Dec. 30, 1941. M. J. McCOMBS 2,268,412

ROTARY IMPACT TOOL

Filed March 3, 1941

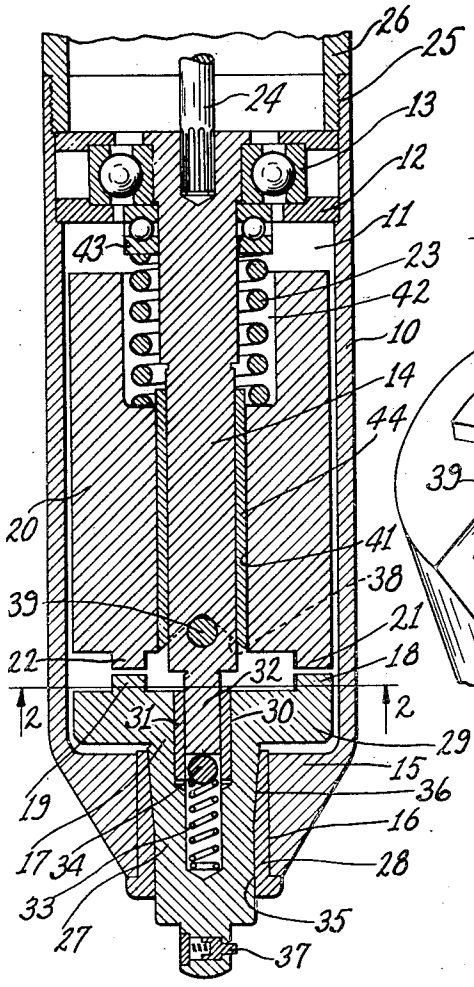


Fig.1

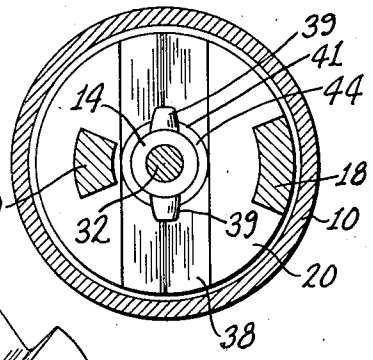


Fig.2

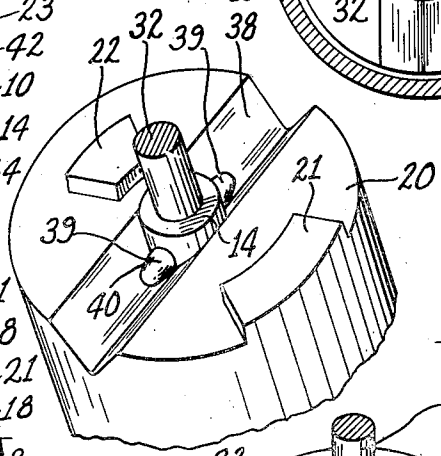


Fig.3

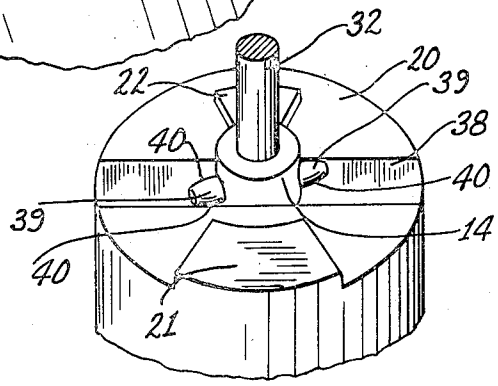


Fig.4

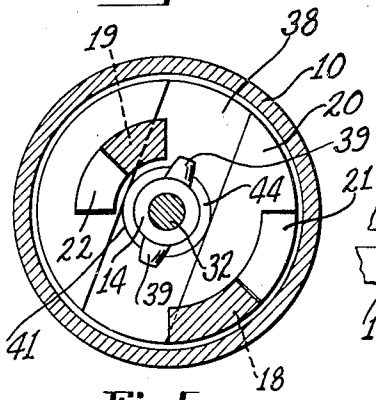


Fig.5

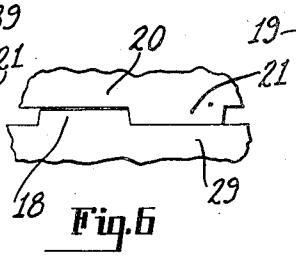


Fig.6

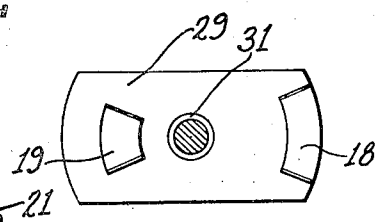


Fig.7

INVENTOR
MELVORNE J. McCOMBS

BY Edmund Reed
ATTORNEY

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ROTARY IMPACT TOOL

Melvorne J. McCombs, Dayton, Ohio, assignor to The Buckeye Portable Tool Company, Dayton, Ohio, a corporation of Ohio

Application March 3, 1941, Serial No. 381,415

15 Claims. (Cl. 192—30.5)

This invention relates to a rotary impact tool of the type used for setting nuts, driving screws and for like purposes, and is a continuation in part of application Serial No. 297,538, filed by me October 2, 1939, now abandoned.

One object of the invention is to provide a rotary impact tool which can be constructed and operated at low cost.

A further object of the invention is to provide such a tool the operation of which will depend wholly on the weight of the rotating mass or hammer, the speed of rotation of said mass and the distance of the point of impact from the axis of rotation, and which will require for its operation only sufficient power to rotate said mass at the desired speed.

A further object of the invention is to provide such a tool which can be operated by power so small as to eliminate all danger of injury to the operator should the tool stall or otherwise fail to operate.

A further object of the invention is to provide such a tool which will operate smoothly and will transmit little or no vibration or shock to the operator.

A further object of the invention is to provide such a tool with an operating connection between the shaft and the hammer which will operate smoothly with a minimum of friction and vibration.

A further object of the invention is to provide such a tool in which the hammer will make a complete rotation between successive impacts.

