United States Patent

[11] 3,624,820

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[54] **REVERSIBLE IMPACT WRENCHES**
8 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **415/152,** 137/614.17, 173/93
[51] **Int. Cl.** **F01d 1/30,** E03b, B25d 15/00
[50] **Field of Search** 415/152, 503; 173/93; 137/614.17

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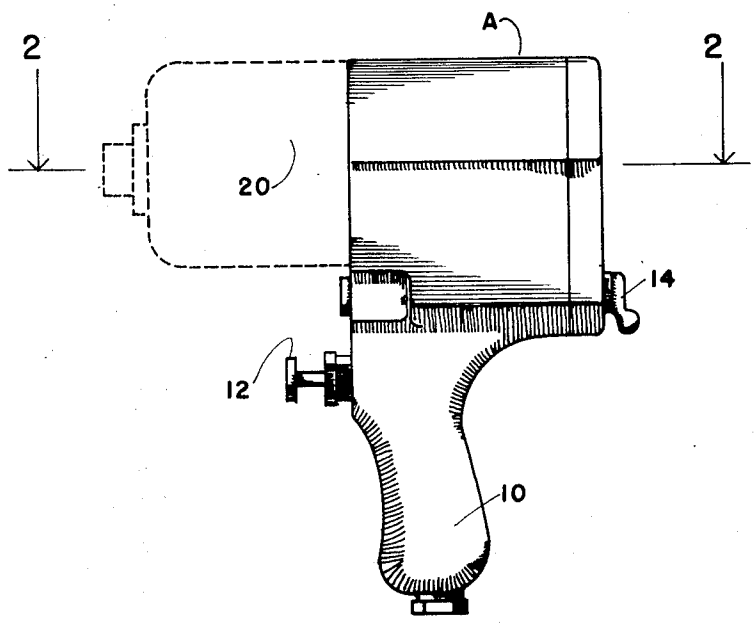
ABSTRACT: This invention relates to a reversible impact wrench in which the rotation director and exhaust are provided in a single continuous bore which may be machined after casting, thereby reducing the cost thereof, and further which provides a manually regulatable trigger valve which utilizes overlapping bores in a sleeve rotatably mounted in a fixed shell to adjust the amount of air delivered to the rotor.



