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3,102,621

IMPACT CLUTCH

Filed Aug. 22, 1960

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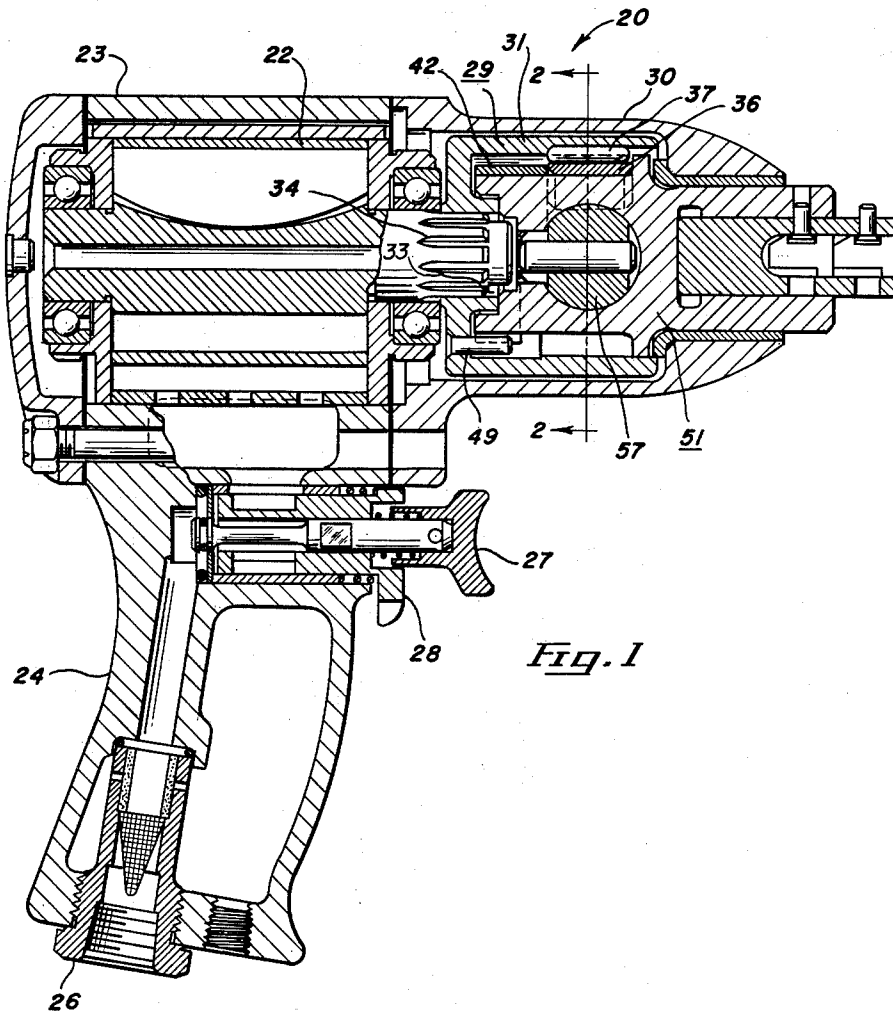


