

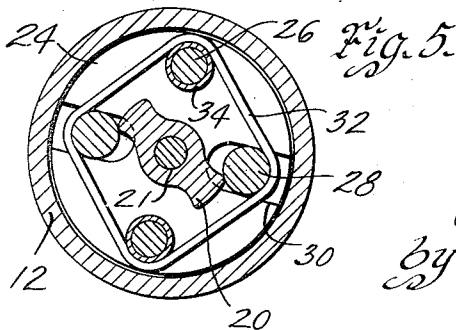
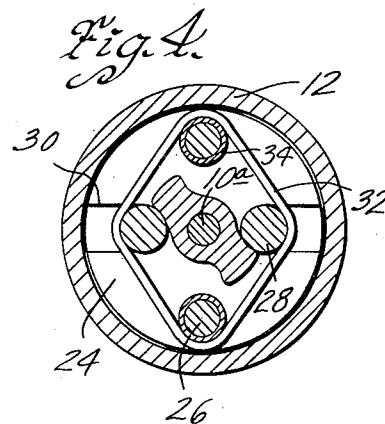
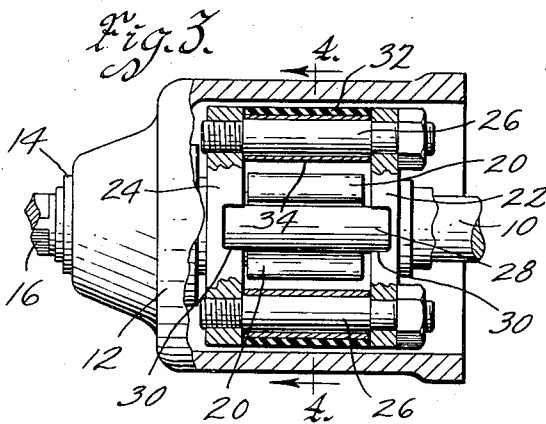
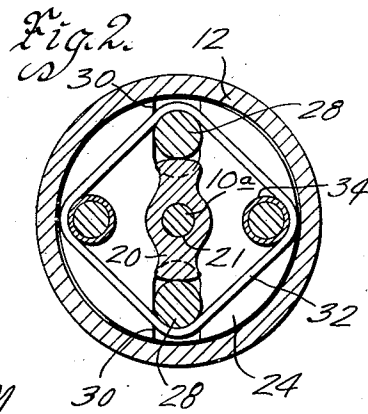
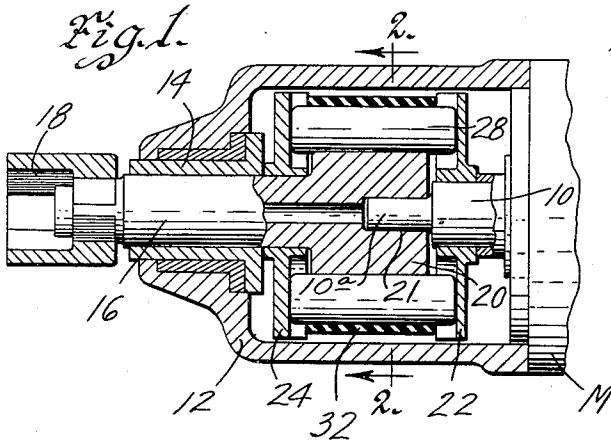
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C. E. FITCH

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IMPACT CLUTCH

Filed June 29, 1943



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## UNITED STATES PATENT OFFICE

2,396,498

## IMPACT CLUTCH

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Application June 29, 1943, Serial No. 492,663

11 Claims. (Cl. 192—30.5)

My present invention relates to an impact clutch wherein rollers are carried by a motor driven shaft and act as driving and impact elements with relation to clutch wrench shaft.

One object of the invention is to provide a comparatively simple impact wrench, which is inexpensive to manufacture and easy to disassemble for renewing worn elements therein.

A further object is to provide an arrangement of driving and driven members with a clutch connection between them, comprising rollers which act as hammers to deliver either continuous rotation to the driven member or intermittent rotation thereto by impact blows when resistance to turning torque increases to a predetermined degree.

Still a further object is to provide a driven member having radial slots carrying rollers which may move freely therein, a wrench shaft having anvil elements to be struck by the rollers and carried along with them, and means to normally hold the rollers inwardly in anvil engaging positions against centrifugal force, the anvil elements being so shaped as to cam the rollers outwardly for releasing the rollers from the anvils and subsequent impact of the rollers against the anvils.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my impact wrench, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawing, in which:

Figure 1 is a sectional view through an impact wrench embodying my invention, and showing it mounted on one end of a prime mover, such as an air motor of the kind disclosed in my copending application, Serial No. 492,662, filed June 29, 1943.

