Nov. 5, 1940. C. E. FITCH 2,220,711

IMPACT TOOL

Filed Jan. 7, 1936

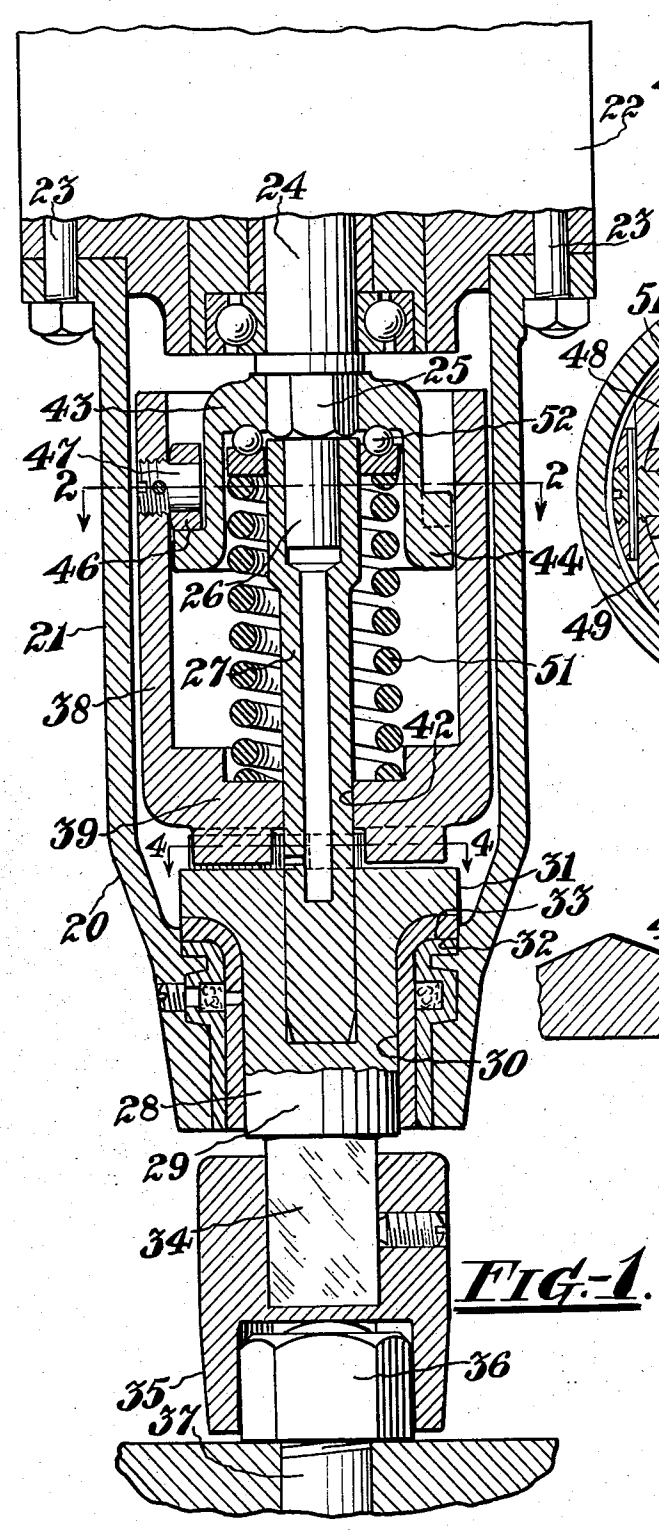


FIG.-1.

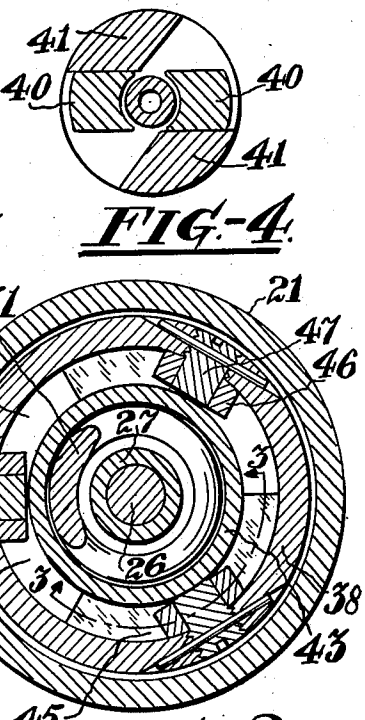


FIG.-2.