Fig. 1

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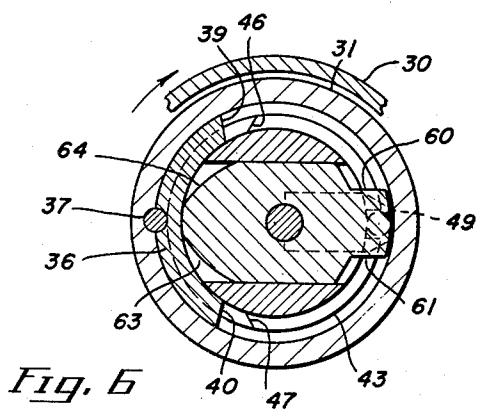
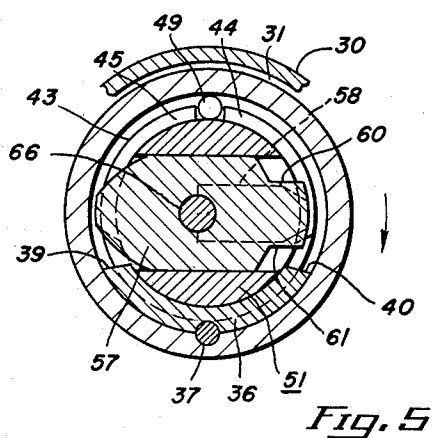
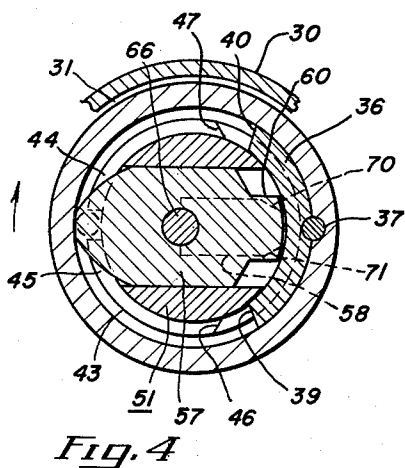
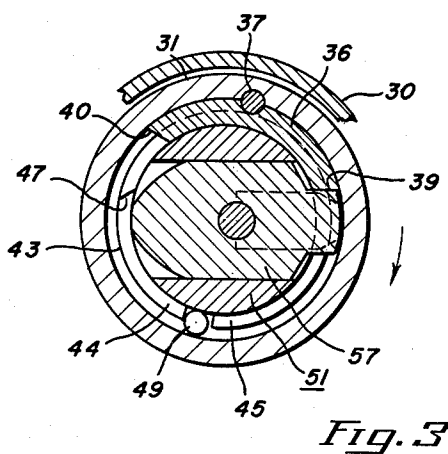
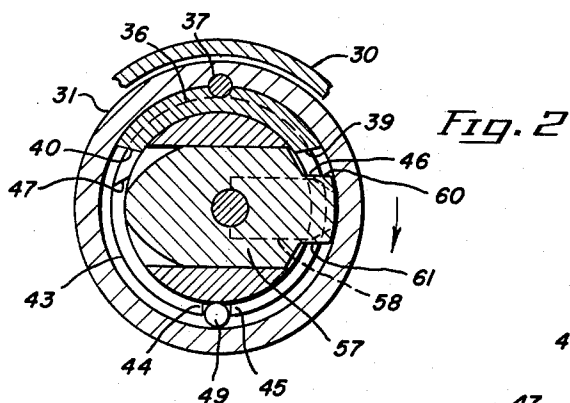
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3 Sheets-Sheet 2