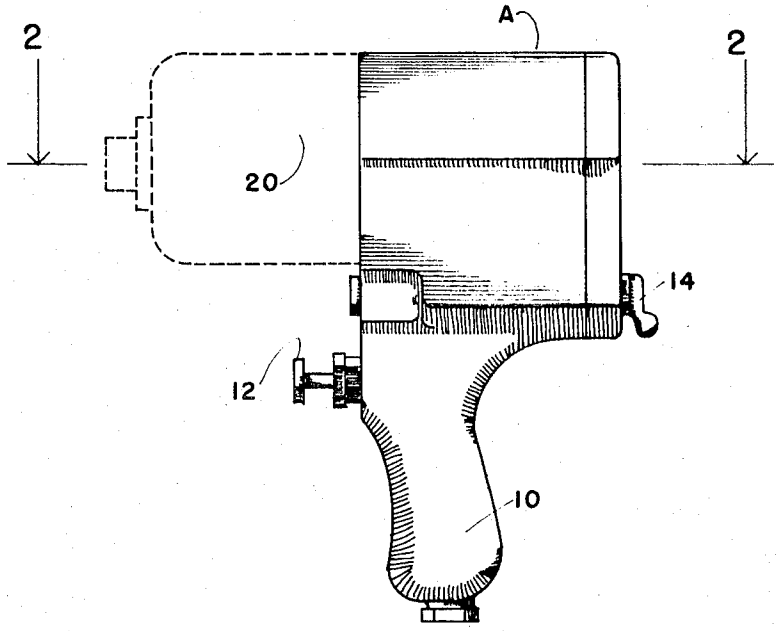


FIG. 1

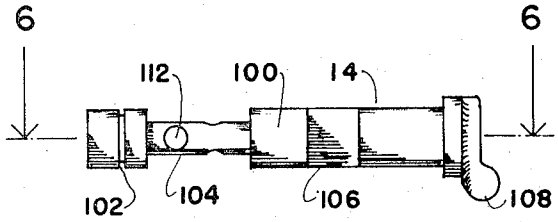


FIG. 5

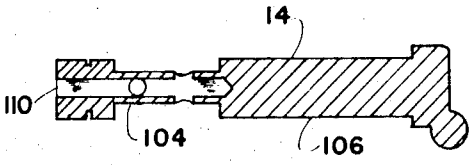


FIG. 7

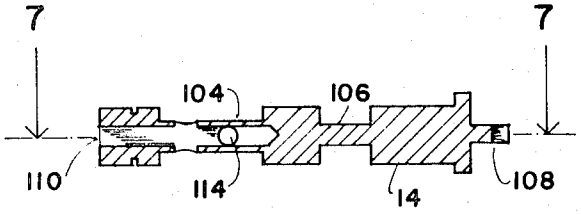


FIG. 6

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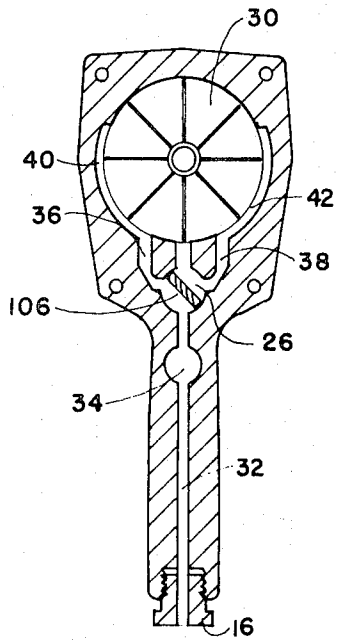

