Aug. 14, 1951 W. G. MITCHELL ET AL 2,564,224

IMPACT TOOL

Filed April 8, 1946 2 Sheets-Sheet 1

FIG. 1

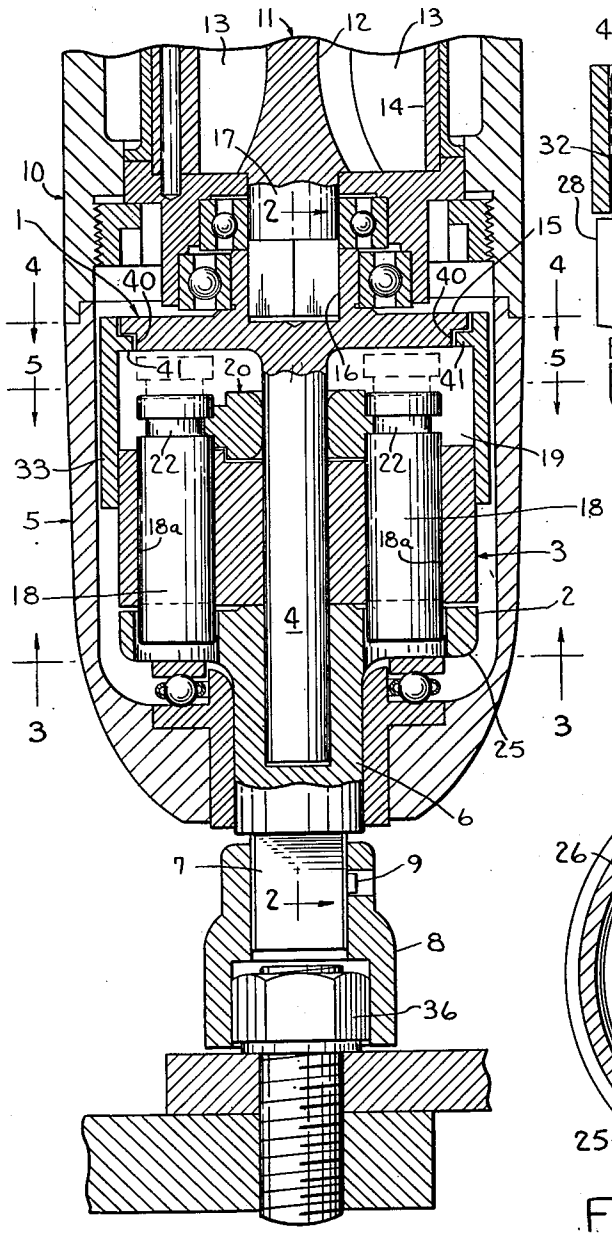
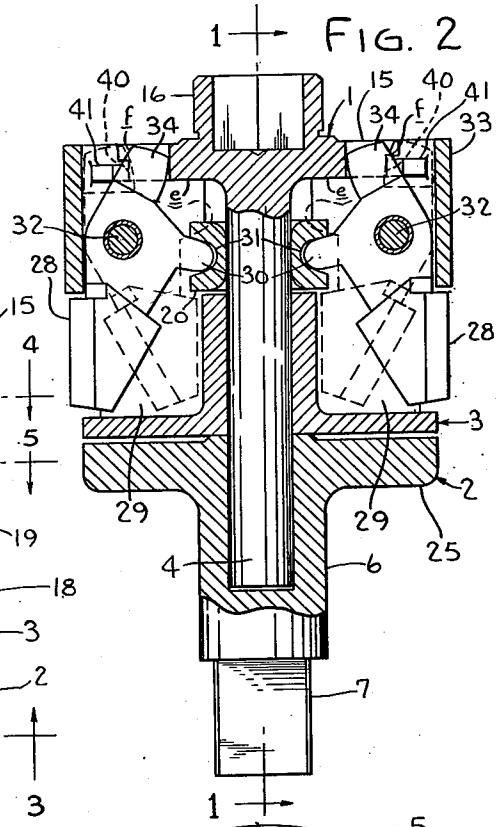