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IMPACT CLUTCH

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3 Sheets-Sheet 3

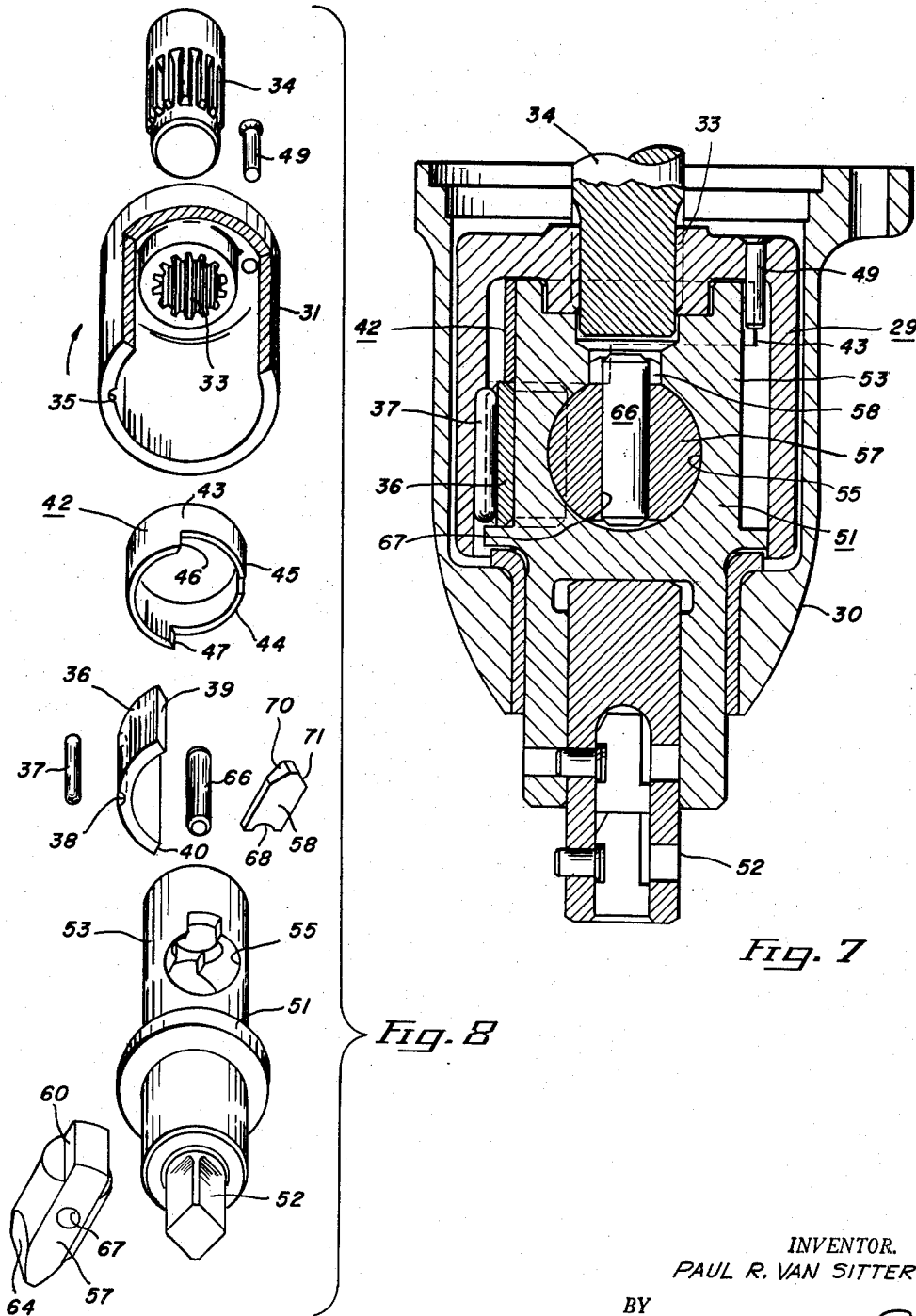


Fig. 7

Fig. 8

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3,102,621

IMPACT CLUTCH

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8 Claims. (Cl. 192—30.5)

The invention relates in general to impact clutches and more particularly to rotary impact clutches which enable a driven member to automatically transmit continual impacts or raps to a driven member, such as a nut or screw, for tightening or loosening operations thereon.

An object of the invention is to provide an impact clutch wherein a hammer member transmits a blow to an anvil member with new and novel means to urge the anvil member out of the path of movement of the hammer member.

Another object of the invention is to provide an impact clutch wherein a hammer member transmits a blow to an anvil member which is then moved out of the path of the hammer member with a means of reducing the engagement force between the hammer and anvil member whereby the anvil member may be more readily or easily moved.

Another object of the invention is to provide an impact clutch wherein a hammer member transmits a blow to an anvil member which anvil member is moved out of the path of travel of the hammer member by means of a cam member.

Another object of the invention is to provide an impact clutch wherein a hammer member transmits an impact to an anvil member which is then moved out of the path of the hammer member, with a spring member which is loaded as the hammer member moves to impact the anvil whereby after impact, the engagement force between the hammer and anvil is reduced and the anvil member is more readily moved.

Another object of the invention is to provide an impact clutch wherein a rotative hammer member upon sufficient load being placed upon a driven shaft and upon the hammer reaching sufficient rotative speed, a camming surface on an annular spring member engages an anvil member or a part connected thereto to load the annular spring member and subsequently, the hammer member impacts a first portion of the anvil member and thereafter the loaded annular spring member relieves the contact pressure or force between the hammer and anvil member and the camming surface moves the anvil member out of the path of travel of the hammer member, and the hammer member upon further rotation engages another portion of the anvil member to move the first mentioned portion of the anvil member back into the path of travel of the hammer member.

Another object of the invention is to provide an impact clutch which does not stall.