FIG. 4

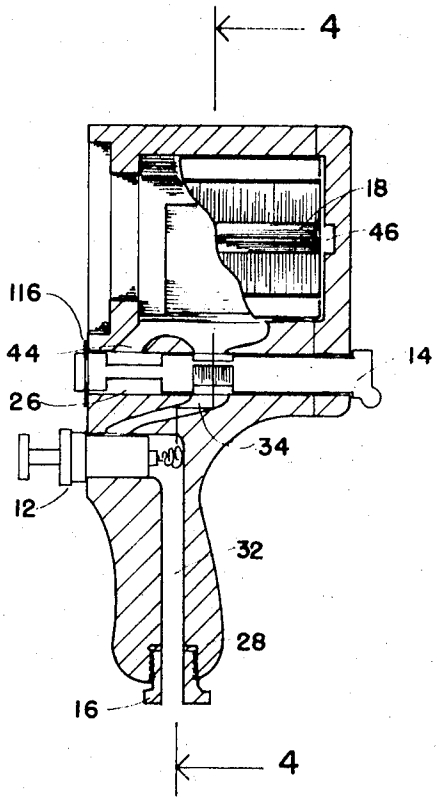

FIG. 3

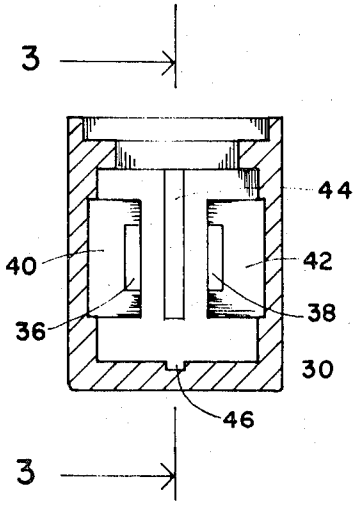

FIG. 2

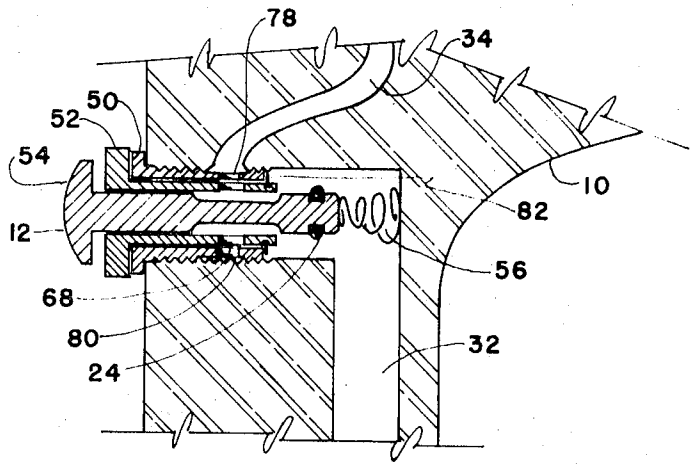
78
34
50
52
54
10
82
12
56
68
80
32
24

FIG. 8

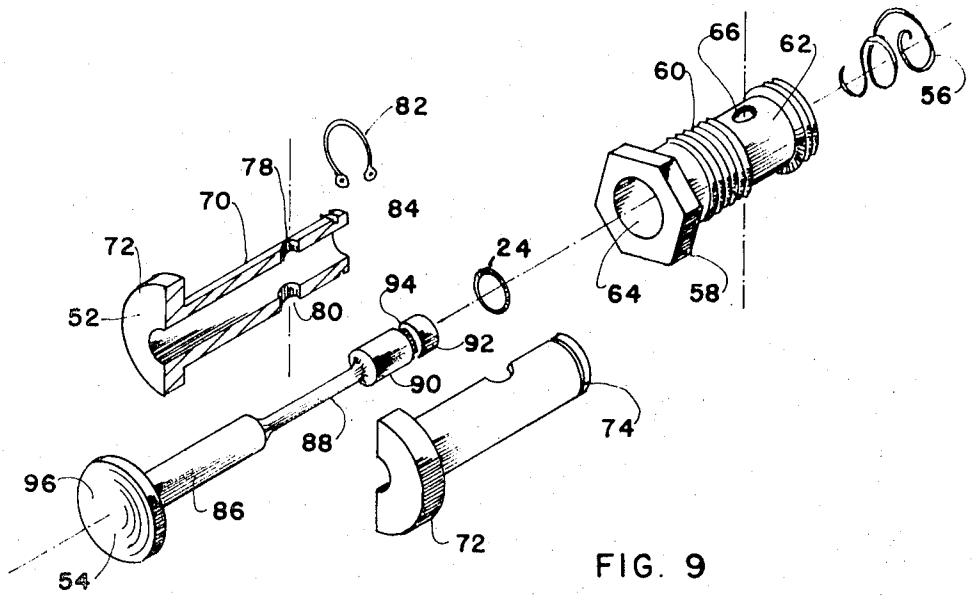
66
62
60
56
82
78
70
84
72
24
94
64
58
52
80
92
90
74
88
96
86
72
54

FIG. 9

REVERSIBLE IMPACT WRENCHES

It is the object of this invention to provide a reversible impact wrench which may be produced at less expense and in which the amount of air delivered to the driving means may be selectively regulated.

With the above and other objects in view, which will become immediately apparent upon reading the specifications, my invention resides in the unique and novel form, arrangement, construction and combination of parts shown in the drawings, explained in the specifications, and claimed in the claims.

IN THE DRAWINGS

FIG. 1 is a side-elevational view of a preferred embodiment of my invention;

FIG. 2 is a sectional view taken along lines 2—2 of FIG. 1 with the rotor removed for clarity;

FIG. 3 is a sectional view taken along lines 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along lines 4—4 of FIG. 3;

FIG. 5 is an enlarged view of the rotation director;

FIG. 6 is a sectional view taken along lines 6—6 of FIG. 5;

FIG. 7 is a sectional view taken along lines 7—7 of FIG. 6;

FIG. 8 is an enlarged fragmentary sectional view of the trigger valve mechanism taken along the same lines as FIG. 3; and

FIG. 9 is an exploded view of the trigger valve mechanism with the shell shown in section for clarity.

CONSTRUCTION

Referring now in more detail and by reference character to the drawings, A designates an impact wrench drive mechanism comprising a handle **10**, a trigger valve **12**, a rotation director **14**, an air attachment plug **16** and a vaned rotor **18** journaled in the handle **10** for powered rotation in either direction. The handle **10** is attached to a conventional drive mechanism and housing **20**, shown in phantom only, which conventionally accepts rotational power from the rotor **18** and transfers the power to a tool (not shown).