A further object of the invention is to provide such a tool which can be quickly and easily connected with the nut or other part to be driven.

A further object of the invention is to provide such a tool with an anvil which has a relatively small inertia in proportion to its strength.

A further object of the invention is to provide such a tool which will be of small size and light weight with respect to the work to be performed.

Other objects of the invention may appear as the tool is described in detail.

In the accompanying drawing Fig. 1 is a longitudinal section taken centrally through a tool embodying my invention; Fig. 2 is a transverse section taken on the line 2—2 of Fig. 1 looking in the direction of the arrows; Fig. 3 is a perspective view of the forward ends of the hammer and drive shaft, showing the parts in their normal positions; Fig. 4 is a perspective view of the forward ends of the hammer and drive shaft showing the relation of the parts when the hammer has been cammed rearwardly; Fig. 5 is a view similar to Fig. 2, showing the jaws of the hammer and anvil in contact; Fig. 6 is a side elevation of portions of the hammer and anvil showing the beveled contact ends of the jaws; and Fig. 7 is a plan view of an anvil.

In the drawing I have illustrated the preferred embodiment of my invention but it will be understood that this embodiment has been chosen for the purposes of illustration only and that the mechanism of the tool may take various forms and arrangements without departing from the spirit of the invention.

That embodiment of the invention here illustrated comprises a casing 10 having within the same a cylindrical work chamber 11. This chamber is closed at its rear end by an annular structure 12 which supports a ball bearing 13 in which is mounted a shaft 14 which extends for substantially the full length of the work chamber. The forward end of the work chamber is closed by an end wall 15 having a bearing 16 in which is mounted an anvil 17 provided with rearwardly extending jaws 18 and 19.

