United States Patent [19]

States

[11] **3,752,278**

[45] **Aug. 14, 1973**

[54] **IMPROVED POWER OPERATED WRENCH OR SCREWDRIVER**

[75] Inventor: **Ronald Frederick States,** London England

[73] Assignee: **Desoutter Brothers Limited,** London, England

[22] Filed: **Feb. 22, 1971**

[21] Appl. No.: **117,655**

[30] **Foreign Application Priority Data**

Dec. 22, 1970 Great Britain 60,815/70

[52] **U.S. Cl.** ..... **192/56 R,** 64/29, 81/52.4, 192/0.034, 192/150, 173/12

[51] **Int. Cl.** **F16d 43/20**

[58] **Field of Search** ..... 192/0.034, 56 R, 192/150; 64/29; 144/32; 81/52.4; 173/12

[56] **References Cited**

UNITED STATES PATENTS

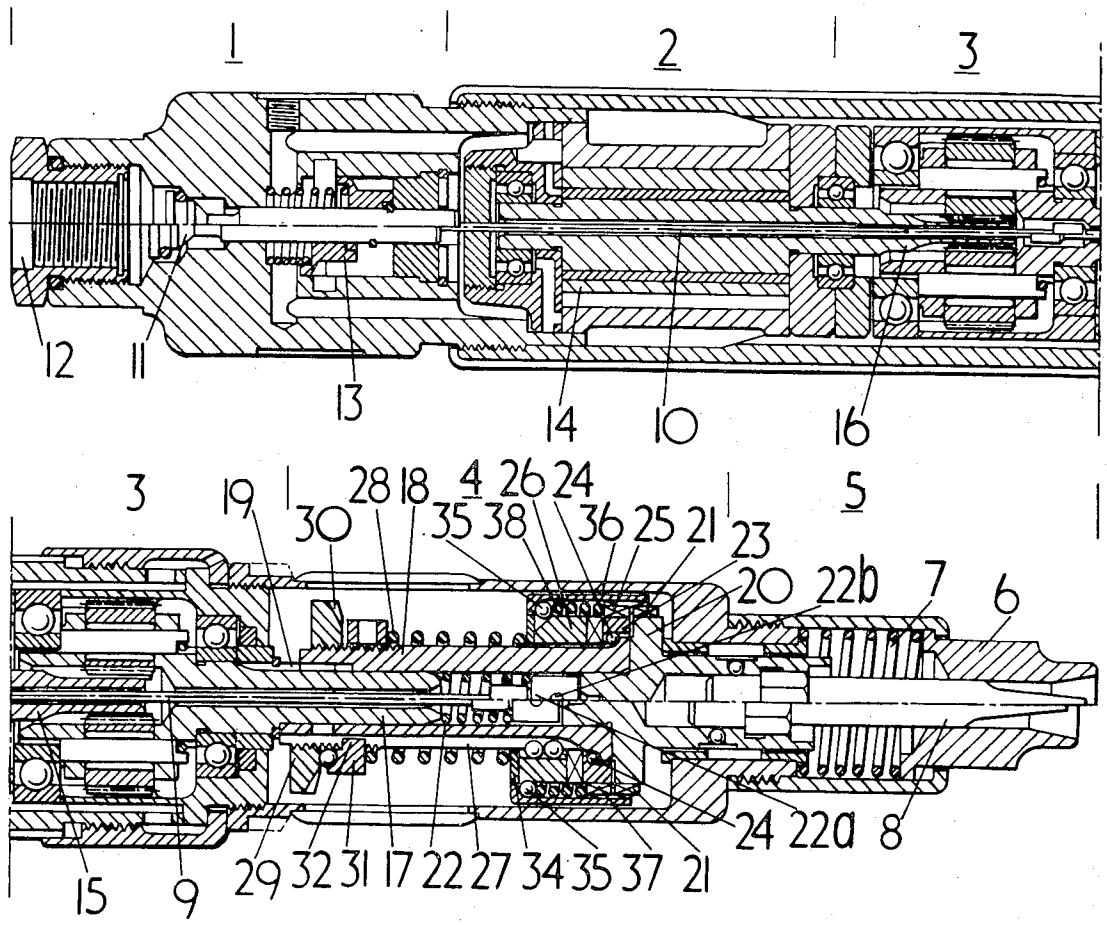
2,884,103	4/1959	Connell	192/56 R
2,881,888	4/1959	Amtsberg	192/56 R
3,091,316	5/1963	Huffman	192/150
3,187,860	6/1965	Simmons	192/150 X
3,237,742	3/1966	Ulbing	192/150
3,288,258	11/1966	Taylor	192/150
3,289,715	12/1966	De Groff et al.	192/150