Figure 2 is a sectional view on the line 2—2 of Figure 1.

Figure 3 is a partial sectional view, similar to Figure 1, showing the parts turned substantially one-fourth revolution.

Figure 4 is a sectional view on the line 4—4 of Figure 3; and

Figure 5 is a sectional view similar to Figure 4, showing the driving member and hammer elements in a slightly different position than in Figure 4.

On the accompanying drawing, I have used the reference character M to indicate generally a motor. The shaft of the motor is indicated at

10. A housing for my impact wrench mechanism is shown at 12 and may be suitably secured to the motor 10.

The housing 12 carries a bearing sleeve 14 for a wrench shaft 16. A suitable tool may be engaged with the shaft 16, as for instance a socket member 18 for engaging a bolt head or nut.

The wrench shaft 16 within the housing 12 has a pair of projections 20 constituting an anvil. Secured to the motor shaft 10 is a drive plate 22, and this plate, together with a plate 24 and a pair of spaced bolts 26 constitute a cage for a pair of rollers 28. The rollers 28 are freely movable in radial slots 30 of the plates 22 and 24, so that they may move outwardly in the slots under the action of centrifugal force.

Counteracting centrifugal force, I provide a resilient member, such as a belt 32 of rubber or the like, so that the rollers are normally held at the inner limits of the slots, as shown in Figure 4. In such position, the rollers may engage the anvil 20 as illustrated in this figure for delivering an impact blow thereto, as will hereinafter appear.

For the purpose of keeping the parts properly aligned, the motor shaft 10 has an extension 10a entering a bore 21 of the anvil 20. The bolts 26 may be provided with tubular sleeves 34, as shown in Figures 2 and 3 around which the belt 32 extends.

#### Practical operation

In the operation of my impact wrench, the parts at certain times may assume the position shown in Figure 2.

As the cage, comprising the plates 22, 24 and 26 rotates clockwise, the slots 30 will carry the rollers or hammer elements 28 beyond the ends of the anvil 20, so that the belt 32 then pulls the rollers inwardly to the inner limits of the slots 30. As the cage and rollers are rotated further, they will finally assume the position shown in Figure 4 engaging the anvil 20.

As long as there is not much resistance to turning torque, as when the bolt or nut is being driven "home," the cage and anvil will rotate as a unit. When the resistance to turning torque increases to a predetermined degree, however, the rollers will be forced outwardly as shown in Figure 5 against the tendency of the belt 32 to hold them inwardly. Finally the rollers will pass beyond the ends of the projections 20 constituting the anvil elements, as seen in Figure 2, and this sudden release of pull on the motor, permits it to accelerate rapidly. The motor M is preferably

a vane-type pneumatic motor, so that when resistance to torque occurs, and the parts assume the position in Figure 5, the pressure builds up to line pressure behind the vanes, and accordingly when the Figure 2 position is reached, the acceleration of the motor is extremely rapid. This results in an impact blow of considerable force being struck on the anvil by the rollers, as in Figure 4, so as to further tighten the bolt or nut. The rollers again release from the anvil and another impact blow is delivered, this operation being repeated in rapid succession and being sufficient to soon twist the bolt or nut off. The operator, however, soon learns by the sound of the tool, or the approximate number of impact blows struck, when to cut off the motor before starting to twist off the bolt or nut.

The ends of the anvil 28 act as cams for moving the rollers 28 outwardly after the impact blow is struck, and the shapes of these cam ends may be varied to secure the desired degree of resistance to torque necessary before release and subsequent impact occurs. The parts, it will be noted, are symmetrical, so that the wrench can operate in either direction for the purpose of loosening bolts and nuts as well as tightening them.

Some changes may be made in the arrangement and construction of the parts of my impact wrench, without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of construction or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In a tool of the character described, a rotary driving element and a rotatable driven member, said driven member having anvil elements, hammer elements carried by said driving element, means on said anvil elements for moving the hammer elements outwardly with respect to the axis of rotation thereof, and a tension element surrounding said hammer elements to hold them normally inward for engaging said anvil elements, said hammer elements being disengaged from said anvil elements upon predetermined resistance to rotation being encountered by said driven member as said driving element continues rotation, said tension element, after said hammer elements pass said anvil elements, biasing said hammer elements inward to strike said anvil elements.

2. In an impact tool, a rotary driving element and a rotatable driven member, said driven member having anvil elements, hammer elements carried by said driving element and subjected to centrifugal force tending to move them outwardly with respect to the axis of rotation thereof, and a resilient belt surrounding said hammer elements to hold them normally inward for engaging said anvil elements, said anvil elements upon predetermined resistance to rotation being encountered by said driven member as said driving element continues rotation, camming said hammer elements out of engagement with the anvil, said belt, after said hammer elements pass said anvil elements, moving said hammer elements inward again to strike said driven member.