FIG. 2



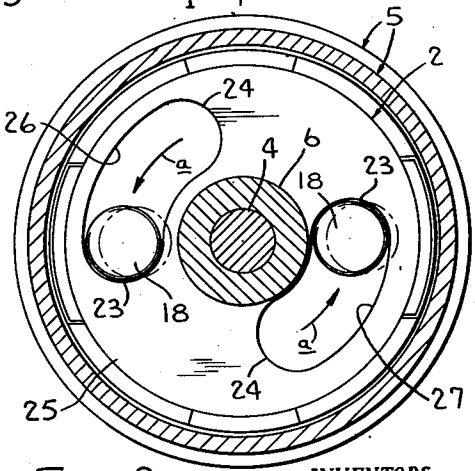


FIG. 3

INVENTORS
WALTER G. MITCHELL
LOUIS P. FOSNOT

BY

ATTORNEY

Aug. 14, 1951 W. G. MITCHELL ET AL 2,564,224

IMPACT TOOL

Filed April 8, 1946 2 Sheets-Sheet 2

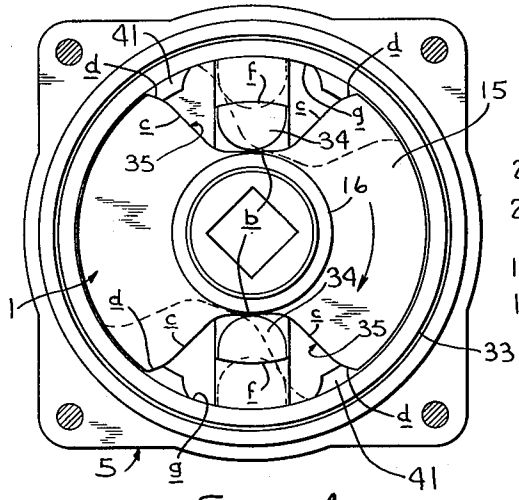


FIG. 4

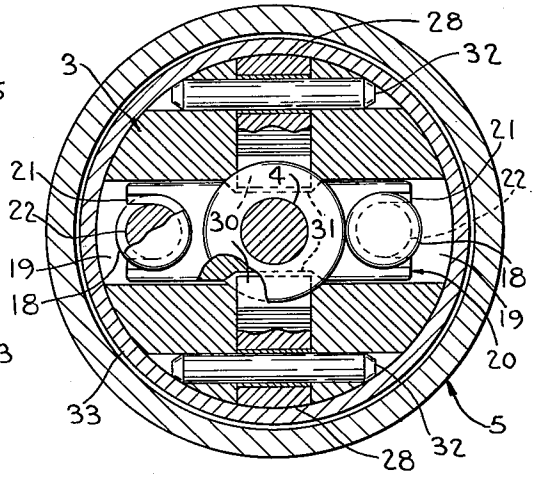


FIG. 5

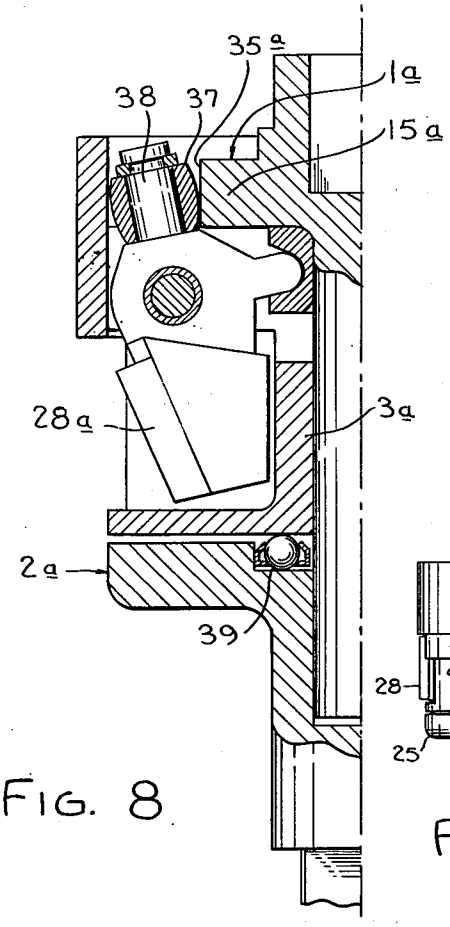


FIG. 8

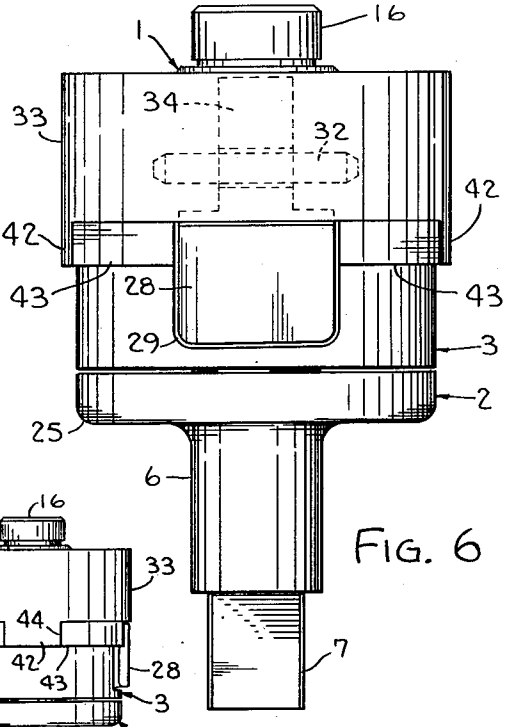


FIG. 6

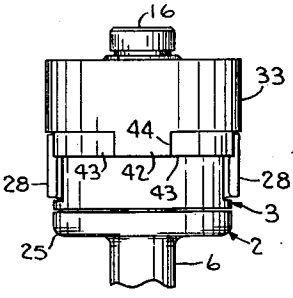


FIG. 7

INVENTORS
WALTER G. MITCHELL
LOUIS P. FOSNOT
BY
ATTORNEY

Patented Aug. 14, 1951 2,564,224

UNITED STATES PATENT OFFICE

2,564,224

IMPACT TOOL

Walter G. Mitchell and Louis P. Fosnot, Aurora, Ill., assignors to Independent Pneumatic Tool Company, Chicago, Ill., a corporation of Delaware

Application April 8, 1946, Serial No. 660,348

31 Claims. (Cl. 192—30.5)

1

This invention relates to improvements in portable power operated impact tools for setting and removing nuts and bolts by power.

The invention, while relating to tools of the character referred to, is particularly concerned with the impact clutch mechanism employed in such tools to clutch and declutch the hammer and the anvil members of the clutch and for imparting rotational hammer blows on the anvil member to tighten or loosen a nut or bolt being driven by the tool.

The invention has among its principal objects the following:

To provide an impact clutch construction in which the impact elements of the clutch are mounted for axial movement of the hammer member and independently thereof to increase the strength and blow delivering power of the clutch by having the hammer member provide extensive supporting and bearing surfaces for the impact elements throughout the major portion of their lengths and whereby the radial dimensions of the clutch are brought within limits for ease in handling and manipulation of the tool;

To provide means for controlling the registry between the impact elements on the hammer member and the abutment means on the anvil member to limit the number of impact blows delivered per revolution of the hammer member in the operation of the tool;

To provide centrifugally responsive fly-weights or equivalent means on the hammer member to move the impact elements axially of the hammer member into the path of the abutments on the anvil member to clutch and deliver hammer blows, respectively, on the anvil member in the operation of the tool;

To provide cam means on the driving member of the clutch and acting on the fly-weights to withdraw the impact means out of the path of the abutments to declutch the clutch in the relative rotation of the driving and the hammer members;

To provide an impact clutch construction wherein the impact elements are in the form of rods extendible through the end portion of the hammer member opposed to the anvil member to engage and impart hammer blows on the anvil member in the movement of the rods axially and independently of the hammer member; and

To provide a collar element on the hammer to hold the pivot pins for the fly-weights in place and against displacement by centrifugal force

2

and vibration in the operation of the clutch device.