Primary Examiner—Allan D. Herrmann
Attorney—Irving M. Weiner

[57] **ABSTRACT**

A power operated wrench or screwdriver having two dog clutches in series for the transmission of the drive in which one is a torque sensitive dog clutch having ramped interengaging driving surfaces adapted to be induced to become displaced against the action of a spring when the torque applied by the tool exceeds a predetermined value while the other one is a non-torque sensitive clutch which is adapted to become disengaged by displacement of the torque sensitive clutch.

2 Claims, 4 Drawing Figures



Patented Aug. 14, 1973 **3,752,278**

3 Sheets-Sheet 1

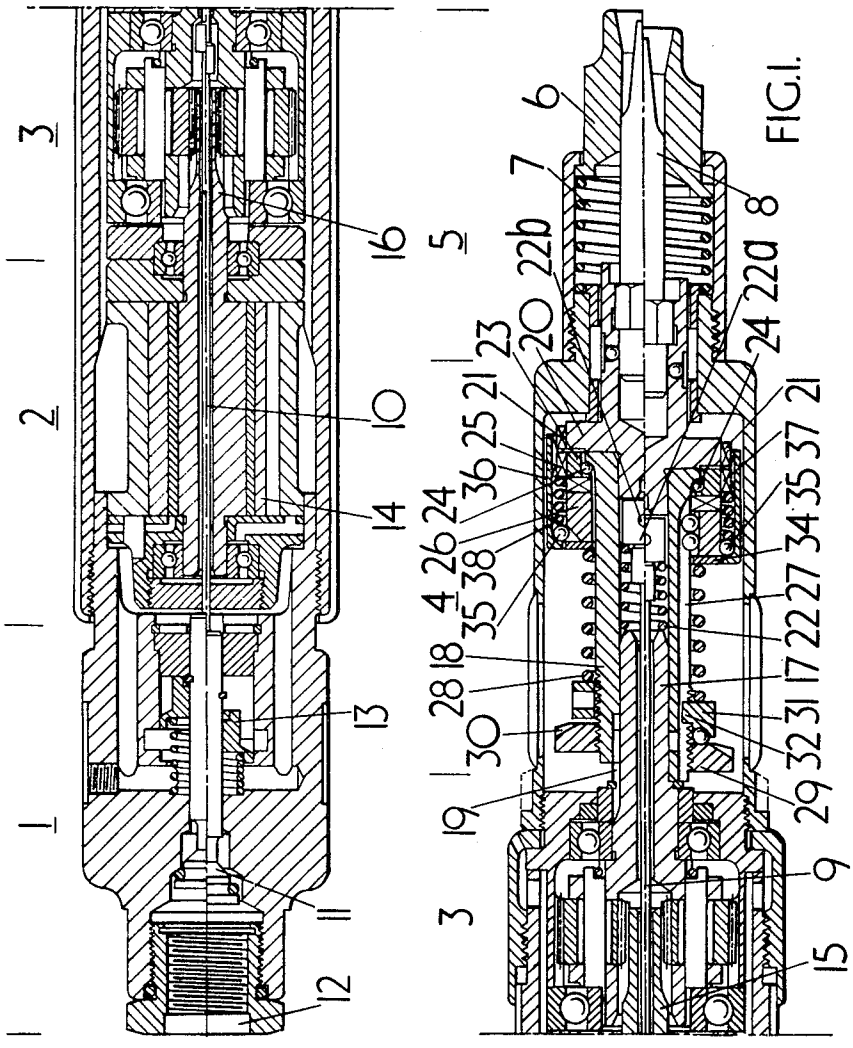


FIG.1.

