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ROTARY IMPACT TOOL

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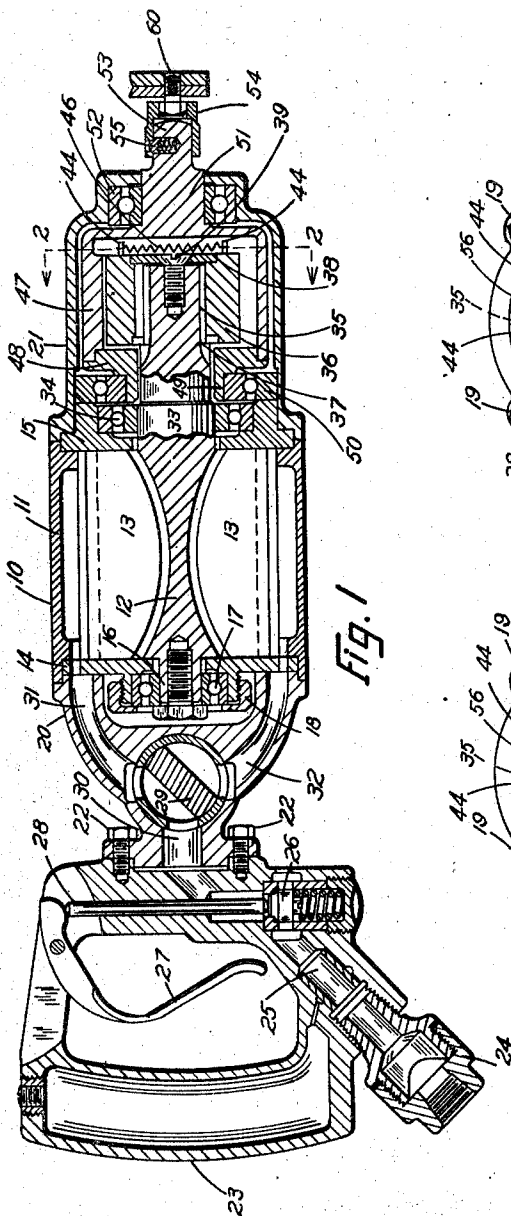


Fig. 1

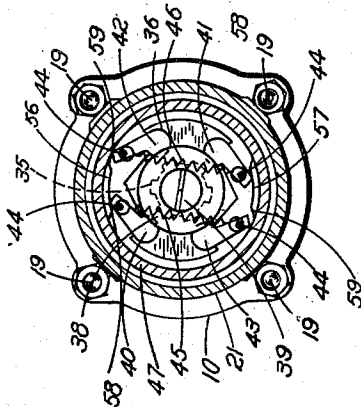


Fig. 3

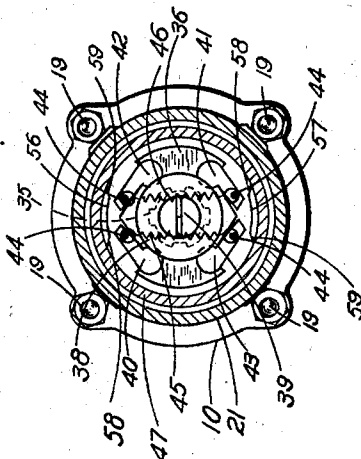


Fig. 2

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ROTARY IMPACT TOOL

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2 Claims. (Cl. 192—30.5)

This invention relates broadly to rotary tools, but more particularly to fluid actuated reversible rotary tools of the impact type.

One object of this invention is to produce a rotary tool or motor adapted to engage the work for normally rotating the same, the tool being provided with means automatically operable for imparting a rapid succession of rotative impacts to the work.

Another object of the invention is to produce an improved rotary tool especially fitted for setting or removing nuts, bolts or the like, and constituting a simple assembly which is strong, durable and efficient.

Other objects and advantages more or less ancillary to the foregoing and the manner in which the various objects are attained, reside in the specific construction and aggroupment of the elements peculiar to this structure, as will become apparent from a more complete examination of this specification, in the claims of which there are assembled certain specific combination of parts and specific constructions indicative of the scope and spirit of the invention.

In the drawing:

Fig. 1 is a longitudinal sectional view of a rotary tool embodying the invention.

Figs. 2 and 3 are cross sectional views taken in a plane indicated by line 2—2 in Fig. 1 and illustrating parts in different positions.

Referring to the drawing in which like symbols designate corresponding parts throughout the several views, 10 represents generally a reversible rotary air motor of any suitable design. For purpose of illustration the motor is shown to include a cylinder housing 11 having a rotor 12 rotatable therein and carrying the usual blades 13 on which the compressed air or motive fluid may be admitted for actuating the rotor in either direction. Keeping the rotor 12 in position against longitudinal movement, there are two stationary bearing plates 14 and 15 rigidly clamped to the cylinder housing 11. Extending rearwardly from the rotor or toward the left in Fig. 1, there is a shafted end 16 journaled within a ball bearing 17, which bearing is held in position within the plate 14 by a retaining nut 18.