The handle **10** comprises a solid metallic block **22** which is provided with a first bore **24** threaded for accepting the trigger valve **12**, a second precision finished bore **26** which extends through the entire handle **10** for nested disposition of the rotation director **14**, a third threaded bore **28** threaded for accepting the hose attachment plug **16**, and an enlarged chamber **30** for permitting rotational movement of the rotor **18**. A first communication passageway **32** establishes fluid communication between the bore **28** and the bore **24**. A second communication passageway **34** establishes fluid communication between the bore **24** and the bore **26**. A pair of opposing passageways **36**, **38**, establish fluid communication between opposing sides of the bore **26** and complementary sides of the chamber **30** through recesses **40**, **42**, which are respectively located on opposing sides of the chamber **30** as shown. An exhaust passageway **44** establishes communication between the chamber **30** and the forward end of the bore **26**. Centrally located at the rear of the chamber **30** is a removable cover **46** in which one end of the rotor **18** is journaled; the other end of the rotor **18** (not shown) is conventionally coupled to the conventional drive mechanism (also not shown) in the housing **20**. Since my invention relates exclusively to the means and methods for producing a selectively reversible impact wrench, the other end of the rotor and the drive mechanism have not been shown and are not explained for the purposes of simplification and clarity.

The trigger valve **12** comprises a shell **50**, an inner sleeve **52**, a plunger **54**, and a biasing spring **56**. The shell **50** includes a hexagonal end **58**, a set of external threads **60**, an external annular recess **62**, a reamed axially extending inner bore **64** and a pair of diametrally opposed radial bores **66**, **68** which provide communication between the inner bore **64** and the annular recess **62**. The threads **60** are sized for mating with the threads of the bore **24**, the recess **62** is located at the juncture of the bore **24** and the passageway **34**, and the bores **66**, **68** are located in the approximate center of the recess **62**, all as best seen in FIGS. **8** and **9**.

The inner sleeve **52** (shown in section in FIG. **9** for purposes of clarity) comprises an elongated cylindrical portion **70** sized for snug-fitting disposition in the inner bore **62**, an annular flange **72** located at one end, an annular recess **74** located at the other end, an inner bore **76** which extends axially from front to back, and a pair of diametrally opposed radially extending bores **78**, **80**, which provide communication between the inner bore **76** and the external portion **70**, as shown. The recess **74** is sized for accepting a spring clip **82** which retains the sleeve **52** within the shell **50**, and the bores **78**, **80**, are located for axial registration with the bores **66**, **68**, when the sleeve **52** is disposed within the shell **50**, and an O-ring seat **84** is provided at the inner end of the inner bore **76**, all for purposes presently more fully to appear.

The plunger **54** includes a cylindrical stem **86** sized for snug-fitting disposition in the inner bore **76**, a centrally located neck **88**, an intermediate cylindrical element **90** which is diametrally larger than the neck **88** but diametrally smaller than the stem **86**, an end portion **92** which is the same diametral size as the stem **86**, and an O-ring seat **94** located between the element **90** and the end **92**. On the outer end the plunger is provided with an enlarged button **96**.

When the plunger **54** is installed in the inner bore **76**, and an O-ring **98** is disposed in the seat **94**, the radial projection of the O-ring **98** cooperates with the O-ring seat **84** in the sleeve **52** to provide a fluid seal and to hold the plunger **54** in the sleeve **52** as shown. The biasing spring **56** which is conventionally disposed between the back wall of the bore **24** normally biases the O-ring **98** against the seat **84** to keep the trigger valve **12** normally closed.

The rotation director **14** comprises an elongated shaft **100** which is diametrally sized for snug-fitting disposition within the bore **26** and which is provided with a spring-clip-receiving recess **102**, a centrally located neck **104**, a centrally located diametral segment **106**, and a head **108**. An elongated bore **110** extends axially from one end of the shaft **100** inwardly past the neck **104**, and a pair of orthogonal bores **112**, **114**, provide communication between the bore **110** and the periphery of the neck **104**. A spring clip **116** in the recess **102** retains the rotation director **14** in the bore **26**.

OPERATION

Air is provided to the back of the bore **26** through the attachment plug **16** and the passageway **32**. The trigger valve **12** is held in the normally closed position by the biasing spring **56**. Depending upon whether clockwise or counterclockwise rotation is desired the head **108** of the rotation director **14** is positioned to the right or to the left respectively. The drawings show the positioning for clockwise rotation with the head **108** to the right, and accordingly that operation will be explained first. With the head **108** to the right, air from the trigger valve **12** will be directed from the bore **26** through the passageway **34**, against the segment **106**, into the passageway **36** and the recess **40**, to the chamber **30** where it impels the rotor **18** in a clockwise (from the operator) direction.