INVENTOR
RONALD FREDERICK STATES
BY
ATTORNEY

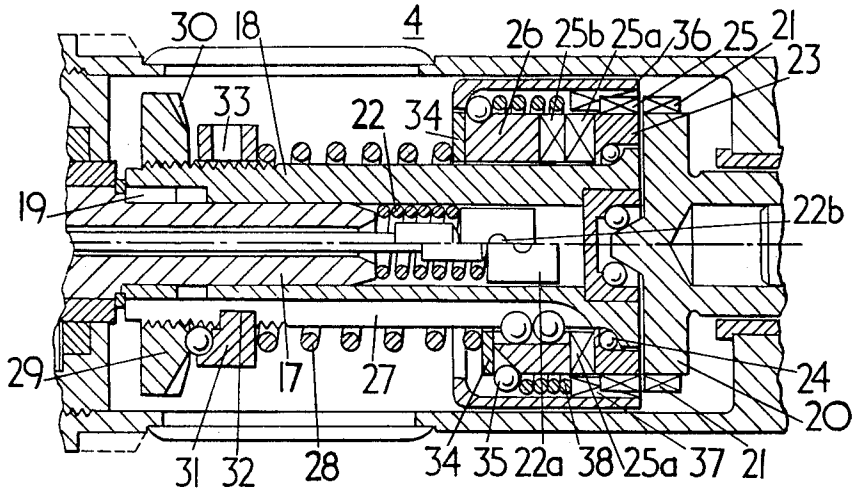


FIG. 2.

INVENTOR
RONALD FREDERICK STATES
BY Irving M. Weiner
ATTORNEY

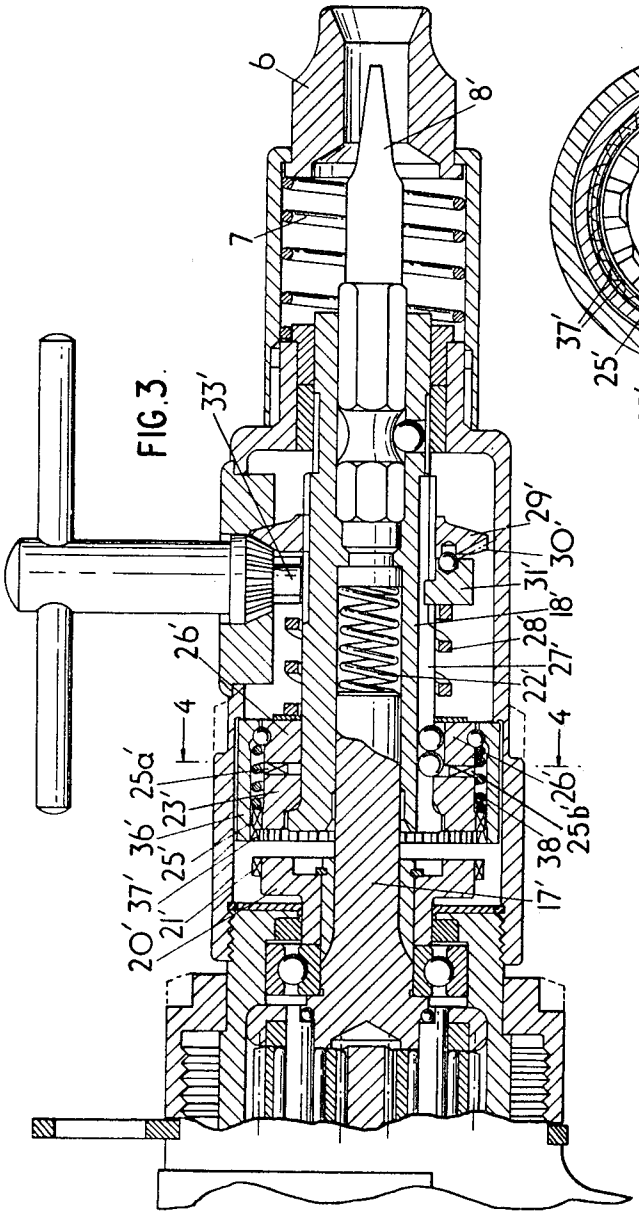


FIG. 3.