A hammer 20 is mounted on the drive shaft 14 for rotation therewith and for axial movement and rotatory movement with relation thereto and is provided with forwardly extending jaws 21 and 22 adapted to cooperate respectively with the jaws 18 and 19 of the anvil. The shaft and hammer are provided with cooperating parts, to be hereinafter described, for supporting the hammer on the shaft, causing it to rotate with the shaft and camming the same rearwardly to disengage the jaws of the hammer from the jaws of the anvil when excessive resistance is offered to the rotation of the hammer. A spring 23 acts on the hammer to move the same to its foremost position and to retain the cooperating parts in contact one with the other. The drive shaft 14 may be driven from any suitable source of power and may be connected therewith in any desired manner, as by a direct connection, reducing gearing or a flexible shaft. In many tools of this type a motor is mounted in and made a part of the tool itself and, in the present instance, the shaft is shown as being rigidly connected with a small diameter shaft 24 adapted to be connected with a motor carried by the tool, and the casing 10 is provided, to the rear of the closure 12, with a screw threaded portion 25 to which is attached a motor casing 26.

Preferably the jaws on the hammer and the anvil are so arranged that when the hammer jaws are disengaged from the anvil jaws the hammer will make substantially a full rotation

and acquire a relatively high momentum before the hammer jaws again engage the anvil. In the present construction the hammer and the anvil are each provided with an outer jaw and an inner jaw located on opposite sides of the axis of rotation and so arranged that the inner jaw of each member may pass between the outer jaw of the other member and the drive shaft and engage the inner jaw of said other member simultaneously with the engagement of the two outer jaws. In the form illustrated the outer jaws, 21 and 18, are arranged at the periphery of their respective supporting members and are of relatively narrow radial width so that their inner arcuate surfaces are spaced substantial distances from the axis of rotation. The inner jaws, 22 and 19, are spaced inwardly from the peripheries of the respective supporting members distances slightly greater than the width of the outer jaws, so that their arcuate outer surfaces will just clear the inner surfaces of the respective outer jaws. Thus when the hammer has been cammed rearwardly the hammer jaws will ride over the corresponding anvil jaws and when they have passed the latter will be returned, by the spring 23, to their normal operative positions but will not again engage the anvil jaws until the hammer has completed a full rotation.

The anvil 17 comprises a shank 27 rotatably mounted in the bearing 16, which in the present instance is provided with a bushing 28, and a head 29 arranged in the forward portion of the chamber and to the rear face of which the jaws 18 and 19 are secured, preferably by forming them integrally therewith. This head may be of the usual circular form or it may be of the form shown in Fig. 7, where the anvil head is shown as of a relatively narrow elongate construction. Such a construction is desirable because it materially reduces the weight of the anvil in proportion to its strength and thus reduces the amount of inertia to be overcome by the hammer. The anvil is provided with an axial recess 30 the rear portion of which is provided with a bushing 31 in which the reduced forward end portion 32 of the shaft 14 is mounted for rotatory and axial movement, the recess serving to maintain the shaft in axial alinement with the anvil. The anvil is preferably so mounted as to be capable of axial movement as well as rotary movement and is held normally in its foremost position, with its jaws out of the plane of rotation of the hammer jaws, by a suitable spring. In the present instance, the recess 30 in the anvil is extended forwardly beyond the bushing 31 and a spring 33 is confined therein between the forward end of the recess and the end of the shaft, a contact member adapted to have a relatively small contact with the end of the shaft, such as a ball 34, being interposed between the rear end of the spring and the end portion 32 of the shaft. This spring thus acts on the shaft and the anvil to retain the latter in its foremost position without offering appreciable resistance to the rotation of the shaft.

