CONTROLLED POWER PNEUMATIC IMPACT WRENCH

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ABSTRACT
A controlled torque reversible pneumatic impact wrench for use particularly in mounting the wheels of automotive vehicles equipped with disc brakes is provided with an air regulating valve introducing differential flows of air to the rotor during the forward and reverse drive conditions of the wrench. In the reverse drive condition of the wrench full air pressure is applied. In the forward drive condition thereof, a restricted air volume is applied as required to develop a predetermined maximum torque.

2 Claims, 12 Drawing Figures
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CONTROLLED POWER PNEUMATIC IMPACT WRENCH

BACKGROUND OF THE INVENTION

This invention relates to reversible pneumatic impact wrenches. It pertains particularly to controlled torque reversible pneumatic impact wrenches of the class employed in applying and removing the mounting bolts used for mounting the wheels on automotive vehicles equipped with disc brakes.

Reversible pneumatic impact wrenches of adjustable torque are well known and widely used. Such wrenches conventionally are supplied with forward and reverse controls adjustable between a plurality of driving torques in both the forward and reverse direction.

The use of such wrenches is attended by a significant disadvantage when they are applied to the application or removal of the nuts to or from the bolts used in mounting the wheels on automotive vehicles equipped with disc brakes. Disc brake assemblies are sensitive to torque and are affected by the torque applied to the lug nuts used for mounting the wheels.

Sufficient torque must be applied to secure the nuts. On the other hand overtorquing warps the rotor of the disc brake assembly and adversely affects the operation of the brakes.

For most efficient operation of the brakes, an adjustment tolerance of 0.0005 inch must be maintained. Overtorquing of the mounting lug nuts can pull the rotor out of adjustment by as much as 0.012 inch. This not only affects the operation of the brake, but may permanently damage the brake parts so that replacement is required.

When using conventional reversible pneumatic impact wrenches for the purpose of changing a tire, the problem is magnified by the fact that it frequently is necessary for the mechanic to adjust the wrench to maximum torque in the reverse setting of the wrench in order to remove nuts which were overtightened when the wheels were mounted. This setting applies a torque in the reverse direction which is far in excess of that which should be applied when the tool is used in the forward drive setting.

Working under the pressure of time, the mechanic then forgets to reduce the wrench torque setting when remounting the wheel. As a consequence, the nuts then are largely overtorqued and the disc brake rotors warped out of adjustment.

It is the general object of the present invention to provide a reversible pneumatic impact wrench of controlled torque in the forward drive position, the torque being predetermined to tighten the mounting nuts of automotive vehicle wheels to the precise condition in which they securely mount the wheels, but without disturbing the setting of the disc brake rotors associated with the wheels.

Still another object of the present invention is the provision of a reversible pneumatic impact wrench of controlled and predetermined torque in its forward drive setting, but capable in its reverse setting of exerting maximum torque as required to loosen the mounting nuts of automotive vehicle wheels which have been overtorqued in their application.

Still a further object of the present invention is the provision of a reversible pneumatic impact wrench of controlled torque which is self compensating in that it delivers the predetermined torque even though the air pressure applied to the wrench varies between wide limits.

Yet another object of the present invention is the provision of a reversible pneumatic impact wrench of conventional contour and design provided with a simple and foolproof torque control.

BRIEF SUMMARY OF THE INVENTION

The hereindescribed reversible pneumatic impact wrench of controlled torque comprises in combination a hollow case, air conduit means in the case, and coupling means for coupling the conduit means to a source of air under pressure.

A throttle valve is present in the conduit for supplying air on demand. A novel combination reversing and air regulating valve is present in the conduit downstream from the throttle valve.

A reversible air driven rotor is coupled to a rotary wrench and driven in forward and reverse directions by air supplied through the conduit. An air exhaust port communicates with the conduit downstream from the rotor.

The combination reversing and air regulating control valve comprises a cylinder equipped with inlet and outlet ports arranged in such a manner that in the reversing position of the valve, maximum air flow passes therethrough and hence maximum torque is applied to the wrench. In the forward position of the valve restricted air flow is transmitted through the valve to the wrench as required to develop a controlled maximum torque of constant and predetermined value.

THE DRAWINGS

FIG. 1 is a view in side elevation of the presently described controlled torque reversible pneumatic impact wrench, partly in section and partly schematic.

FIG. 2 is a fragmentary view in rear elevation illustrating a control for the wrench.

FIGS. 3, 4, 5, and 6 are detail sectional views taken along lines 3—3, 4—4, 5—5 and 6—6 respectively of FIG. 1 and illustrating the operation of the wrench in the forward drive position.

FIG. 7 is a fragmentary sectional view corresponding to FIG. 1 but illustrating the wrench in its reverse drive position.

FIG. 8 is a fragmentary view in rear elevation similar to FIG. 2 and illustrating the setting of the valve controlling the operation of the wrench in the reverse drive position.