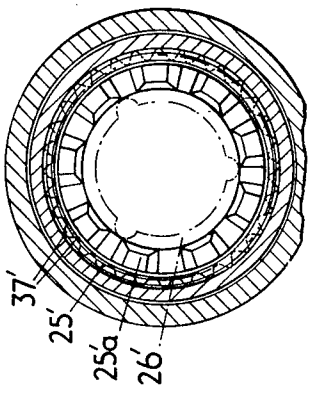


FIG. 4.

INVENTOR
RONALD FREDERICK STATES
BY Irving M. Weiner
ATTORNEY

IMPROVED POWER OPERATED WRENCH OR SCREWDRIVER

The invention relates to a power operated wrench or screwdriver, and in particular to a hand held wrench or screwdriver having a pneumatic motor, a reduction gear driven by the motor, an output shaft for the reduction gear, a head which supports a tool for engaging a fastener which is to be rotated, and a clutch which is driven by the output shaft of the gear and which is adapted to drive the tool.

The clutch is formed of two portions, a torque-sensitive portion and a non-torque-sensitive portion, the one is driven by the other when a torque delivered by a tool does not exceed a predetermined value.

The torque-sensitive portion has two main members, a driving member and a driven member. These members are mounted upon a tubular member co-axially with the output shaft of the gear, one of which is splined thereto and is movable longitudinally of the tubular member against the action of a helical spring positioned co-axially of the tubular member. The driving member and driven member are provided with inter-engaging members located between them which causes a relative longitudinal movement of the members when a torque delivered by the tool exceeds the predetermined value. This relative longitudinal movement occurs without disengagement of the members.

The non-torque-sensitive clutch portion is mounted coaxially of the output shaft of the gear. Circumferentially spaced dogs located on the non-torque-sensitive clutch portion engage circumferentially spaced dogs on one of the two members of the torque-sensitive clutch portion when the torque delivered by the tool is less than a predetermined value. When the torque transmitted by the tool exceeds this predetermined value, the spaced dogs on the non-torque-sensitive clutch portion disengage from the spaced dogs on the torque-sensitive clutch portion and ride over one another as the two members of the torque sensitive clutch portion move longitudinally relative to one another.

The accompanying drawings show, by way of example only, two embodiments of the invention in which,

FIG. 1 is a longitudinal section of a first embodiment,

FIG. 2 is a part section of a portion 4 of FIG. 1 where the drive has been interrupted,

FIG. 3 is a part longitudinal section of the second embodiment, while,

FIG. 4 is a cross-section on the line 4—4 of FIG. 3.

Pneumatic hand held screwdriver shown in FIGS. 1 and 2 comprises a control valve part 1, a motor part 2, a reduction gear portion 3, a clutch part 4, and a head part 5, the arrangement of the component parts shown in the parts 1–3 and 5 are by way of example only and may be modified as is desired seeing that the invention resides principally in the arrangement of the component parts of the clutch part 4.

When the tool is applied to a screw, the finder 6 is pushed back against the action of the spring 7 and the screwdriver 8 is engaged in the slot in the screw and upon further pressure the rods 9 and 10 move towards the valve part 1, an initial distance and open the valve 11. Air is thus permitted to flow from the connector 12 via the valve 13 to the motor 14 in the portion 2. The action of the valve 13 is described thereinafter.

The section of FIG. 1 is divided longitudinally so that the upper half represents the position of the screwdriver and clutch part 4 in the rest position, while the lower half represents these elements while the screwdriver is being driven by way of the clutch part 4. Part FIG. 2 represents the clutch 4 after interruption of the drive when a predetermined value of torque has been obtained.

The drive from the motor 14 passes to the two stage reduction gear 15 by way of the hollow shaft 16 and emerges by way of the hollow shaft 17 in the clutch part 4.