The shank 27 of the anvil extends forwardly beyond the bearing 16 and is adapted to be connected with the implement to be operated. In the present instance, it is provided with means 37 for securing thereto a socket wrench, screw driver or the like, not shown. This implement will be herein referred to as a socket wrench adapted to set a nut, for convenience of reference but without the intent to limit the character of the tool used. In the use of a tool of this kind it is customary to engage the socket with the nut by slipping it over the nut and rotating the tool as a whole and the socket until the nut enters the socket of the wrench. Often the contact of the socket with the nut so resists the rotation of the socket and anvil that the casing will rotate with relation thereto, thus making the placing of the socket in operative position on the nut difficult. To avoid this difficulty I have provided means for resisting the rotation of the casing with relation to the anvil so long as the anvil is in its foremost position and for releasing the anvil for free rotation with relation to the casing when the anvil has been moved rearwardly from its foremost position. In the arrangement shown the bushing 28 of the bearing 16 is formed with a cylindrical forward portion 35 and a tapered rear portion 36. The forward portion of the shank of the anvil is cylindrical and has proper bearing contact in the cylindrical portion of the bearing, and the rear portion of the shank is tapered to conform to the taper 36 of the bearing. Thus when the anvil is pressed to its foremost position by the spring 33 the tapered portion of the shank will have wedging contact with the tapered portion of the bearing and the resulting friction will strongly resist any rotation of the bearing with relation to the shank. When the anvil has been pushed rearwardly to jaw engaging position the tapered portions of the shank and bearing are disengaged so that the anvil has free rotation in the bearing, and the cylindrical portion of the shank is of such length that it will have proper bearing support in the cylindrical part of the bearing when the anvil is in its rearmost operating position. The jaws of the hammer and anvil are usually brought into cooperative relation, that is, into the same plane of rotation, by placing the wrench in engagement with the nut and then exerting a downward pressure on the tool which results in the casing of the tool moving forwardly with relation to the anvil and the hammer jaws moving into the plane of rotation of the anvil jaws. While this movement is in fact a movement of the casing with relation to the anvil it will, for convenience of reference, be herein referred to as the axial movement of the anvil.

For the purpose of providing the operating connection between the driving shaft 14 and the hammer 20 the latter is provided in its lower end with forwardly facing recesses arranged on opposite sides of the shaft and each having that wall thereof which is foremost in the direction of rotation of the shaft inclined rearwardly with relation to said direction of rotation. Parts, such as studs, are rigidly secured to the shaft and extend into the respective recesses where they have supporting and camming engagement with the walls of the recesses. In the preferred construction the hammer is provided in its forward end with a forwardly facing groove 38 extending diametrically thereof and of an inverted V-shape. The end portions of this groove constitute the two recesses and the converging side walls thereof constitute cam surfaces with one or the other of which the studs cooperate. The studs are shown at 39 as the projecting end portions of a pin which is rigidly mounted in the shaft. These end portions are tapered outwardly and their contact surfaces are curved about transverse axes as shown at 40 to provide narrow surfaces to contact with the inclined walls of the groove and thus reduce friction to a minimum. The hammer is held normally in its foremost position by the

spring 23 and when in that position the studs 39 are seated in the apex of the V-shaped groove. So long as no substantial resistance is offered to the rotation of the hammer the contact of the studs with the inclined walls of the groove will cause the hammer to rotate with the shaft without displacing the studs from the apex of the groove, but if substantial resistance is offered to the rotation of the hammer, as by the tightening down of the nut, the foremost inclined surfaces of the groove will ride over the respective studs and the hammer will be cammed rearwardly so as to disengage the hammer jaws from the anvil jaws, thus permitting the hammer jaws to move over the anvil jaws. As soon as the hammer jaws have passed the anvil jaws the spring will force the hammer forwardly to its normal position and during this axial movement of the hammer the inclined surfaces of the groove acting on the studs will cause the hammer to rotate at a slightly greater speed than the shaft so as to quickly restore the groove to its normal position with relation to the studs. This restoration takes place quickly after the hammer jaws have passed beyond the anvil jaws and the continued rotation of the shaft and hammer imparts to the latter a high momentum before the hammer jaws again engage the anvil jaws. The arrangement of the studs and inclined walls is such that the studs move freely and smoothly over the inclined walls with but little friction and the shock due to the impact of the jaws is so absorbed that very little shock or vibration is transmitted to the operator. The camming action of the studs on the inclined walls will move the hammer rearwardly and disengage the jaws when the contact faces of the jaws are perpendicular but it is preferable to slightly incline the jaw faces so as to expedite the movement of the hammer jaws over the anvil jaws. A further advantage of the converging walls of the recesses or grooves is that this arrangement makes the tool reversible and the hammer will operate with the same efficiency when the drive shaft is rotated in either direction.