FIGS. 9, 10, 11 and 12 are detail sectional views taken along lines 9—9, 10—10, 11—11 and 12—12 of FIG. 7, and illustrating the air flow through the tool with the control valve set in the reverse drive position.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

As viewed in FIG. 1, the hereindescribed controlled torque, reversible, pneumatic impact wrench is housed in a hollow case indicated generally at 20 and consisting of a handle 22 and a head 24. Air under pressure is supplied to the wrench through the handle by means of an air line 26 which in the applied position communicates with a conduit segment 28.
A throttle valve 30 of the check valve type is controlled by a trigger 32 in conventional manner. It serves as an on-off valve in the use of the tool.

Air under pressure admitted to the wrench via conduit segment 28 drives a conventional air motor rotor 34 coupled to a conventional wrench head 36.

The operation of the rotor is controlled by means of a combination reversing and air regulating valve indicated generally at 40. It comprises a cylinder type valve which preferably is formed as a single integrated unit, although if desired it may be fabricated from components parts tied together and working as a single unit.

As illustrated particularly in FIG. 6, valve 40 comprises a cylinder body 42 which acts as a bearing in mounting the valve. It has on one end an outwardly extending shaft 44 to which is pinned a control knob 46.

A diametrically opposed shaft 48 is integrated with the other end of cylinder body 42, coaxially with shaft 44. It mounts a bearing 50 with integral head 52. O-rings 54, 56 seal off the valve assembly.

Valve body 42 is formed with a hollow chamber 58. The chamber is provided with three ports: two inlet ports and an outlet port which functions in two positions of the valve.

The inlet ports are indicated at 60, 62, respectively, FIG. 3. Inlet port 60 is used during forward driving of the wrench. It is of restricted size as required to apply a predetermined maximum torque. Inlet port 62 is used in the reversing position of the wrench. It is of maximum size as required to deliver maximum torque when the tool is reversed.

An outlet port 64, FIG. 4, communicates with a conduit segment 66 leading to the forward drive side of rotor 34. The same outlet port, port 64, communicates with a conduit segment 70 leading to the reverse side of the rotor in the 180° adjusted position of the valve.

There thus are provided two pairs of ports, alternately operable in the forward and reverse drive positions of the wrench. In the forward drive position, restricted inlet port 60 is coupled to exhaust port 64; which communicates with conduit segment 66. In the reverse drive setting of the tool, enlarged inlet port 62 is coupled with exhaust port 64, which now communicates with conduit segment 70.

**OPERATION**

The combination reversing and air regulating valve thus may be set between two positions by operation of operating knob 46. In the forward drive or clockwise position of FIGS. 2-6 inclusive (position R of FIG. 2), air under pressure admitted through conduit segment 28 passes through restricted inlet port 60 and into chamber 58, enlarged inlet port 62 being blanked off. The pressure air then leaves the chamber via exhaust port 64 and passes through conduit segment 66 to the chamber housing rotor 34. It is exhausted from this chamber by conduit segments 70 and 80, the latter of which communicates with exhaust ports 72, FIG. 1.

In the reverse setting of the wrench, indicated by the symbol L of FIG. 8, the reverse sequence occurs. This is illustrated in FIGS. 7-12 inclusive.

In this setting of the tool enlarged inlet port 62 registers with conduit segment 28 and restricted inlet port 60 is blanked off.

Air under pressure enters chamber 58 via enlarged inlet port 62, and leaves via outlet port 64 adjusted to the position of FIG. 10. It passes through conduit segment 70 to the chamber housing rotor 34, driving the latter in the reverse direction. It exhausts through conduit 66 which now connects with conduit 80 communicating with exhaust ports 72.

Thus by a simple adjustment of the control knob it is possible to shift the tool between a forward drive position wherein it delivers a controlled and predetermined torque and a reverse drive position wherein it delivers unrestricted torque determined only by the capacity of the tool.

Having thus described my invention in preferred embodiments, I claim:

1. A controlled torque pneumatic impact wrench comprising in combination:
   a. a hollow case,
   b. air conduit means in the case,
   c. coupling means for coupling the conduit means to a source of air under pressure,
   d. throttle valve means in the conduit means for supplying air thereto on demand,
   e. combination reversing and air regulating valve means in the conduit means downstream from the throttle valve means,
   f. reversible air driven rotor means in the conduit means downstream from the combination reversing and air regulating valve means,
   g. rotary wrench means coupled to the rotor means and
   h. air exhaust port means communicating with the conduit means downstream from the rotor means,
   i. the combination reversing and air regulating control means comprising:
      1. a rotatably mounted hollow cylinder adjustable between two positions,
      2. two inlet ports in the cylinder registrable selectively with the infed side of the conduit means,
      3. rotor forward and reverse drive outlet ports in the cylinder registrable selectively with the outfeed side of the conduit means,
      4. one pair of ports comprising one inlet port and the outlet port communicating through the conduit means with the forward drive side of the reversible motor and the other pair of ports comprising the other inlet port and the outlet port communicating through the conduit means with the reverse drive side of the reversible motor,
      5. the said one pair being of predetermined but smaller capacity than the said other pair,
      6. and adjusting means on the cylinder for adjusting it alternately between forward and reverse drive conditions of the rotor.

2. The pneumatic impact wrench of claim 1 wherein the inlet port component of said one pair of ports is of restricted capacity determining the air flow through said one pair.