The cylinder housing 11 is actually clamped, by bolts 19, between two housings, one a valve housing 20 and the other a front housing 21. Secured to the valve housing 20 by cap screws 22, there is a back head or handle 23 equipped with a motive fluid connection 24. From the connection 24, the motive fluid may be admitted into

the valve housing 20 through a port 25, which is controlled by a throttle valve 26 operable by a trigger 27 and a rod 28.

Rotatably mounted within the valve housing 20, there is a four way valve 29 having pressure fluid admitted thereto from the port 25 through a port 30. This valve is of a standard type operable for controlling the admission of the pressure fluid into the cylinder housing 11 through either a port 31 or 32 for actuating the motor in either direction.

It is to be understood that the motor described above for purpose of illustration, may be of any suitable type, and since that motor does not form a part of this invention, no further description is thought necessary other than pointing out that the invention hereinafter described is shown to be used with a reversible motor, but could just as well be adapted to a non-reversible motor.

Referring now more particularly to the invention which is generally contained within the front housing 21, 33 represents a drive shaft extending forwardly from the rotor 12 and shown in the drawing to be an integral part of the rotor. In practice, questions of design and arrangement of parts may require the shaft 33 to be independent of the rotor, and be coupled therewith by any suitable means such as gear, splines or the like. In the present construction, the driving shaft 33 is journaled within a ball bearing 34 mounted within the bearing plate 15. The front end portion of the shaft 33 is formed with straight longitudinally disposed splines 35, interlocked with similar splines formed internally of a driving head 36, which head is thereby carried by the shaft 33 for rotation therewith. To maintain the head 36 against longitudinal movement, the shaft 33 is formed with an annular shoulder or step 37 engaging one side of the head while the other side thereof is engaged by a washer 38 secured to the shaft 33 by a screw 39. The driving head 36 is accurately machined to pivotally receive two sets of pawls or weights, one set comprising two pawls 40 and 41 diametrically opposed to each other, and the other set comprising two pawls 42 and 43 also diametrically opposed to each other. These pawls extend longitudinally of the head 36 in end engagement with the shoulder 37 formed on the shaft 33 and the washer 38, and are pivotally mounted within the head as clearly shown in Fig. 3. Between the pawls 40 and 42 and the pawls 41 and 43, the head is cut away to make room for the pawls when in a retracted position as shown in Fig. 2, and enables them when in this position to

remain within an imaginary circle of a diameter equal to the normal diameter of the head 36. Extending from each pawl outside of the washer 38, there is a short stem or pin 44. The pawl 40 is connected to the pawl 43 by a tension spring 45 having its ends attached to the respective pin of the pawls, while the pawl 41 is similarly connected to the pawl 42 by a tension spring 46.

Rotatable within the front housing 21, there is a cup shaped work engaging member or driven head 47 within which is rotatably mounted the driving head 36. This driven head has its rear end supported by a plate 48 which is formed with a stem 49 journaled within a ball bearing 50. Toward the front, the driven head 47 is reduced to form a stem 51 journaled within a ball bearing 52, and a shank end 53 of polygonal shape protruding outside of the front housing to receive a work engaging socket 54 detachably secured thereon by a spring pressed plunger 55.

Inside of the cup shaped driven head 47, there are formed two diametrically opposed lugs or clutch jaws 56 and 57 which extend longitudinally of the head a distance equal to the width of the pawls carried by the driving head. These lugs are preferably made an integral part of the driven head, and each has two inclined side walls or striking faces 58 and 59 with which the pawls are capable of engagement.

In the operation of the device, let it be assumed that the throttle valve 26 is open and that motive fluid is admitted into the cylinder housing 11 through the valve 29 and the port 31 for imparting rotation to the rotor in a counterclockwise direction in Figs. 2 and 3, and that the work to be driven by the motor is a bolt 60 operatively engaged by the socket 54. In this instance, it will be understood that the rotation of the rotor is transmitted to the driving head 36 through the shaft 33. During the rotation of the head 36, the tension of the springs 45 and 46 will be overcome by the centrifugal force applied to the four pawls carried by the head 36, thus causing the pawls to move into engagement with the lugs 56 and 57. When the rotor is rotating in a counterclockwise direction in Figs. 2 and 3, the pawls 42 and 43 will engage the side walls 59 of the lugs 56 and 57, while the pawls 40 and 41 will simply ride the lugs as shown in Fig. 3. When the driven head 47 is not subjected to a torque resistance, that is, when the bolt 60 is free to rotate, the pawls 42 and 43 will remain in engagement with the lugs 56 and 57 respectively, thereby transmitting rotary motion to the driven head 47 and in turn to the work or bolt 60.