The weight of the hammer will be determined in accordance with the work for which the tool is designed but in any event it is desirable that the hammer should be as compact as is possible consistent with its weight, so as not to unnecessarily enlarge the size of the casing. In the present instance, the cylindrical weight 20 is of a diameter approximating the diameter of the work chamber, just enough clearance being left to prevent the contact of the hammer with the casing. The length of the hammer approximates the distance between the anvil and the rear closure 12 of the work chamber, sufficient space being left to the rear of the hammer to permit of its axial movement. The hammer is provided with a longitudinal small diameter opening 41 extending for the full length thereof and the rear portion of this opening is slightly enlarged to provide a relatively shallow recess 42 to receive the forward end of the spring 23, the rear end of which is seated against a ball bearing 43. That portion of the opening in front of the recess 42 has bearing contact with the shaft 14 and may, if desired, be provided with a bushing 44, which of course forms a part of the hammer. Thus the hammer occupies substantially all of the available space within the work chamber and can be made of the desired weight without increasing the size of the casing.

When the tool is to be used for driving a nut the socket is placed over the nut, usually while the hammer is rotating, and forward pressure is exerted on the tool as a whole to move the hammer forwardly with relation to the anvil and bring the hammer jaws into the plane of rotation of the anvil jaws. The contact of the hammer jaws with the anvil thus will cause the anvil to rotate with and at the same speed as the hammer so long as no substantial resistance is offered to the rotation. When excessive resistance is offered to the rotation of the anvil and therefore to the rotation of the hammer, as by the tightening of the nut, the hammer will be cammed rearwardly as above described to disengage the hammer jaws from the anvil jaws and the hammer jaws will pass over and beyond the anvil jaws and will move into the plane of rotation of the anvil jaws as soon as they have cleared the latter. The hammer will then rotate at the same speed as the shaft until the hammer jaws again engage the anvil jaws. This series of operations will continue until sufficient impacts have been imparted to the anvil to fully tighten the nut and the wrench is then removed from the nut. Usually the wrench is removed as soon as the nut is fully tightened but this is not essential because the hammer will continue to operate when the nut and therefore the anvil have ceased to rotate and no substantial shock will be transmitted to the operator and there is no danger of injury to the operator.

The construction and operation of the tool is such that it may be operated with very little power, the only power required being that necessary to rotate the hammer at the desired speed. Due to the construction and operation described the tool is not only highly efficient in its operation but can be produced at a relatively low cost, the relatively small number of parts thereof being of such a character that they can be cheaply manufactured. These parts are of such a character that the tool is of a very durable character and has a long life.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a rotary impact tool, a casing, an anvil rotatably mounted in the forward portion of said casing, having means for connecting the same with an implement to be operated and provided with rearwardly extending jaws, a drive shaft rotatably mounted in said casing in substantially axial alinement with said anvil and adapted to be connected with a source of power, a hammer mounted on said shaft for rotation therewith and for both axial and rotatory movement with relation thereto and provided with forwardly extending jaws to cooperate with the jaws on said anvil, said hammer having an axial opening to receive said shaft and being provided with a forwardly facing groove parts of which extend outwardly from opposite sides of said opening, each part of said groove having that wall thereof which is foremost in the direction of rotation of said shaft inclined rearwardly with relation to said direction of rotation, studs secured to said shaft, extending into the respective parts of said groove and having supporting engagement with the walls

thereof, said studs and said groove constituting the sole driving connection between said shaft and said hammer, and spring means acting on said hammer to hold the inclined walls thereof in contact with said studs and to yieldably resist the rearward movement of said hammer, whereby the contact of said studs with said inclined walls will cause said hammer to rotate with said shaft and will move said hammer rearwardly with relation to said shaft when excessive resistance is offered to the rotation of said hammer.