The invention consists further in the structural features and combination of parts hereinafter described and claimed.

In the accompanying drawings:

Fig. 1 is a longitudinal sectional view with parts in elevation of a portable power operated impact tool containing an impact clutch mechanism of our invention; the upper or motor portion of the tool being broken away and the section being taken on line 1—1 of Fig. 2 to show the impact elements of the clutch device in positions to engage the abutments on the anvil member thereof;

Fig. 2 is a similar sectional view of the clutch unit removed from the tool and showing, in full lines, the centrifugally responsive fly-weights swung outwardly to engage the clutch; the section being taken on line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 1 showing, in full lines, the impact elements of the clutch device in engagement with their respective abutments on the anvil member;

Fig. 4 is a similar sectional view taken on line 4—4 of Fig. 1 showing the cam means interposed between the driving member and the fly-weights of the clutch;

Fig. 5 is a similar sectional view taken on line 5—5 of Fig. 1 to show the relative positions and mounting of the impact elements and the fly-weights, respectively, in the hammer member of the clutch;

Fig. 6 is a side elevational view of the clutch unit removed from the tool;

Fig. 7 is a similar view to show more in detail the locking connection between hammer member and the collar element thereon to be hereinafter described; and

Fig. 8 is a modified form of construction designed for use in larger heavy duty tools.

As shown in the drawings, the impact clutch device of our invention comprises a driving member 1, an anvil member 2, and an interposed hammer member 3, all assembled in axial alignment by a clutch shaft 4 and mounted for relative rotation in the forward casing section 5 of the tool. The hammer member 3 is a solid cylindric body of the desired weight or mass and is mounted for rotation about the shaft 4 which is provided on and fixed to the driving member 1. The shaft 4 extends axially through the hammer member 3 and into a hollow spindle 6 on the anvil member 2. The spindle 6 journals the

anvil member 2 for rotation in the casing section 5 of the tool as shown in Fig. 1. The spindle 6 terminates in a non-circular section 7 exterior of the tool case to mount and drive a nut or bolt engaging socket 8 which is releasably connected with the spindle section 7 by a spring biased detent pin 9 as shown in Fig. 1.

Mounted in the rear section 10 of the tool casing is the tool motor 11 for driving the spindle 6 and the attached socket 8 through the clutch device of our invention in the operation of the tool, the motor 11 being of the desired power operated type. A fluid pressure actuated rotary motor is shown in Fig. 1 and in a motor of this type its rotor 12 with its radial blades or vanes 13 is located within a cylinder 14 clamped within the tool case section 10 and held against rotation therein. The motor 11 is of the reversible type for setting and removing nuts and bolts by the power of the tool. The tool is provided with the necessary porting and pressure fluid passage system to control the supply of fluid pressure or compressed air to the tool motor for operating it and a reversible valve (not shown) is included in the tool assembly to control the direction of rotation of the tool motor as well understood in the art.

The driving member 1 of the clutch device has a disc-like member 15 at the upper or inner end of the shaft 4 and extending over the adjacent end of the hammer member 3. Said disc 15 is integrally or otherwise rigidly connected with the shaft 4 and has a hollow central hub portion 16 aligned with the shaft 4 to couple the driving member 1 to the lower trunnion section 17 of the tool motor, therebeing a non-rotative connection between the parts for a direct drive between them. The hub 16 and the trunnion 17 are supported in the tool case in antifriction bearings mounted therein as shown in Fig. 1, and which bearing assembly provides a journal to revolubly support the clutch unit within the tool case at its end opposite to the anvil member 2.

Slidably mounted in the hammer member 3 are one or more impact elements 18, 18, a pair of such elements being employed in the specific embodiment of the invention herein shown. The impact elements 18 are preferably in the form of steel or other hardened rods mounted in the body of the hammer member 3 in substantially parallel relation to each other and to the clutch axis as defined by the shaft 4. By this arrangement the hammer member 3 is provided with a pair of longitudinally extending bores 18a, one for each rod 18, to provide extensive supporting and bearing surfaces for the rods 18 throughout the major portion of their length to increase the strength and blow delivering power of the clutch. Also, with the rods 18 mounted in and extending axially of the hammer member 3, the clutching and impact action of the clutch takes place between the opposed ends of the hammer and the anvil members about the shaft 4 and the radial and axial dimensions of the clutch device are materially reduced to bring the clutch construction within limits for ease in handling and manipulation of the tool.

The upper or inner ends of the rods 18, which are substantially of the same length, extend into a cross-slot 19 in the hammer member 3 and are connected together for movement in unison by a cross-member 20 located within said slot as shown in Fig. 5. The cross-member 20 is slidably mounted on the shaft 4 where it extends through the slot 19 and said rods 18 have rotative connection with the opposite ends of the cross-member 20 for self adjustment to distribute the wear on the lower or blow delivering ends of the rods by presenting different circumferential portions thereof to the abutments on the anvil member 2 to be presently described. The rotative connections between the rods 18 and the cross-member 20 comprise bifurcations 21, 21 in the opposite ends of the cross-member 20 to engage reduced neck portions 22, 22 on the impact rods 18 as shown in Figs. 1 and 5.

The lower or blow delivering ends of the rods 18 are projectible beyond the lower end of the hammer member 3 into and out of the path of abutments 23, 24 provided on the radial wall 25 of the anvil member 2 to clutch and declutch the hammer and the anvil members 2, 3 and to impart a series of impacts or rotational hammer blows on the anvil member 2 at said abutments to tighten or loosen the nut or bolt being driven in the operation of the tool. The end wall 25 of the anvil member 2 is opposed to and relatively close to the adjacent end of the hammer member 3 to limit the axial extent of the clutch unit for compactness in design and to limit the amount of axial movement required of the impact rods 18 to be moved into and out of the path of the abutments on the anvil member in operation of the clutch.