3. In an impact tool of the character disclosed, a rotary driving element and a rotatable driven member, said driven member having an anvil element, a hammer element carried by said driv-

ing element and movable substantially radially with respect to the axis of rotation thereof, and a belt under tension around said hammer element to normally hold it inward for engaging said anvil element, said anvil element constituting cam means to release said hammer element from said anvil element in opposition to said tension belt upon predetermined resistance to rotation being encountered by said driven member.

4. In a tool of the class described, a driver, a driven element, and a cooperative connection between said driver and said driven element comprising slots in said driver, a pair of rollers movable relative to and carried by said driver in said slots, said driven element being provided with opposite, outwardly directed projections constituting anvil elements for said rollers to strike again, whereby the rollers act as driving and impact elements in relation to said anvil elements, said rollers being freely movable in said slots and tending to move outwardly from the center of rotation by centrifugal force, resilient means to normally hold them inwardly against the action of centrifugal force to travel in a path which effects their engagement with said anvil elements to impart rotation to said driven element simultaneously with the rotation of said driver, or through intermittent impact of said rollers against said projections and thereby imparting rotation to said driven element by impact blows when resistance to torque rises to a predetermined degree, said projections at that time coacting with said rollers to move them outwardly by cam action.

5. In a tool of the character described, a driven element, a rotary driving element, a hammer element carried thereby for substantially radial movement relative thereto, said driven element having an outward projection to be struck by said hammer element, resilient means normally holding said hammer element inward to cause it to strike said projection, and said projection constituting cam means for moving said hammer outward relative to said projection upon the driven element encountering resistance to turning torque greater than a predetermined degree.

6. In an impact tool, a rotary driving element, a hammer element carried thereby for substantially radial movement relative thereto, a tool having an outward projection to be struck by said hammer element, a resilient band normally holding said hammer element inward to cause it to strike said projection, said projection constituting cam means for moving said hammer outward relative to said projection upon the said tool element encountering resistance to turning torque greater than a predetermined degree.

7. A device for accumulating torsional force in an impact tool comprising a rotary anvil, a prime mover, and means of rotative connection between said prime mover and said rotary anvil comprising a rotor driven by said prime mover, said rotor having a radial slot, a roller received therein, said anvil having an outward projection adapted to be struck by said roller as it travels in an inward path, means biasing said roller to assume said inner path until striking said projection, said projection being shaped to cam said roller outwardly to clear the projection after the roller strikes it.

8. Means for accumulating torsional force in an impact tool comprising a rotary anvil, a prime mover, and means of rotative connection between said prime mover and said rotary anvil compris-

ing a rotor driven by said prime mover, said rotor having a substantially radial slot, a hammer slidably received therein, said anvil having an outward projection adapted to be struck by said hammer as it travels in a small circular path, means biasing said hammer to assume said path until it strikes said projection, said projection being shaped to cam said roller outwardly to a larger circular path clear of the projection after the hammer strikes it, and when the tool encounters greater resistance to torque than a predetermined degree.

9. In an impact tool, a motor shaft, a driven shaft and an operative connection between said shafts comprising a driving element carried by said motor shaft, a rotary anvil carried by said driven shaft, and a hammer element carried by said driven shaft for driving and impact coaction with said anvil, said driving element having a substantially radially arranged slot in which said hammer element is freely movable and wherein it tends to move due to centrifugal force, means opposing and overcoming the centrifugal force whereby said hammer elements normally remain inwardly in said slot for striking said anvil, and means for disengaging said hammer element from said anvil element upon resistance to turning torque greater than the driving torque of said driven shaft, said last means comprising a cam face on said anvil element.

10. In an impact tool, a motor shaft, a driven shaft and an operative connection between said

shafts comprising a driving element carried by said motor shaft, a rotary anvil carried by said driven shaft, and a hammer element carried by said driving element for driving and impact coaction with said anvil, said driving element having a substantially radially arranged slot in which said hammer element is freely movable and wherein it tends to move due to centrifugal force, means opposing and overcoming the centrifugal force whereby said hammer elements normally remain inwardly in said slot for striking said anvil, and means included in the anvil element for disengaging said hammer element from said anvil element upon resistance to turning torque.

11. In a tool of the character disclosed, a motor shaft, a driven shaft and an operative connection between said shafts comprising a driving element carried by said motor shaft, a rotary anvil carried by said driven shaft, and a pair of hammer elements carried by said driving element for driving and impact coaction with said anvil, said hammer elements tending to move outward in response to centrifugal force, resilient belt means opposing and overcoming the centrifugal force whereby said hammer elements normally remain inwardly, said anvil element having cam faces for disengaging said hammer elements from the anvil element upon predetermined resistance of the driven shaft torque greater than the driving torque to said driven shaft.

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