2. In a rotary impact tool, a casing, an anvil mounted in the forward portion of said casing for both rotatory movement and axial movement and having rearwardly extending jaws, means for yieldably retaining said anvil normally in its foremost position, a drive shaft rotatably mounted in said casing in substantially axial alinement with said anvil and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movements with relation to said shaft and provided with forwardly extending jaws arranged to cooperate with the jaws of said anvil only when the latter is in its rearmost position, said hammer having forwardly facing recesses adjacent to and spaced about said shaft, each recess having that wall thereof which is foremost in the direction of rotation of said shaft inclined rearwardly with relation to said direction of rotation, parts rigidly connected with said shaft, extending into the respective recesses and constituting the sole support for said hammer, and spring means acting on said hammer to hold the walls of said recesses in contact with said parts and to yieldably resist the rearward movement of said hammer, whereby the action of said parts on said inclined walls will cause said hammer to rotate normally at the speed of said shaft and will cam said hammer rearwardly with relation to said shaft when excessive resistance is offered to its rotation.

3. In a rotary impact tool, a casing, an anvil mounted in the forward portion of said casing for both rotatory movement and axial movement and having rearwardly extending jaws, means for yieldably retaining said anvil normally in its foremost position, a drive shaft rotatably mounted in said casing in substantially axial alinement with said anvil and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movement with relation to said shaft and provided with forwardly extending jaws arranged to cooperate with the jaws of said anvil only when the latter is in its rearmost position, said hammer having forwardly facing recesses adjacent to and spaced about said shaft, each recess having that wall thereof which is foremost in the direction of rotation of said shaft inclined rearwardly with relation to said direction of rotation, said hammer having an axial bearing of relatively small diameter through which the body of said shaft extends, studs rigidly secured to the body of said shaft, extending into the respective recesses and constituting the sole support for said hammer, and spring means acting on said hammer to maintain a yieldable driving contact between the inclined walls of said recesses and said studs which will permit said hammer to be moved rearwardly by said studs when excessive resistance is offered to the rotation thereof.

4. In a rotary impact tool, a casing, an anvil rotatably mounted in the forward portion of said casing, having means for connecting the same with an implement to be operated and provided with rearwardly extending jaws, a drive shaft rotatably mounted in said casing in substantially axial alinement with said anvil and adapted to be connected with a source of power, a hammer mounted on said shaft for rotation therewith and for both axial and rotatory movement with relation thereof and provided with forwardly extending jaws to cooperate with the jaws on said anvil, said hammer having an axial opening to receive said shaft and being provided with a forwardly facing groove parts of which extend outwardly from opposite sides of said opening, each part of said groove having that wall thereof which is foremost in the direction of rotation of said shaft inclined rearwardly with relation to said direction of rotation, studs secured to said shaft, extending into the respective parts of said groove and having round tapered end portions provided with contact surfaces curved outwardly about transverse axes to provide narrow contact with the inclined walls of said groove throughout the movement of said contact surfaces with relation to said walls, and spring means acting on said hammer to maintain driving contact between said inclined walls and said studs and to yieldably resist the rearward movement of said hammer.

5. In a rotary impact tool, a casing, an anvil mounted in the forward portion of said casing for both rotatory movement and axial movement and having rearwardly extending jaws, means for yieldably retaining said anvil normally in its foremost position, a drive shaft rotatably mounted in said casing in substantially axial alinement with said anvil and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movements with relation to said shaft and provided with forwardly extending jaws arranged to cooperate with the jaws of said anvil only when the latter is in its rearmost position, said hammer having forwardly facing recesses adjacent to and spaced about said shaft, each recess having that wall thereof which is foremost in the direction of rotation of said shaft inclined rearwardly with relation to said direction of rotation, parts rigidly connected with said shaft, extending into the respective recesses and constituting the sole support for said hammer, said parts having surfaces curved about intersecting axes to provide narrow contact with the inclined walls throughout the movement of said parts with relation to said walls, and spring means acting on said hammer to hold the walls of said recesses in contact with said parts and to yieldably resist the rearward movement of said hammer.