Other objects and a fuller understanding of this invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a side elevational view in section of the rotary impact tool of the present invention;

FIGURE 2 is a sectional view taken generally along the line 2—2 of FIGURE 1;

FIGURES 3—6 are views also taken along the line 2—2 of FIGURE 1, but showing the parts in progressive rotational positions;

FIGURE 7 is a sectional view of only the clutch portion of the tool taken 180 degrees from the FIGURE 1 position; and

FIGURE 8 is an exploded view of the impact clutch parts shown in FIGURE 7.

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FIGURE 1 illustrates the impact tool, indicated generally by the reference numeral 20, of the present invention and the means for driving the impact clutch 29 of the present invention may be varied; however, in this instance, the means utilized comprises an air motor 22 contained within a housing 23 with a pistol grip type handle 24 whereby an operator can conveniently hold the device. A fitting 26 is provided for attachment to an air line and a trigger 27 is conveniently positioned for actuation by an operator of the device to either permit or prohibit air actuation of the motor. The rotation of the air motor in either a clockwise or counterclockwise direction is controlled by member 28 in a manner which is well known by those skilled in the art.

The present invention is directed primarily to the impact clutch mechanism 29 which will be described in detail hereinafter. The impact clutch mechanism shown in the drawings includes a secondary housing 30 which extends from the housing 23 and mounted for rotary movement within the housing 30 is a driver shell 31. This shell 31 is a continuous annular member which is positioned closely adjacent the housing 30. Wall means 33 at one end of the driver shell provide a splined opening into which a splined drive shaft 34 fits, which in turn is driven by the rotor of the motor 22. With this connection, it will be apparent that upon rotation of the air motor 22, the driver shell 31 will also be caused to rotate. A hammer segment 36 is secured to an inner wall of the driver shell by means of a segment pin 37. The segment pin 37 resides partially in a groove 35 in the driver shell 31 and partially in a groove 38 in the hammer segment 36 thereby rotatively connecting the driver shell and hammer segment together. The hammer segment 36 is provided with first and second hammer surfaces 39 and 40. A cam ring 42 is also positioned within the driver shell 31 and axially in line with the hammer segment 36. The cam ring includes an annular spring portion 43 having first and second end portions 44 and 45 and first and second camming surfaces 46 and 47, respectively. A cam ring pin 49 extends through an opening in the driver shell 31 and resides between the end portions 44 and 45, respectively, of the annular spring portion 43. By means of this construction, it will be noted that the cam ring 42 is driven through its rotative movement by means of the driver shell 31.

A driven shaft 51 is provided which has a first end portion 52 which extends from the housing 30 and is provided with means for attaching various types of tools such as sockets, screw drivers, etc. The driven shaft 51 also has a second portion 53 which extends within and resides in the housing 30 and in such position that the cam ring 42 and the hammer segment 36 are closely adjacent the outer peripheral surface thereof. Wall means 55 serve to define a transverse opening through the second end portion of the driven shaft 51. An anvil member 57 resides in the transverse opening 55 as well as a shifter member 58. The anvil member 57 has first and second impact surfaces 60 and 61 on a first end portion thereof and first and second cam surfaces 63 and 64, respectively, on a second end portion thereof. A pin 66 has one end portion which resides in an opening 67 in the anvil member and which has another end portion which resides adjacent an arcuate surface 68 on the shifter member 58. This serves to operatively connect the anvil and shifter members together and the movements which they go through will be discussed hereinafter. The shifter member also has first and second cammable surfaces 70 and 71, respectively.

The operation of the device can best be understood from viewing FIGURES 2—6. In first describing the operation, let it be assumed that the first end portion of the driven shaft is being utilized to turn down a nut or bolt