With the foregoing in view, the abutments 23, 24 are at the ends of arcuate slots 26, 27 provided in the anvil wall 25 to receive the rods 18 when projected from the hammer member 3, as shown in Fig. 3. The slots 26, 27 are concentric with the clutch axis and when in register with the rods 18 permit them to enter and engage the abutments to either clutch the hammer and the anvil members together as when driving a nut or bolt which is free to turn or deliver a series of rotational hammer blows on the abutments to tighten or loosen a nut or bolt when it resists the driving torque of the tool motor. The slots 26, 27 are elongated circumferentially and are of sufficient length to permit easy entry of the rods 18 into them and strike against the abutments at the ends of the slots for substantially their full width.

Rotating the hammer member 3 in the direction of the arrows *a* in Fig. 3, the rods 18 engage the abutments 23 of the respective slots 26, 27 to set and tighten a nut or bolt with a right-hand thread or to loosen and unscrew a nut or bolt with a left-hand thread. Rotating the hammer member 3 in a reverse direction engages the rods 18 with the abutments 24 of the slots for a reverse action of the clutch.

To control the number of impact blows delivered on the anvil member 2 per revolution of the hammer member 3 relatively to the anvil member, the slots 26, 27 are disposed at different radial distances from the clutch axis as defined by the shaft 4. The same arrangement is followed in mounting the rods 18 in the hammer member 3. For example, the slot 26 in the embodiment shown is arranged at a greater radial distance from the clutch axis 4 than the slot 27 and with a like arrangement for the impact rods 18 in the hammer member 3, the impact rod 18 closest to the clutch axis functions only with the slot 27 while the other rod 18 functions only with the slot 26. This is clearly indicated in Fig. 3, wherein it will be noted that the rods 18 register with the slots in one rotative position only of the hammer and the anvil members and in other positions are prevented from entry into the slots

by the intervening anvil wall 25 as shown by the full and broken line positions, respectively, of the rods 18 in Fig. 3. This limits the clutching and impact action of the clutch to once in each rotative cycle of the hammer member.

Mounted on the hammer member 3 are a pair of centrifugally responsive fly-weights 28, 28, one for each of the impact rods 18, and located in axially extending chambers 29, 29 disposed on opposite sides of the slot 19 and intersecting the same as shown in Figs. 2, 5 and 6. The chambers 29 are located between the rods 18 and allow lugs 30 adjacent the upper ends of the fly-weights 28 to engage the cross-member 20 in grooves 31, 31 in the sides thereof. The lugs 30 have rounded outer ends for ease in operation in the grooves 31 and serve to move the rods 18 by the cross-member 20 towards and from the anvil member in the swinging movement of the fly-weights 28 by centrifugal force and a cam action, respectively.

The fly-weights 28 are pivoted on the hammer member 3 within the chambers 29 by pivot pins 32, 32, one for each fly-weight, and arranged in transverse relation to the shaft 4. The pivot pins 32 are anchored in the hammer member 3 by a collar element 33 to be presently described and shown in Figs. 1, 2, 5 and 6 of the drawings. The fly-weights 28 are preferably widened laterally at their outer swinging ends as shown in Fig. 6 to be rendered more responsive to centrifugal force in the rotation of the hammer member 3. The chambers 29 in the hammer member 3 are widened to conform to the increased width of the fly-weights 28 and the latter co-operate with the sides of the respective chambers 29 to be supported and guided thereby in their swinging movement to actuate the impact rods 18.

The fly-weights 28 are provided at their upper ends with rigid, upwardly extending lugs 34, one on each fly-weight, and which lugs 34 extend into peripheral recesses 35, 35 in the disc 15 of the driving member 1 of the clutch. These lugs 34 serve to connect the hammer member 3 with the driving member 1 for rotation thereby and for actuating the fly-weights 28 to withdraw the impact rods 18 out of the slots 26, 27 to declutch the anvil member 2.

The inner sides of the lugs 34 are rounded as shown in Fig. 4 for ease in operation against the opposed edges of the recesses 35, the latter being diametrically disposed in the disc 15 to receive the lugs 34 and each recess 35 has substantially the same shape as shown in Fig. 4 In this respect each recess 35 has a contour providing the recess with a centrally disposed deep portion *b*, and inclined or camming portions, *c*, *c* on opposite sides thereof to operate in reverse directions of rotation of the disc 15. Said inclined portions *c* extend to and connect with the end portions *d*, *d* of the recesses.

The deep portions *b*, *b* of the recesses 35 allow the fly-weights 28 to be moved by centrifugal force in the rotation of the hammer member 3 into the full line positions shown in Fig. 2 to project the impact rods 18 to their fullest extent into the slots 26, 27 in the anvil member 2 and clutch the latter with the hammer member 3 for rotation by the driving pressure of the disc 15 against the sides of the lugs 34 when the nut or bolt engaged by the tool socket 8 is free to turn.

When rotation of the anvil member 2 is arrested by the tightened nut or bolt, the rods 18 strike the abutments 23 or 24 towards which they are driven and the rotation of the hammer member 3 is momentarily halted at the time of the impact reducing centrifugal force on the fly-weights 28 and allowing the driving disc 15 in its continued rotation under the torque of the tool motor to move the cam-surfaces *c* with respect to the lugs 34 and swing the fly-weights 28 inwardly towards the shaft 4 as indicated by the broken line showing of the fly-weights in Fig. 2.

The lugs 34 now are at the adjacent end portions *d* of the recesses 35 and the hammer member 3 being declutched from the anvil member 2 is again driven by the driving pressure on the lugs 34. As the hammer member 3 is accelerated under the drive of the tool motor centrifugal force again operates on the fly-weights 28 swinging them outwardly and causing the rods 18 to be projected into the slots 26, 27 to deliver further rotational hammer blows on the anvil member 2 at the abutments to further tighten or loosen the nut or bolt being driven by the tool. The impact action of the clutch repeats automatically and rapidly as long as the tool remains applied to nut or bolt being driven. For a nut or bolt to be tightened, the tool remains applied to the nut or bolt until the desired tension is gained, whereupon the tool is removed from the work. For a nut or bolt to be unscrewed the tool remains applied to the nut or bolt until the same is loosened or removed as the case may require.