6. In a rotary impact tool, a casing, a drive shaft rotatably mounted in said casing and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movement with relation thereto and provided with forwardly extending jaws, said hammer having an axial bore to receive said shaft and a forwardly facing transverse groove intersecting said bore, said groove having on each side of said bore a wall inclined rearwardly with relation to the direction of rotation of said shaft, parts connected with said shaft for rotation therewith, extending into said groove and engaging said inclined walls thereof, spring means to yieldably

retain said hammer in engagement with said parts, said shaft having a part extending forwardly beyond said hammer, and an anvil mounted in the forward portion of said casing for both rotatory and axial movements and having an axial recess to receive said forwardly extending part of said shaft, said anvil having rearwardly extending jaws to cooperate with the jaws of said hammer and a spring mounted in said recess and acting on the end of said shaft to move said anvil to its foremost position.

7. In a rotary impact tool, a casing, a drive shaft rotatably mounted in said casing and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movements with relation thereto and provided with forwardly extending jaws, said hammer and said shaft having parts cooperating to support said hammer on said shaft and to cam said hammer rearwardly when excessive resistance is offered to its rotation, spring means to hold said hammer normally in its foremost position and to resist the rearward movement thereof, said shaft having a part extending forwardly beyond said hammer, said casing being provided at its forward end with a bearing having a cylindrical forward portion and a forwardly tapered rear portion, an anvil having a shank provided with a cylindrical portion and a forwardly tapered portion mounted in said bearing for both rotary movement and axial movement, said anvil also having a rearwardly facing axial recess in which said forwardly extending part of said shaft is rotatably supported, said recess being of such depth that said anvil may have rearward axial movement with relation to said shaft, said anvil also having rearwardly extending jaws movable into and out of the plane of rotation of said hammer jaws by the axial movement of said hammer, and a spring confined in said recess between the end wall thereof and said shaft to exert forward pressure on said anvil.

8. In a rotary impact tool, a casing, a drive shaft rotatably mounted in said casing and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movements with relation thereto and provided with forwardly extending jaws, said hammer and said shaft having parts cooperating to support said hammer on said shaft and to cam said hammer rearwardly when excessive resistance is offered to its rotation, spring means to yieldably retain said hammer in its foremost position, an anvil rotatably mounted in the forward portion of said casing, provided with rearwardly extending jaws and axially movable to move said jaws into and out of the plane of rotation of said hammer jaws, and means for yieldably retaining said anvil in its foremost position, said anvil and said casing having parts arranged to have wedging engagement one with the other to resist the rotation of said casing with relation to said anvil when said anvil is in its foremost position and to release said anvil for free rotation when it is moved rearwardly from said foremost position.

9. In a rotary impact tool, a casing, a drive shaft rotatably mounted in said casing and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movements with relation thereto and provided with forwardly extending jaws, said shaft and said hammer having interengaging parts to cam said hammer rearwardly with relation to said shaft when excessive resistance is offered to the rotation of said hammer, said casing being provided at its forward end with a bearing, an anvil having rearwardly extending jaws to cooperate with the jaws on said hammer and having a shank portion mounted in said bearing for both rotary movement and axial movement, said bearing and said shank having cooperating cylindrical portions arranged to rotatably support said anvil in all axial positions of the latter and having complementary forwardly tapered portions to the rear of said cylindrical portions and adapted to be brought into wedging engagement one with the other by the forward axial movement of said anvil to frictionally resist the relative rotation of said anvil and said bearing while said anvil is in its normal foremost position.

10. In a rotary impact tool, a casing, a drive shaft rotatably mounted in said casing and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movement with relation thereto and provided with a pair of forwardly extending jaws, said shaft and said hammer having interengaging parts arranged to cam said hammer rearwardly with relation to said shaft when excessive resistance is offered to the rotation of said hammer, an anvil rotatably mounted in the forward portion of said casing and having a pair of rearwardly extending jaws to cooperate with the corresponding jaws on said hammer, each pair of jaws comprising an outer jaw and an inner jaw, the inner jaw of each pair being so arranged and of such radial width that it will pass the outer jaw of the other pair between the latter and the axis of rotation of said hammer, whereby when said hammer is cammed rearwardly and the jaws thereof disengaged from the jaws of said anvil, said hammer will have made a full rotation and acquired high momentum before its jaws again engage the jaws of said anvil.