and is doing so by an appropriate tool attached thereto. If it first be assumed that the nut is turning freely, the drive shaft 34 and driven shaft 51 turn as a unit and there is no relative rotational movement between the driver shell 31 and the anvil member 57. The drive under these circumstances is basically effected by means of friction between the parts, centrifugal action because of the off-center condition of the anvil member, and other factors inherent within the device. As the nut which is being turned down meets with a small amount of resistance to turning, substantially the same resistance to rotational movement is transmitted to the driven shaft 51 and the anvil member 57. FIGURE 2 illustrates what happens under this set of circumstances. With the driver shell rotating in a clockwise direction, the first camming surface 46 of the cam ring 42 engages the shifter member 58. As the camming surface 46 engages the shifter member, it exerts a force on the shifter member tending to move the shifter member and the anvil member 57 to the left as seen in FIGURE 2. This constitutes a first means for moving the anvil member from the impact to the non-impact position. Since the relative speed of rotation between the anvil member and the hammer segment is comparatively small, the anvil member will be moved to the left into the positions shown in FIGURES 4 and 5 before the first hammer surface 39 has an opportunity to strike the first impact surface 60. In other words, the anvil member is moved into the position shown in FIGURE 4 and the hammer segment passes by the end portion of the anvil member which carries the impact surfaces 60 and 61. When the hammer segment 36 has reached the position shown in FIGURE 5, it engages the first cam surface 63 on the other end portion of the anvil member 57 and cams the anvil member and shifter member into the position shown in FIGURES 6, 2 and 3. This moves the impact end portion of the anvil member into a position to be impacted by the hammer segment.

Assume now that the nut which is being turned down meets with a large amount of resistance to turning. In this situation, the operation of the device is basically as follows. Upon clockwise rotation of the driver shell and hammer segment, the first camming surface 46 of the cam ring 42 engages the first cammable surface 70 of the shifter member 58. As soon as this occurs, the annular spring portion 43 of the cam ring is loaded because the driver shell is driving the cam ring by means of the cam ring pin 49 engaging the first end portion 44 of the annular spring 43. Because of the high relative speed of rotation between the anvil member 57 and the hammer segment 36, the first hammer surface 39 strikes the first impact surface 60 to provide an impact to the anvil member and as a result, to the driven shaft 32, and the nut which is being turned down. The impact position is shown in FIGURE 3. The position of FIGURE 3 also indicates that the annular spring portion of the cam ring has been loaded because of the spacing between the cam ring pin 49 and the second end portion 45 of the annular spring 43. After the impact between the hammer surface 39 and the impact surface 60, the loaded annular spring 43, which along with the other elements may be referred to as a second means, tends to reverse the driver shell and thereby relieve the frictional contact force or pressure between the impact surface 60 and the hammer surface 39 and at the same time still urge the first camming surface 46 of the cam ring 42 against the cammable surface 70 of the shifter member 58 which serves to move the shifter and anvil members to the left into the position shown in FIGURE 4. This does away with the problem that the contact between the hammer segment and the anvil member may serve in some instances to cause the anvil member to stick in the position shown in FIGURE 3, thereby leaving the device in what might be referred to as a stalled position. The anvil member is moved back into the position shown in FIGURE 2 by means of the hammer segment engaging the first cam surface 63

on the left end portion of the anvil as shown in FIGURES 5 and 6. This may be referred to at times as a third means for moving the anvil member from the non-impact to the impact position. This serves to move the impact end portion of the anvil member back into the path of movement of the hammer segment whereby the same sequence of events is repeated and a series of impact blows are transmitted to the anvil member and as a consequence, to the nut or other object which is being turned down or loosened, whichever the case may be.

As mentioned hereinabove, the air motor 22 is reversible by manipulating the member 28 in a manner which is well known to those skilled in the art and the impact clutch portion of the device, best shown in FIGURES 2-6, operates in the same manner as hereinabove described; however, exactly in reverse. In other words, referring to any of FIGURES 2-6, the impacts are transmitted to the anvil member by means of the second hammer surface 40 engaging the second impact surface 61. The anvil member in this situation is shifted from the position shown in FIGURE 2 to the position of FIGURE 4 by means of the engagement of the second camming surface 47 of the cam ring 42 with the second cammable surface 71 of the shifter member 58. The anvil member is moved after impact from the position of FIGURE 4 back to the position of FIGURE 2 by engagement of the hammer segment 36 with the second cam surface 64 on the left end portion of the anvil member.