The dotted line showing in Fig. 4 shows the lugs 34 at one end of each recess 35 when the driving disc 15 has disengaged the rods 18 from the anvil member 2 and is beginning to accelerate the hammer member 3. As previously mentioned in response to this action, centrifugal force swings the fly-weights outwardly and moves their lugs 34 into the deeper portions *b* of recesses 35 in the disc 15 to engage the rods 18 with the anvil member 2. In the reverse rotation of the tool motor, the lugs 34 are moved towards the opposite ends of the recesses 35 at *d* to again accelerate the hammer member 3 and decrease any breaking action of the rods 18 against the anvil member 2.

When the lugs 34 are at the ends *d* of the recesses 35 the rods 18 are completely withdrawn from the slots 26, 27 in the anvil member 2 as shown in the raised or withdrawn positions of the rods 18 in the broken line positions in Fig. 1. At such time the driving pressure of the disc 15 on the lugs 34 holds the lower ends of the rods 18 out of rubbing contact with the anvil wall 25 to avoid the breaking action above referred to. Hence, undue friction is avoided and the high efficiency of the tool is assured. The nut or bolt to be driven is marked 36 in Fig. 1.

Inasmuch as the impact rods are mounted in the hammer member for rotation relative thereto, different impacting faces of the impact rods are presented to the abutments at the ends of the slots upon each successive impact. This eliminates the concentration of wear at certain points on the impacting surfaces as is the case where impacting jaws are fixed relative to each other on both the anvil and the hammer member. This rotation of the impact rods is accomplished prior to impact by frictional engagement of the rods with the anvil. The impact rods 18 after relative rotation between the hammer member and the anvil has recommenced, are moved downwardly by the fly-weights 28 so that the lower ends of the impact rods engage the top surface of the anvil and slide therealong in frictional contact therewith. The respective rods 18 and the respective slots 24 are spaced at different distances from the axis of rotation of the hammer

and anvil and consequently the rods slide along in frictional contact with the anvil until they are in registry with their respective slots. When this registry has been established, the rods 18 move down and forwardly against the opposite ends of the respective slots for impacting engagement. As shown in Fig. 3, when the impact rods 18 slide over the slots 24 with which they are not in registry, a small fraction of their lower surfaces engages the marginal portions of the anvil adjacent those slots, and consequently a portion of the lower surfaces of the rods overhang these slots. Since the rods are therefore in frictional contact with the anvil at those marginal portions of the slots with only a portion of their end surfaces, continued movement of the rods as the hammer rotates will effect their rotation relative to the hammer, the contact of the rods with the anvil being off center.

For larger heavy duty tools, we propose the arrangement shown in Fig. 8. Here, the fly-weight 28*a* has a rotative bearing collar 37 or equivalent on its upper lug 38 to reduce friction between the lug and engaged edge of the recess 35*a* in the disc 15*a* of the clutch driver 1*a*. Also, the anvil member 2*a* is mounted on an antifriction bearing 39 interposed between the hammer member 3*a* and the anvil member 2*a*. Otherwise, the parts are substantially the same as hereinbefore described and shown.

Returning now to the collar element 33, the latter has a tight or pressed fit on the hammer member 3 in enclosing relation to the cross-slot 19 and extending slightly beyond the upper end of the hammer member 3 against which the disc 15 has bearing as shown at *e*, *e* in Fig. 2. It is at these points that the lugs 34 on the fly-weights 28 extend axially beyond the hammer member 3 and into the recesses 35 in the disc 15 as shown.

The disc 15 has a peripheral groove 40 to receive a flange structure 41 on the inner side of the collar element 33 as shown in Figs. 1 and 2. This flange structure 41 provides a guide for the disc 15 and is interrupted so that lugs 34 may enter the recesses 35 in Fig. 4. Hence, the lugs 34 on the fly-weights 28 may contact the inner surface of the collar element 33 to support the fly-weights 28 against the pressure thereon when driving the hammer member 3 relatively to the anvil member 2.

The outer surfaces *f*, *f* of the fly-weights 28 on the lugs 34 conform to the inner circular contour *g* of the collar 33 between the flanges 41 to effectively support the fly-weights under the driving pressure of the disc 15 thereon and relieve the pivot pins 32 of a shearing strain.

It will be noted that the pins 32 have their opposite ends in contact with the inner surface of the collar 33 in Fig. 5, and that the ends of the pins are conical so that this contact will take place in any rotative position the pins may assume. This contact of the pins 32 with the collar 33 holds the pins 32 in place and against the forces set up in the operation of the clutch device, that is, against centrifugal force in the rotation of the hammer member and against vibration in the hammering or impact action of the rods 18 on the abutments 23 or 24.

The collar 33 is held from rotation on the hammer member 3 by the tight fit thereon and by the tongues 42 on the collar member interlocking with lugs or integral projections 43 on the hammer member on opposite sides of the fly-weights 28 as shown in Figs. 6 and 7. To accomplish this locking result, the tongues 42 fit into slots 44

formed between the lugs 43 as detailed in Fig. 7. The tongues 42 are diametrically arranged on the collar element 33 and the slots 44 have a complementary disposition on the hammer member 3. The lugs 43 are interrupted at the chambers 29 so that collar member 33 does not hinder the outwardly swinging movement of the fly-weights 28 by centrifugal force. This is apparent from the showing in Figs. 2 and 6.

The impact clutch of our invention is simple and inexpensive in construction and is adapted by its compact and unitary assembly to be incorporated in the outer casing of a portable power operated tool as in Fig. 1. Moreover, with the impact elements 18 mounted for movement axially of the hammer member 3 and independently thereof the clutching and impact action of the clutch may take place at the opposed end portions of the hammer and the anvil members and relatively close to the cluth axis to produce an efficient and effective impact clutch construction for setting and removing nuts and bolts by power.

