever and said oscillating member, and means to control the supply of pressure fluid to said cylinder.

4. A portable power wrench comprising a lever adapted to be supported on the part
90 to be rotated and to be held from rotation itself by engagement with a stationary abutment, a circular-shaped head on the supported end of said lever, a polygonal socket rotatably carried by said head, an oscillat-
95 ing ring mounted on said head, pawl and ratchet means between said socket and said ring, a hydraulic cylinder and piston respectively pivoted at their outer ends to said lever and said ring, flexible means to supply
100 pressure fluid to said cylinder, and remote means for regulating and controlling the pressure fluid.

In witness whereof I have hereunto set my hand this 23rd day of April, 1930. 105

CAIUS E. WEAVER.

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