After the bolt is initially set, it tends to resist further rotation of the driven head 47, increasing thereby the torque resistance of the head. This increased resistance will gradually retard the speed of the motor, thereby reducing the centrifugal force applied to the pawls and causing the pawls to assume the position shown in Fig. 2, that is out of engagement with the lugs 56 and 57 due to the action of the springs 45 and 46. The contact angle between the pawls and the lugs 56 and 57 is calculated to be somewhat smaller than the corresponding friction angle, allowing thereby a comparatively free pivotal movement of the pawls due to the action of the springs 56 and 57, and preventing the contact angle to cause the disengagement or camming movement of the pawls away from the lugs during normal operation.

Subsequent to the disengagement of the pawls

42 and 43 with the lugs 56 and 57, the rotor now disengaged from the driven head 47 will again regain its maximum speed, imparting thereby a centrifugal force to the pawls, which force will overcome the effort of the springs 45 and 46 and cause the sudden reengagement of the pawls 42 and 43 with the striking faces 59 of the lugs 56 and 57, thereby imparting a rotative impact to the driven head 47 and consequently to the work or bolt 60. This sudden reengagement of the pawls with the lugs of the driven head 47 will again retard the speed of the rotor, reducing thereby the centrifugal force imparted to the pawls and causing their disengagement due to the action of the springs 45 and 46 in the manner above described.

From the foregoing description, it will be understood that the pawls 41, 42, 43, and 44 together with the lugs 56 and 57 form a clutch mechanism wherein the pawls constitute driving clutch means or jaws centrifugally movable into operative engagement with the lugs or driven jaws 56 and 57, and capable of release to enable relative rotation between the heads 36 and 47. When the rotor reaches its maximum speed, the driving jaws 42 and 43 are automatically thrown into engagement with the driven head or work engaging member 47 for imparting a continuous rotation to the work until the rotation is materially resisted by the work. In this instance, the driving jaws will again automatically be disengaged from the work engaging member, allowing the rotor to again regain its maximum speed for causing the reengagement of the jaws, and consequently of the rotor with the work. Through this engagement and disengagement of the jaws, the work engaging member is subjected to a rapid succession of rotative impacts which will continue as long as the throttle valve 26 is left open.

When the speed of the motor is retarded by an increased torque resistance applied thereto which will subsequently enable the driving jaws to move out of engagement, the motive fluid admitted into the motor will increase in pressure, consequently building up energy in the motor which will be released upon the disengagement of the jaws for imparting rotation to the rotor. This increased energy will cause the rotor to immediately regain its maximum speed for effecting the reengagement of the jaws and the consequential transmission of a rotative impact to the driven head 47 of an intensity greater than that resulting from the normal rotation of the rotor.

When it is desired to drive the work in the other direction, the valve 29 may be positioned for admitting motive fluid into the cylinder 11 through the port 32. In this instance the driving head 36 will rotate in a clockwise direction in Figs. 2 and 3 causing the pawls or jaws 40 and 41 to strike the side wall 58 of the lugs or jaws 56 and 57 for driving the work engaging member in the manner as above described.

Although the foregoing description is necessarily of a detailed character, in order to completely set forth the invention, it is to be understood that the specific terminology is not intended to be restrictive or confining and it is to be further understood that various rearrangements of parts and modifications of structural detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

I claim:

1. In a device of the character described, the combination of a driving head having rotation

imparted thereto in either direction, a rotatable driven head, clutch jaws stationary on said driven head, two sets of driving jaws carried by said driving head for rotation therewith and pivotal movement relative thereto on axes parallel to the center axis thereof, said driving jaws being centrifugally pivoted into operative engagement with said clutch jaws one set during rotation of said driving head in one direction and the other set during rotation of said driving head in the other direction, said driving jaws being capable of release to enable relative rotation between said clutch and driving jaws, and means automatically effecting said release upon a predetermined reduction in the rotary speed of said driving jaws.

2. In a device of the character described, the combination of a driving head having rotation imparted thereto in either direction, a rotatable

5 driven head, clutch means between said heads including weights pivotally carried by said driving head for rotation therewith and pivotal movement relative thereto on axes parallel to the center axis thereof, and a stationary lug on said driven head extending longitudinally thereof, said weights being moved into engagement with said lug under the action of the centrifugal force resulting from the rotation of said driving head and disposed in a manner enabling during normal conditions of operation transmission of rotation between said heads and under abnormal conditions of operation transmission of rotary impacts to said driven head irrespective of the direction of rotation of said driving head.

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