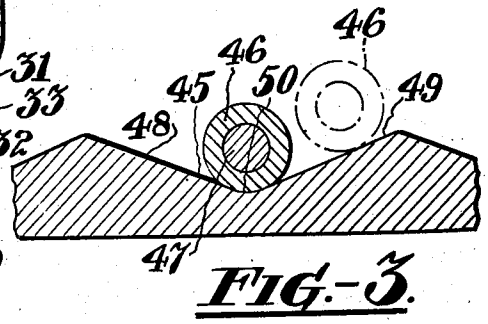


FIG.-3.

FIG.-4.

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IMPACT TOOL

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4 Claims. (Cl. 192—30.5)

This invention relates to impact tools, and more particularly to impact tools of the rotary type.

One object of the invention is to assure a driving force commensurate with the immediate requirements of the work.

Another object is to subject the work to a series of impacts when the torsional force of the tool proves ineffective for performing the work.

Another object is to simplify the construction of devices of this character and to assure a rugged tool comprising only a minimum number of parts which will be well able to withstand the rough usage to which tools of this character are usually subjected.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawing accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is an elevation, in section, of a tool constructed in accordance with the practice of the invention,

Figure 2 is a transverse view taken through Figure 1 on the line 2—2,

Figure 3 is a sectional elevation taken through Figure 2 on the line 3—3 and showing the development of a detail, and

Figure 4 is a view taken through Figure 1 on the line 4—4.

Referring more particularly to the drawing, the impact tool designated generally by 20 comprises a casing 21 upon the rear end of which is mounted a motor 22 to supply the motive power for operating the tool 20.

The motor 22 is secured to the casing 21 by bolts 23 and, while its details of construction are omitted, is intended as an illustration of a constant speed reversible motor capable of operating the tool selectively in opposite hand directions.

The shaft 24 of the motor carries an extension 25 which projects coaxially into the casing 21. The free end of the extension 25 is in the form of a reduced stem 26 which extends into and serves as a guide member for the end of a rod 27 in the casing 21. The rod 27 may be capable of free rotation on the stem 26 and is seated with its opposite or forward end in a head or anvil 28 rotatable in the front end of the casing 21.

The anvil 28 comprises a cylindrical body portion 29 which rotates within a bearing 30 in the front end of the casing 21 and on the rearward portion of the anvil is an external flange 31 of which the forward surface 32 seats against a shoulder 33 of the bearing 30. On the front end of the anvil is a shank 34 to which may be attached a tool 35, as for example a wrench shown as engaging a nut 36 for rotating it on a bolt 37.

The means employed for transmitting the rotary movement of the motor shaft 24 to the anvil 28 consists of an impact member or hammer 38. The hammer is of cup-shape, having its end wall 39 adjacent the anvil 28, and on the outer surface of the end wall 39 are clutch members 40, two being shown in the present instance, to engage clutch members 41 on the adjacent end of the anvil 28. The forward portion of the hammer 38 is guided by the rod 27 which extends through an aperture 42 in the wall 39.

The driving connection between the shaft 24 and the hammer 38 shown for illustrative purposes consists of a driving head 43 which extends into the hammer 38 and interlockingly engages projections on the inner surfaces of the hammer. The driving head may have a free running fit within the hammer and is affixed in suitable manner to the shaft 24, but relative endwise movement between the driving head and the anvil is prevented by rod 27. On the free end of the driving head is an external flange 44 having a series of notches, or V-shaped cam surfaces, 45 in its rearward surface to engage projections, or followers, on the hammer which, in the present instance, consist of rollers 46 carried by spindles 47 threaded into the wall of the hammer 38.

In the form of the invention illustrated in the drawings, three followers are shown and the flange 44 is accordingly provided with a corresponding number of V-shaped cam surfaces 45. The depth of the notches 45 exceed the length of the clutch members 40 and each notch is defined by two surfaces 48 and 49 which incline in opposite directions and merge with their lowermost ends into a surface 50 corresponding to the curvature of the rollers 46.

To the end that the hammer 38 may be constantly urged in a direction for maintaining the clutch members 40 in engagement with the clutch members 41 and the rollers 46 in the bottoms of the notches 45, a compression spring 51 is disposed about the rod 27 and seats with one end against the wall 39. The opposite end of the spring 51 seats against an anti-friction bearing 52 interposed between the spring and the driving head 43.