The details of construction and arrangement of parts shown and described may be variously changed and modified without departing from the spirit and scope of our invention, except as pointed out in the annexed claims.

We claim as our invention:

1. An impact clutch of the character described comprising, relatively rotatable axially aligned, driving, hammer and anvil members, the hammer and the anvil members having axially opposed wall portions with abutments on the axially opposed wall portion of the anvil member, impact means carried by and movable independently of the hammer member into and out of the path of the abutments on the axially opposed wall portion of the anvil member for clutching and declutching said last two members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of said last two members, centrifugally responsive means carried by the hammer member for moving the impact means into the path of said abutments, cam means on the driving member for moving the impact means out of the path of said abutments, and means for rotating the driving member.

2. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said members having axially opposed end wall portions with abutments on the end wall portion of the anvil member, impact rods slidably mounted in the hammer member in substantially parallel relation to said axis, said rods being supported by the hammer member for the greater portions of their lengths and movable through the end wall portion of the hammer member into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member in the relative rotation of the two members, centrifugally responsive means for moving the impact rods into the path of said abutments, cam means for moving the impact rods out of the path of said abutments, and means for rotating the hammer member.

3. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said members having axially opposed end wall portions with abutments on the end wall

portion of the anvil member, impact rods slidably mounted in the hammer member and movable substantially parallel to said axis into and out of the path of the abutments on the end wall portion of the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, centrifugally responsive fly-weights pivoted on the hammer member for moving the rods into the path of the abutments, means for moving the rods out of the path of said abutments, and means for rotating the hammer member.

4. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said members having axially opposed end wall portions with abutments on the end wall portion of the anvil member, impact rods slidably mounted in the hammer member on opposite sides of said axis and movable substantially parallel thereto into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, a cross-member connecting said rods, centrifugally responsive fly-weights pivoted on the hammer member and acting on said cross-member for moving the rods into the path of said abutments, means for moving the rods out of the path of said abutments, and means for rotating the hammer member.

5. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said members having axially opposed end wall portions with abutments on the end wall portion of the anvil member, impact rods slidably mounted in the hammer member on opposite sides of said axis and movable substantially parallel thereto into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, a cross-member connecting said rods and having a rotative connection therewith, centrifugally responsive fly-weights pivoted on the hammer member and acting on said cross-member for moving the rods into the path of said abutments, means for moving the rods out of the path of said abutments, and means for rotating the hammer member.

6. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said members having axially opposed end wall portions with abutments on the end wall portion of the anvil member, impact rods slidably mounted in the hammer member on opposite sides of said axis and movable substantially parallel thereto into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, a cross-member connecting said rods, centrifugally responsive fly-weights pivoted on the hammer member and operable on said cross-member for moving the rods into the path of said abutments, means for moving the rods out of the path of said abutments, and means for rotating the hammer member, said cross-member having bifurcations engaging reduced portions of the rods.

7. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said members having axially opposed end wall portions with abutments on the end wall portion of the anvil member, impact rods slidably mounted on the hammer member on opposite sides of said axis and movable substantially parallel thereto into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of said two members, a cross-member connecting said rods, centrifugally responsive fly-weights pivoted on the hammer member on opposite sides of said cross-member and engaging the same for moving the rods into the path of said abutments, means acting on the fly-weights for moving the rods out of the path of said abutments and means for rotating the hammer member.

8. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said members having axially opposed end wall portions with abutments on the end wall portion of the anvil member, impact rods slidably mounted in the hammer member and movable substantially parallel to said axis into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, centrifugally responsive fly-weights pivoted on the hammer member for moving said rods into the path of said abutments, lugs on the fly-weights, and driving means operating on said lugs for withdrawing the rods out of the path of said abutments and for rotating the hammer member.

9. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said anvil member having abutments on its portion opposed to the hammer member, impact means carried by the hammer member and movable independently thereof into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, centrifugally responsive fly-weights pivoted on the hammer member on pivoted pins disposed transversely to and on opposite sides of said axis for moving the impact means into the path of said abutments, anchoring means for said pins, means for moving the fly-weights out of the path of said abutments, and means for rotating the hammer member.

10. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said anvil member having abutments on its portion opposed to the hammer member, impact means carried by the hammer member and movable independently thereof into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, centrifugally responsive fly-weights pivoted on the hammer member on pivot pins at substantially right angles to said axis for moving the impact means

into the path of said abutments, a sleeve element fitted on the hammer member about the ends of said pins for anchoring the same in the hammer member, means for moving the fly-weights in the opposite direction to withdraw the impact means out of the path of said abutments, and means for rotating the hammer member.

11. An impact clutch of the character described comprising, relatively rotatable hammer and anvil members arranged for rotation about a common axis, said anvil member having abutments on its portion opposed to the hammer member, impact means carried by the hammer member and movable independently thereof into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, centrifugally responsive fly-weights pivoted on the hammer member on pivot pins at substantially right angles to said axis for moving the impact means into the path of said abutments, a sleeve element fitted on the hammer member about the ends of said pins for anchoring the same in the hammer member, an interfitting connection between the hammer member and the sleeve for holding the latter against rotation on the hammer member, means for moving the fly-weights in the opposite direction to withdraw the impact means out of the path of said abutments, and means for rotating the hammer member.

12. An impact clutch of the character described comprising, relatively rotatable, axially aligned, hammer and anvil members having axially opposed wall portions with abutments on the axially opposed wall portion of the anvil member, impact rods slidably mounted in the hammer member and movable substantially parallel to said axis into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, centrifugally responsive means carried by the hammer member for moving the rods into the path of said abutments, means for moving the rods out of the path of said abutments, and means for rotating the hammer member, said rods and said abutments being arranged to provide for a predetermined number of impacts per revolution of the hammer member.