The clutch comprises a torque-sensitive portion and a non-torque-sensitive portion and comprises a tubular member 18 which is splined upon the shaft 17 by splines 19 for longitudinal movement to the left of FIG. 1, by reason of pressure upon the screwdriver 8, as shown in the lower part of the figure. This movement is caused by the movement of a first non-torque sensitive clutch portion member 20, part of which is formed as a holder for the screwdriver and part of which is formed at its periphery into closely spaced dogs 21. The helical spring 22 urges the clutch member 20 in the direction of the head of the tool.

FIG. 2 shows two positions of a torque sensitive clutch portion. The upper half of the drawing is when the torque sensitive clutch portion is displaced. The lower half of the drawing shows a position when the torque sensitive clutch portion is fully engaged, but still rotating owing to residual inertia. This rotation does not allow union between members 21 and 36, owing to the relative rotational movement therebetween

A second non-torque sensitive clutch portion member 23 is supported for free rotation by the balls 24 on the tubular member 18, and is provided with closely spaced dogs 25 around the periphery, which match the dogs 21 on the member 20. The clutch member 23 is also provided on the side with dogs 25*a* having ramped load taking surfaces which constitutes the driven member of a torque sensitive dog clutch portion of the kind previously referred to. The driving ramped dogs 25*b* of the torque sensitive clutch portion are formed upon a ring like member 26 splined upon the tubular member 18 for longitudinal movement by the spline 27 and against the action of the spring 28.

The clutch member 26 is connected to the abutment member 22*a* by a radial pin 22*b* passing through bores in both members and free to move longitudinally in slots provided in the wall of the tubular member 18. Consequently, the clutch member 26 and the abutment member 22*a* move together when the clutch member 26 moves under the action of torque and the abutment member 22*a* is moved to the left and move the rods 9 and 10 a second step under the action of the torque sensitive clutch.

One end of the tubular member 18 is provided with a screw thread upon which is mounted the abutment ring 29 having a bevel gear 30 thereon. Adjacent the abutment ring 29 is a further ring like member 31 which is slidable longitudinally over the thread on the tubular member 18, and which is prevented from rotation by an inwardly directed tooth 32 which enters the spline 27. The ring like member 31′ is provided with a bore 33′ into which may be inserted a key having a bevel gear thereon, as shown in FIG. 3, which engages the bevel gear 30′ on the abutment ring 29′ and by the latter may be rotated on the tubular member 18′ to adjust the pressure provided by the spring 28′.

Sandwiched between the spring **28** and the ring like member **26** is a thrust washer **34** which forms one side of a groove containing the balls **35** which support a hollow cylindrical third non-torque sensitive portion member **36** having long dogs **37**, which are capable of bridging between the periphical dogs on the members **20** and **23**, as shown in FIG. **1**, in both situations. The third clutch member **36** is urged to engage by the light spring **38**. When the torque sensitive clutch portion members move relative to one another under the action of the torque provided by the tool, when it has reached a predetermined value, as shown in the upper part of FIG. **2**, the dogs on the third clutch member **36** become disengaged from the dogs **21** and the drive to the screwdriver is interrupted.

Because of the interruption of the drive torque is no longer applied to the torque sensitive clutch portion and the members thereof immediately become fully engaged again, as shown in the lower part of FIG. **2**. However, due to the close spacing of the dogs on the non-torque sensitive clutch portion they are unable to reengage and ride the one set over the other as long as the motor is kept running. Owing to the movement of the rods **9** and **10** by the connecting pin **22b**, the valve **13** is moved to the left to the position shown in the lower half of FIG. **1**, where the supply of air is interrupted and the motor stops. The valve **13** being of the kind which is held closed by back pressure. The motor cannot start again until the supply of air to the tool is interrupted for long enough for the valve **13** to open.

As soon as the motor stops the dogs of the third and first clutch members **36** and **20** become engaged again under the action of the spring **38**, the edges of the dogs being so shaped as to make engagement easy.

It can be realised from the above description that in the absence of the valve **13** and the means for closing it after the disengagement of the non-torque sensitive clutch, the drive to the screwdriver remains interrupted after the predetermined torque has been reached. It being merely necessary for the operator to interrupt the air to the tool to stop the motor and thus allow the non-torque sensitive clutch portion to engage to prepare the tool for use upon a further screw.