That air is then directed around the rotor and into the bore **26** in the vicinity of the neck **104** via the passageway **44**. The air is exhausted out the front of the wrench A through the bores **112**, **114**, and out the bore **110**.

To reverse the direction of the rotor **18**, the head **108** is moved 90° to the left, which causes the segment **106** to divert the air into the passageway **38** and the recess **42** and thereafter into the chamber **30** against the other side of the vaned rotor **18**. In the reverse direction, air is exhausted in the identical manner through the passageway **44**, the bores **112**, **115**, and the bore **110**.

If desired, indicia means (not shown) or stops (not shown) may be provided on the cover **46** to identify optimum position of the head **108** for alternative operation.

The trigger valve **12** provides for air regulation in the air supplied to the chamber **30**. It will be noted that the position of the shell **50** remains fixed with respect to the handle **10**. It should be noted, however, that the sleeve **52** is rotatable with respect to the shell **50**. By rotating the sleeve **52** in the shell **50**, the degree of overlap of the bores **66, 68** in the shell **50** and the bores **78, 80** in the sleeve **52** may be selectively varied, and the amount of air which passes from the back of the bore **26** into the chamber **30** when the plunger **54** is urged inwardly may thus be regulated.

It should be understood that changes, alterations and modifications in the form, construction, arrangement, combination of various parts of my invention herein shown may be made and substituted without departing from the nature and principle of my invention.

Having thus described my invention what I claim and desire to secure by Letters Patent is recited in the specifications, shown in the drawings and claimed in the claims.

1. A reversible pneumatic impact wrench drive device comprising a housing integrally including a rotor chamber and first and second bores in said housing, a trigger valve mounted in said first bore, rotation directing means rotatably mounted in the second bore, a vaned rotor journaled in the chamber, coupling means for supplying air under pressure to the housing, a first passageway between the coupling means and the first bore, a second passageway between the first bore and the second bore, third and fourth passageways in said housing between the second bore and opposing sides of the rotor chamber, a fifth passageway in said housing between the rotor chamber and the second bore, and exhaust means for taking air from the fifth passageway and directing said air out of the housing, said trigger valve being normally closed, said rotation directing means integrally including means for selectively directing air from the second passageway to the third passageway and from the second passageway to the fourth passageway, said rotation directing means also integrally including means for pneumatically isolating the second passageway from the fifth passageway.

2. The device of claim **1** wherein the second bore is a uniform bore which extends completely through the housing, and the rotation directing means comprises a cylindrical member which extends completely through said bore in snug-fitting relationship with respect thereto.

3. The device of claim **2** in which the third and fourth passageways are on opposing sides of the second bore and the cylindrical member, and in which two segments have been cut away from opposing sides of the cylindrical member at the third and fourth passageways to define a diametral baffle which selectively diverts air from the second passageway to either the third or the fourth passageway.

4. The device of claim **3** wherein the fifth passageway is axially displaced from the second, third and fourth passageways in the second bore, and the cylindrical member is provided with a diametrally reduced neck in the vicinity of the fifth passageway for collection of exhaust air in the second bore about the neck.

5. The device of claim **4** wherein the cylindrical member also includes an axially extending escape passageway which extends from one end of the member to the neck for exhausting the air collected about the neck.

6. The device of claim **1** wherein the trigger valve integrally includes means for selectively varying the amount of air passed from the first passageway to the second passageway.

7. The device of claim **1** wherein the trigger valve includes a shell secured to the housing in the first bore, a cylindrical sleeve rotatably mounted in the shell, a plunger slidably mounted in the sleeve and spring biased to the normally closed position, a first radially extending port located in the shell at the junction between the second passageway and the first bore, and a second radially extending port located in the sleeve for selective-overlapping engagement with the first port whereby to regulate selectively the size of the opening between the first bore and the second passageway.

8. The device of claim **7** wherein a diametrally reduced neck is provided in the shell in the vicinity of the first port whereby to provide better air movement from the overlapped first and second ports to the second passageway.

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