13. An impact clutch of the character described comprising, relatively rotatable, axially aligned, hammer and anvil members having axially opposed end wall portions with arcuate slots in the end wall portion of the anvil member and providing abutments at the ends of said slots, impact rods slidably mounted in the hammer member and movable axially thereof into and out of the path of the abutments as provided by said slots for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments, means for moving the rods into and out of said slots, and means for rotating the hammer member.

14. An impact clutch of the character described comprising, relatively rotatable, axially aligned, hammer and anvil members having axially opposed end wall portions with arcuate slots in the end wall portion of the anvil member and providing abutments at the ends of said slots, impact rods slidably mounted in the hammer member and movable axially thereof into and out of the path of the abutments as provided by said slots for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments, means for moving the rods into and out of said slots, means for rotating the hammer member, said rods and slots registering in one rotative position only of the hammer member relatively to the anvil member.

15. An impact clutch of the character described comprising, relatively rotatable, axially aligned, hammer and anvil members having axially opposed end wall portions with arcuate slots in the end wall portion of the anvil member and providing abutments at the ends of said slots, impact rods slidably mounted in the hammer member and movable axially thereof into and out of the path of the abutments as provided by said slots for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments, means for moving the rods into and out of said slots, and means for rotating the hammer member, said rods and slots being concentric to the clutch axis and disposed at different radial distances therefrom to register the rods with the slots in one rotative position only of the hammer member relatively to the anvil member.

16. An impact clutch of the character described comprising, relatively rotatable, axially aligned, driving, hammer and anvil members, said hammer and anvil members having abutments on the portion of the anvil member axially opposed to the hammer member, impact means carried by and movable axially of the hammer member into and out of the path of the abutments on the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, centrifugally responsive fly-weights pivoted on the hammer member for moving the impact means into the path of said abutments, said driving member having recesses therein provided with cam contours, said fly-weights having lugs coacting with said cam contours for withdrawing the impact means from the path of said abutments in the relative rotation of the driving and the hammer members, and means for rotating the driving member.

17. An impact clutch of the character described comprising, relatively rotatable, driving, hammer and anvil members, said anvil member having abutments, impact rods slidably mounted in the hammer member and movable axially thereof into and out of the path of said abutments to clutch and declutch the hammer and the anvil members and to impart rotational hammer blows on the anvil member in the relative rotation of said two members, centrifugally responsive means carried by the hammer member for moving the rods into the path of said abutments, and cam-means on the driving member for moving the rods out of the path of said abutments and exerting a driving pressure on the rods for holding the same out of the path of the abutments until moved by centrifugal force into the path of the same.

18. An impact clutch of the character described comprising, relatively rotatable driving, hammer and anvil members, impact means interposed between said hammer and anvil members to clutch and declutch the same and to impart rotational hammer blows on the anvil member in the rotation of the hammer member with respect to the anvil member, said impact means

including centrifugally responsive fly-weights pivoted on the hammer member for actuating said impact means, cam-recesses in the driving member and having relative deep and connected inclined portions to co-act with said fly-weights, and means for rotating the driving member.

19. An impact clutch of the character described comprising, relatively rotatable driving, hammer and anvil members, impact means interposed between said hammer and anvil members to clutch and declutch the same and to impart rotational hammer blows on the anvil member in the rotation of the hammer member with respect to the anvil member, said impact means including centrifugally responsive fly-weights pivoted on the hammer member to actuate said impact means, cam-means on the driving member for rotating the hammer member by exerting a driving pressure on the fly-weights, means on the hammer member to relieve the pivots of the fly-weights of said driving pressure, and means for rotating the driving member.

20. An impact clutch of the character described comprising, relatively rotatable driving, hammer and anvil members, impact means interposed between said hammer and anvil members to clutch and declutch the same and to impart rotational hammer blows on the anvil member in the relative rotation of the hammer and the anvil members, said impact means including a centrifugally responsive fly-weight pivoted on the hammer member to actuate said impact means and having an axially extending lug thereon, a revoluble bearing element on said lug, cam-means on the driving member and acting on the fly-weight through said bearing lug, and means for rotating the hammer member.

21. An impact clutch comprising, relatively rotatable hammer and anvil members, the anvil members having abutments thereon, impact means carried by the hammer member and movable into and out of the path of said abutments for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of the two members, centrifugally responsive fly-weights pivoted on the hammer member for moving the impact means into the path of said abutments, a driving member having cam-means operating on said fly-weights for moving the impact means out of the path of said abutments, and means for rotating the driving member, said cam-means acting on the ends of the fly-weights opposite to the ends thereof co-acting with said abutments.

22. In an impact clutch of the character described comprising, an operative assembly of relatively rotatable hammer and anvil members, means on the anvil member providing arcuate paths and associated abutments, impact means on said hammer member and movable independently thereof into and out of said paths and the abutments associated therewith for clutching and declutching said hammer and anvil members and for imparting rotational hammer blows on the anvil member at said abutments in the relative position of said two members, means for moving said impact means into and out of the paths of said abutments, and means for rotating said hammer member, said paths and associated abutments being arranged for the impact means to engage the abutments on one rotative position only of the hammer member relatively to the anvil member.

23. In an impact wrench, the combination of,

an operative assembly of relatively rotatable hammer, anvil and driving members, means providing abutments on the anvil member in opposition to the hammer member, impact means on the hammer member and movable relatively thereto into and out of the path of said abutments for clutching and declutching said hammer and anvil members and for imparting rotational impacts on the anvil member at the abutments in the relative rotation of the hammer and the anvil members, cam-means on the driving member and co-acting with said impact means for controlling the movement thereof into and out of the path of said abutments, said cam-means having means enabling centrifugal force to project the impact means into the path of said abutments and means responsive to the torque of the driving member to allow the latter to rotate ahead of the hammer member to withdraw the impact means out of the path of the abutments following an impact blow thereon.