A tool without such a valve **13** is shown in FIGS. **3** and **4** which is of the kind having a pistol grip, and only the front end of the tool is shown. The action of the torque sensitive clutch portion and the non-torque sensitive clutch portion are similar to that shown in the embodiment of FIGS. **1** and **2**, but differ in that the clutch portions are the opposite way round. The member **20'** is the driving member of the non-torque sensitive clutch portion and is driven by splines on the driving shaft **17'**. The torque sensitive clutch portion is mounted for longitudinal movement in splines **27'** and is urged to the left of the figure to engage the member **20'** by the action of the spring **28'**. When the motor is started the dogs **21'** on the outer periphery of the member **20'** enter the dogs **37'** in the inner periphery of cylindrical third clutch member **36'**, which is driven thereby and in consequence drives the second clutch member **23'** by way of the dogs **25'** therein, and by way of the torque sensitive dogs **25'***a* and **25'***b* and drives the clutch member **26'** splined to the tubular member **18'** by way of the balls in the splines thereof. Thus the screwdriver **8'** is driven. When the torque rises to the predetermined value, clutch member **26'** moves away from clutch member **23'**, taking with it cylindrical third clutch member **36'**, and disengaging dogs **37'** from driving dogs **21'**. These cannot be united whilst motor and shaft **17'** are rotating. When the pressure on the screwdriver is released the clutch member **36'** is withdrawn under the action of spring **22'** from the clutch member **20** and assumes the position as shown in FIG. **3**. Upon releasing the push-button of the tool the motor stops and the clutch members are ready then for reengagement for the subsequent operation by pressure upon the screwdriver.

The section of FIG. **4** clearly shows the shape of the ramp dogs of the torque sensitive clutch and their relationship with one another, both clutch members having dogs of the same shape. It is to be understood that the above description is by way of example only, and that details for carrying the invention into effect may be varied without departing from the scope of the invention.

I claim

1. A power operated wrench or screwdriver comprising a motor, a reduction gear driven by the motor, an output shaft for the reduction gear, a head providing support for a tool for engaging a fastener to be rotated, and a clutch driven by the output shaft of the gear and having means for driving said tool, the clutch being formed in two portions, a torque-sensitive portion and a non-torque-sensitive portion, the one being driven by the other when the torque delivered by the tool does not exceed a predetermined value, the torque-sensitive portion comprising two main members, a driving member and a driven member, mounted upon a tubular member coaxial with the output shaft of the gear, and one of which is splined thereto and is movable longitudinally of the tubular member against the action of a first spring positioned upon tubular member, said driving member and driven member of the torque-sensitive portion being provided with inter-engaging members therebetween which cause longitudinal movement of said splined member thereof when the torque delivered by the tool exceeds said predetermined value without disengagement of the members, the non-torque-sensitive portion comprising two main co-axial members, a driven member associated with the tool and having circumferentially spaced dogs around the outer periphery thereof, and a driving member comprising a sleeve around the torque-sensitive portion and having circumferentially spaced dogs around the inner periphery thereof drivingly engageable with the dogs on the driven member of the non-torque-sensitive portion, and which are of such length as to be permanently engaged with circumferentially spaced dogs around the periphery of one of the main members of the torque-sensitive portion, the sleeve being movable longitudinally against the action of a second spring to disengage the drive of the second portion of the clutch, said sleeve being coupled to the longitudinally movable part of the torque-sensitive portion, so that, when the torque transmitted by the tool rises to said predetermined value, the drive, by way of the non-torque-sensitive portion, is interrupted by said longitudinal movement of the sleeve, and the dogs on the latter, due to the action of the second spring and their relative rotational speed, rotate in contact with the dogs on the driven member of the non-torque-sensitive portion without engagement while the motor is operative.

2. A power operated wrench or screwdriver as claimed in claim **1**, in which the force exerted by said first spring is adjustable to vary the maximum predetermined value of torque transmitted by the wrench or screwdriver.

* * * * *