The operation of the device is as follows: Let it be assumed that it is intended to thread the nut to the bolt and that these elements are threaded

in the right hand direction which requires, therefore, that the motor be rotated in the same direction. During this operation and while the nut 36 is rotating relatively freely upon the bolt 37 the hammer 38 is held in the position illustrated in the drawing by the spring 51 for transmitting the rotary movement from the driving head 43 to the anvil 28. More specifically, the force of the spring 51 maintains the clutch members 40 in engagement with the clutch members 41, and the followers 46 are held seated in the bottoms of the V-shaped cam surfaces 45.

The parts will occupy these relative positions until the work resists the force of the motor, as when the nut 36 bears against the work and tends to stall the motor. The motor, however, continues its rotary movement, and when the resistance to its rotation exceeds the compressive force of the spring the inclined surfaces 49 will slide under the rollers 46 and lift the hammer 38 in the direction of the motor and thus move the clutch members 40 out of engagement with the clutch members 41.

Inasmuch as the notches 45 are of greater depth than the clutch members 40 the rollers 46 will not pass over the crests of the inclined surfaces 49 but will occupy positions on the inclined surfaces 49 sufficiently high to enable the free ends of the clutch members 40 to pass the corresponding ends of the clutch members 41. This retracting movement of the hammer obviously compresses the spring 51 and the force thus stored in the spring will maintain the end surfaces of the clutch members 40 and 41 in body engagement with each other during the subsequent rotative movement of the hammer 38, it being understood that when declutched the anvil 28 remains stationary.

When the trailing edges of the clutch members 40 step off the end faces of the clutch members 41 the spring 51 will immediately act to shift the hammer 38 in the direction of the anvil 28 and thus cause the clutch members 40 to move into the transverse plane of the clutch members 41. During this period in the cycle of operations the compressive force of the spring 51 will also operate to shift the hammer 38 angularly with respect to the driving head 43 by causing the followers 46 to roll downwardly along the inclined surfaces 49 into the bottoms of the notches 45 so that the rotative movement of the hammer is accelerated considerably beyond that of the driving head 43.

The energy thus imparted to the hammer causes the clutch members 40 to strike sharply against the clutch members 41 and thereby materially increase the impact of the hammer against the anvil over that which would result if the hammer merely rotated at the same speed as the motor immediately prior to the delivery of the blow of the hammer against the anvil.

This operation of the hammer may continue until the nut 36 is tightened securely on the bolt 37, that is, the motor will continue to rotate without retardation, and the hammer will be intermittently disconnected and connected with the anvil and deliver a series of impacts against the anvil for tightening the nut on the bolt or for removing it, as the case may be. In the latter event the motor will, of course, operate in a reverse direction to cause cooperation between the inclined surfaces 48 and the rollers for declutching the hammer from the anvil and to cause the accelerated angular movement of the hammer responsible for the added impacting force thereof.

I claim:

1. In a tool of the character described, a rotary anvil, a rotary hammer for striking said anvil, clutch members on said anvil and hammer, reversible driving means for the hammer and a flexible connection between said hammer and driving means comprising a spring under compression in the direction of the axis of the hammer to press the hammer toward the anvil to normally hold the clutch members on the hammer in engagement with the clutch members on the anvil and means to convert the compression force of the spring into rotational movement of the hammer with respect to the driving means regardless of the direction of rotation of the driving means.

2. In a tool of the character described, the combination of a rotatable head, a rotatable hammer associable with said head for delivering rotative impacts thereto, a reversible power actuated element, cam means connecting said element to said hammer for rotating the same in the other direction, and compression means cooperating with said cam means for imparting additional rotative impact power to said hammer the direction of the rotative impact depending on the direction of rotation of the power element.

3. In a tool of the character described, a rotary anvil, a rotary hammer for striking said anvil, clutch members on said anvil and hammer, reversible driving means for the hammer, a flexible connection between said hammer and driving means comprising a spring under compression only to normally maintain the clutch members on the hammer in engagement with the clutch members on the anvil and a V-shaped cam and follower carried by the hammer and driving means kept in constant contact with each other by the spring and adapted to convert the compression force of the spring into rotational movement of the hammer with respect to the driving means regardless of the direction of rotation of the driving means.

4. In a tool of the character described, a rotary anvil, a rotary hammer for striking said anvil, clutch members on said anvil and hammer, reversible driving means for the hammer and a flexible connection between said hammer and driving means comprising a spring under compression only to normally maintain the clutch members on the hammer in engagement with the clutch members on the anvil, and a cam and follower carried by the driving means and hammer kept in constant contact with each other by the spring and adapted to convert the compression force of the spring into rotational movement of the hammer with respect to the driving means regardless of the direction of rotation of the driving means.

CLIFFORD E. FITCH.