24. In an impact wrench, the combination of, an operative assembly of relatively rotatable hammer, anvil and driving members, means providing abutments on the anvil member in opposition to the hammer member, impact means carried by and rotatable with the hammer member, said impact means being movable relatively to the hammer member into and out of the path of said abutments for clutching and declutching said hammer and anvil members and for imparting rotational impacts on the anvil member at the abutments in the relative rotation of the hammer and anvil members, said impact means being movable by centrifugal force into the path of said abutments, cam-means on the driving member and co-acting with said impact means for controlling the movement thereof with respect to said abutments, said cam-means cooperating with said centrifugal force and said driving member, respectively, whereby the hammer member may move ahead of the cam-means before impact of the impact means with the abutments so that the cam-means may move forwardly relatively to the hammer member after impact to positively withdraw the impact means from the path of said abutments, and means for rotating the driving member.

25. In an impact wrench, an assembly of relatively rotatable hammer, anvil and driving members, abutments on the anvil member in opposition to the hammer member, impact elements mounted on the hammer member and movable into and out of the path of said abutments to clutch and declutch the hammer and anvil members and to impart rotational hammer blows on the anvil member in the relative rotation of the two members, centrifugally responsive means carried by the hammer for moving the impact elements into the path of said abutments, and cam means on the driving member in engagement with the centrifugal means for moving the impact elements out of the path of said abutments after impact, said cam means having bearing surfaces engageable by said centrifugal means enabling the hammer member to rotate under centrifugal force ahead of the driving member before impact of the impact elements with the abutments by movement of said centrifugal means in one direction relative to and against said bearing surfaces and allowing the driving member to rotate ahead of the hammer member and impact elements by movement of said centrifugal means in the other direction relative to and against said bearing surfaces to with-

draw the impact elements out of the path of the abutments following the impact blow thereon.

26. An impact clutch of the character described comprising relatively rotatably hammer and anvil members, the hammer and the anvil members having opposed wall portions with abutments on the opposed wall portion of the anvil member, impact means carried by and movable independently of the hammer member into and out of the path of the abutments on the opposed wall portion of the anvil member for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments in the relative rotation of said members, centrifugally responsive means also carried by the hammer and pivoted thereto and operably connected with the impact means for moving the impact means into the path of said abutments, cam-means for moving the impact means out of the path of said abutments, and means for rotating the hammer member.

27. In an impact clutch of the character described, the combination of relatively rotatable, axially aligned hammer, anvil and driving members, means providing abutments on the anvil member in opposition to the hammer member, impact means rotatably mounted on said hammer member for rotation with and for rotation relative to said hammer member, said impact means being movable axially relative to the hammer member into and out of the path of said abutments for clutching and declutching said hammer and anvil members and for imparting rotational hammer blows on the anvil member at the abutments in the relative rotation of the hammer and anvil members and being rotatable relative to said hammer member prior to impacting engagement for presenting a different impacting face to said abutment upon each successive impact, means for moving the impact means into and out of the path of said abutments, and means for rotating the hammer member.

28. In an impact clutch of the character described, the combination of relatively rotatable, axially aligned hammer, anvil and driving members, means providing abutments on the anvil member in opposition to the hammer member, impact means rotatably mounted on said hammer member for rotation with and for rotation relative to said hammer member, said impact means being movable axially relative to the hammer member into and out of the path of said abutments for clutching and declutching said hammer and anvil members and for imparting rotational hammer blows on the anvil member at the abutments in the relative rotation of the hammer and anvil members, said anvil having means engageable with said impact means for effecting limited rotation thereof relative to the hammer member prior to impacting engagement to cause said impact means to present a different impact face to said abutment upon each successive impact, means for moving the impact means into and out of the path of the abutments, and means for rotating the hammer member.

29. An impact clutch of the character described, comprising relatively rotatable, axially aligned hammer and anvil members having axially opposed wall portions with arcuate slots in the end wall portion of the anvil member and providing abutments at the ends of the slots, impact rods rotatably and slidably mounted on said hammer member for rotation with and for rotation relative to said hammer member and for axial movement thereof into and out of the path of the abutments for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments, each impact rod being adapted to register with one respective slot and to overhang and frictionally engage with a portion of its end the marginal portion of another slot with which it is out of registry whereby said rods will be rotated prior to impact relative to the hammer member to cause said rods to present different impacting faces to said abutments upon each successive impact, means for moving the impact rods into and out of the path of the abutments, and means for rotating the hammer member.

30. An impact clutch of the character described comprising relatively rotatable, axially aligned hammer and anvil members having axially opposed end wall portions with arcuate slots in the end wall portion of the anvil member and providing abutments at the ends of the slots, impact rods slidably mounted in the hammer member and movable axially thereof into and out of the path of the abutments as provided by said slots for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments, said abutments and rods having impacting faces adapted to be engaged upon impact and said impacting faces being disposed in parallel planes which are parallel with the axis of said hammer and anvil, means for moving the rods into and out of said slots, and means for rotating the hammer member.

31. An impact clutch of the character described comprising relatively rotatable, axially aligned hammer and anvil members having axially opposed end wall portions with arcuate slots in the end wall portion of the anvil member and providing abutments in the ends of the slots, impact rods slidably mounted in the hammer member and movable axially thereof into and out of the path of the abutments as provided by said slots for clutching and declutching said members and for imparting rotational hammer blows on the anvil member at said abutments, means for moving the rods into and out of the slots, said means operating on the end portions of the rods opposite the ends thereof which are engageable with the anvil member, and means for rotating the hammer member.

WALTER G. MITCHELL.
LOUIS P. FOSNOT.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,730,890	Kaisser	Oct. 8, 1929
2,196,589	Jimerson	Apr. 9, 1940
2,219,865	Fitch	Oct. 29, 1940
2,219,883	Amtsberg	Oct. 29, 1940
2,326,347	Forss	Aug. 10, 1943
2,339,530	Van Sittert	Jan. 18, 1944
2,339,531	Van Sittert	Jan. 18, 1944