It will thus be seen that an impact clutch has been provided wherein the engagement force or pressure between the anvil and hammer members is reduced after impact, thereby enabling the anvil member to be more readily or easily shifted out of the path of movement of the hammer member. This obviates the possibility of stalling or sticking of the parts. It will also be seen that the impact clutch which has been provided utilizes a hammer segment to provide continual impacts to an anvil member, and as a consequence, to a driven member which hammer segment also serves to move the hammer member back into the path of the hammer segment so that a continual series of impacts may be given to the driven member. The specific use of the cam ring herein disclosed which comprises an annular spring member and camming surface provides an efficient and reliable means of relieving the contact force between the hammer and anvil while still providing a means by way of the shifter member to move the anvil out of the path of the hammer after the impact has been accomplished.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A rotary impact clutch including in combination a drive and a driven member, said drive member including a hammer surface movable in a rotational path, said driven member having a transverse opening therein, an anvil member residing in said transverse opening and having first and second end portions thereon, said first end portion of said anvil member having an impact surface thereon and said second end portion having a camming surface thereon, said anvil member being movable in said transverse opening between first and second positions, said impact surface in said first position of said anvil member being located in the path of movement of said hammer surface and said camming surface being located out of the path of movement of said hammer surface, means for moving said anvil member from said first to said second position, said camming surface in said second position of said anvil member being located in the path of movement of said hammer surface and said im-

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impact surface being located out of the path of movement of said hammer surface, and said hammer surface upon engagement with said camming surface moving said anvil member from said second to said first position.

2. A rotary impact clutch including in combination a drive and a driven member, said drive member including a hammer surface movable in a rotational path, said driven member having a transverse opening therein, an anvil member residing in said transverse opening and having first and second end portions thereon, said first end portion of said anvil member having an impact surface thereon and said second end portion having a camming surface thereon, said anvil member being movable in said transverse opening between first and second positions, said impact surface in said first position of said anvil member being located in the path of movement of said hammer surface and said camming surface being located out of the path of movement of said hammer surface, means for moving said anvil member from said first to said second position, including a cam ring comprising a cam surface and an annular spring member driven by said drive member, said camming surface in said second position of said anvil member being located in the path of movement of said hammer surface and said impact surface being located out of the path of movement of said hammer surface, and said hammer surface upon engagement with said camming surface moving said anvil member from said second to said first position.

3. A rotary impact clutch including in combination, a driver shell having a splined opening extending axially therein, a splined drive shaft residing in said splined opening for rotatively driving said driver shell, a hammer segment having a hammer surface and fitting a portion of the inner surface of said driver shell, a segment pin coacting with said driver shell and said hammer segment for rotatively securing the two together, a cam ring including an annular spring member having first and second end portions, said cam ring including a camming surface, said cam ring being positioned adjacent the inner surface of said driver shell and axially in line with said hammer segment, a cam ring pin secured by said driver shell and extending between said first and second end portions of said cam ring for causing said driver shell to move said cam ring, a driven shaft having a first end portion having means for holding a tool, said driven shaft having a second end portion residing within said cam ring, wall means defining a transverse opening through said driven shaft, an anvil member residing in said transverse opening and having an impact surface on a first end portion and a cam surface on a second end portion thereof, a shifter member residing in said transverse opening adjacent said anvil member, a pin member extending into openings in said anvil and shifter member to secure said members together for movement in said transverse opening, rotation of said splined drive shaft causing rotation of said driver shell and upon sufficient load being placed upon said driven shaft and said driver shell reaching sufficient rotative speed said camming surface of said cam ring engages said shifter member to load said annular spring member and subsequently said hammer surface engages and imparts an impact to said impact surface of said anvil and as a result to said driven member and thereafter said loaded annular spring member relieves the contact pressure between said hammer and impact surfaces and said camming surface moves said shifter and anvil members in said transverse opening out of the line of travel of said camming and hammer surfaces, said hammer member subsequently engaging said cam surface on said second end portion of said anvil member to move said impact surface back into the path of travel of said hammer surface to repeat the cycle.

4. A rotary impact clutch including in combination, a driver shell, a drive shaft for rotatively driving said driver shell, a hammer segment having a hammer surface and fitting a portion of the inner surface of said driver shell,

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a segment pin coacting with said driver shell and said hammer segment for rotatively securing the two together, a cam ring including an annular spring member having first and second end portions, said cam ring including a camming surface, said cam ring being positioned adjacent the inner surface of said driver shell, a cam ring pin secured by said driver shell and extending between said first and second end portions of said cam ring for causing said driver shell to rotatively move said cam ring, a driven shaft having a first end portion having means for holding a tool, said driven shaft having a second end portion, wall means defining a transverse opening through said driven shaft, an anvil member residing in said transverse opening and having an impact surface on a first end portion and a cam surface on a second end portion thereof, a shifter member residing in said transverse opening adjacent said anvil member, a pin member extending an opening in said anvil member and adjacent said shifter member to operatively secure said members together for movement in said transverse opening, rotation of said drive shaft causing rotation of said driver shell and upon sufficient load being placed upon said driven shaft and said driver shell reaching sufficient rotative speed said camming surface of said cam ring engages said shifter member to load said annular spring member and subsequently said hammer surface engages and imparts an impact to said impact surface of said anvil and as a result to said driven member and thereafter said loaded annular spring member relieves the contact pressure between said hammer and impact surfaces and said camming surface moves said shifter and anvil members in said transverse opening out of the line of travel of said camming and hammer surfaces, said hammer member subsequently engaging said cam surface on said second end portion of said anvil member to move said impact surface back into the path of travel of said hammer surface to repeat the cycle.

5. A rotary impact clutch including in combination, a driver shell, a drive shaft for rotatively driving said driver shell, a hammer segment having a hammer surface and fitting a portion of the inner surface of said driver shell, a segment pin coacting with said driver shell and said hammer segment for rotatively securing the two together, a cam ring including an annular spring member having first and second end portions, said cam ring including a camming surface, said cam ring being positioned adjacent the inner surface of said driver shell, a cam ring pin secured by said driver shell and extending between said first and second end portions of said cam ring for causing said driver shell to move said cam ring, a driven shaft having a first end portion having means for holding a tool, said driven shaft having a second end portion residing within said cam ring, wall means defining a transverse opening through said driven shaft, an anvil member residing in said transverse opening and having an impact surface on a first end portion and a cam surface on a second end portion thereof, a shifter member residing in said transverse opening adjacent said anvil member, and a pin member extending into an opening in said anvil member and adjacent said shifter member to operatively secure said members together for movement in said transverse opening.

6. An impact wrench including in combination a drive and a driven member, a hammer member driven through a circular path of movement by said drive member, an anvil member carried by said driven member and movable laterally with respect thereto between impact and non-impact positions and having first and second end portions, said first end portion of said anvil member in said impact position being located in said path of movement of said hammer member and upon movement of said hammer member through said path said hammer member strikes said anvil member thereby imparting a force to said driven member, first means acting on said anvil member for moving the same laterally from said impact to said non-impact

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position whereat said second end portion of said anvil member is located in said path of movement of said hammer member, spring means acting between said drive member and said anvil member tending to separate said hammer member and anvil member after impact whereby said anvil member may be more easily moved from said impact to said non-impact position, said second end portion of said anvil member including a cam surface and upon engagement therewith by said hammer member said anvil member is moved laterally from said non-impact position to said impact position.

7. An impact wrench including in combination a drive and a driven member, a hammer member driven through a circular path of movement by said drive member, an anvil member carried by said driven member and movable laterally with respect thereto between impact and non-impact positions, said anvil member in said impact position being located in said path of movement of said hammer member and upon movement of said hammer member through said path said hammer member strikes said anvil member thereby imparting a rotative force to said driven member, first means acting on said anvil member for moving the same laterally from said impact to said non-impact position, and spring means acting between said drive member and said anvil member tending to separate said hammer member and said anvil member after impact whereby said anvil member may be more easily moved from said impact to said non-impact position.

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8. An impact clutch including in combination a driving motor, a drive member connected to and movable with said driving motor, a driven member, an anvil carried by said driven member and movable between impact and non-impact positions, a hammer member carried by said drive member and engageable with said anvil in said impact position thereof, spring means acting between said drive member and said anvil and driven by said drive member, said spring means acting on said anvil to utilize a portion of the motor torque in moving said anvil from said impact to said non-impact position, said spring means also tending to separate said hammer member and anvil after an impact therebetween whereby said anvil may more readily be moved from impact to non-impact position.

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