11. In a rotary impact tool, a casing, a drive shaft rotatably mounted in said casing and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movement with relation thereto and provided with a pair of forwardly extending jaws, said shaft and said hammer having interengaging parts arranged to cam said hammer rearwardly with relation to said shaft when excessive resistance is offered to the rotation of said hammer, an anvil rotatably mounted in the forward portion of said casing and having a pair of rearwardly extending jaws to cooperate with the corresponding jaws on said hammer, each pair of jaws comprising a relatively narrow outer jaw adjacent the periphery of its supporting member and having an arcuate inner surface spaced a substantial distance from the axis of rotation of said hammer, and an inner jaw adjacent said axis and having an arcuate outer surface, said outer surface of said inner jaw of each pair of jaws being spaced from said axis a radial distance slightly less than the radial distance between said axis and the inner surface of the outer jaw of the other pair of jaws, whereby said hammer is caused to make a full rotation between successive impacts of said jaws.

12. In an impact tool, a casing having a cylindrical work chamber provided with front and

rear closures, said closures having alined bearings, an anvil rotatably mounted in the front bearing and having a head in the forward portion of said work chamber, said head being provided with rearwardly extending jaws and an axial bearing recess, a shaft rotatably mounted in the rear bearing and having a part extending into the bearing recess in said anvil, a cylindrical hammer mounted on said shaft for rotation therewith and for both axial and rotatory movements with relation thereto and having forwardly extending jaws to cooperate with the jaws on said anvil, said shaft and said hammer having cooperating parts to drivingly connect the same and shaped to cam said hammer rearwardly with relation to said shaft when excessive resistance is offered to the rotation of said hammer, and a spring confined between said hammer and said rear closure to maintain said parts in operative relation, said hammer being of a diameter approximating the diameter of said chamber and of a length approximating the distance between said anvil and said rear closure, said hammer being normally spaced from said rear closure a relatively short distance sufficient only to permit said axial movement thereof with relation to said shaft, said hammer having a small diameter axial opening extending for the full length thereof, the rear end of said opening being slightly enlarged to form a relatively shallow recess to receive the end of said spring, and the wall of that portion of said opening in front of said recess having bearing contact with said shaft.

13. In a rotary impact tool, a casing, a drive shaft rotatably mounted in said casing and adapted to be connected with a source of power, a hammer supported by said shaft for rotation therewith and for both axial and rotatory movements with relation thereto and provided with forwardly extending jaws, said hammer and said shaft having part cooperating to support said hammer on said shaft and to cam said hammer rearwardly when excessive resistance is offered to its rotation, spring means to yieldably retain said hammer in its foremost position, a bearing in the forward portion of said casing, and an anvil having a shank rotatably mounted in said bearing and a relatively narrow elongate head arranged in the forward portion of said casing and provided with rearwardly extending jaws opposed to the jaws of said hammer.

14. In a rotary impact tool, a casing, an anvil rotatably mounted in the forward portion of said casing having means for connecting the same with an implement to be operated and provided with rearwardly extending jaws, a drive shaft rotatably mounted in said casing in substantially axial alinement with said anvil and adapted to be connected with a source of power, a hammer mounted on said shaft for rotation therewith and for both axial and rotatory movement with relation thereto and provided with forwardly extending jaws to cooperate with the jaws on said anvil, said hammer having a plurality of forwardly facing radial recesses substantially V-shaped in cross section, studs rigidly secured to said shaft, extending into the respective recesses and having supporting and driving engagement with the walls thereof, and spring means acting on said hammer to hold the walls of said recesses in contact with said studs and to yieldably resist the rearward movement of said hammer, whereby the contact of said studs with the inclined walls of said recesses will cause said hammer to rotate with said shaft and will move said hammer rearwardly with relation to said shaft when excessive resistance is offered to the rotation of said hammer.

15. In a rotary impact tool, a casing, a drive shaft rotatably mounted in said casing and adapted to be connected with a source of power, a bearing near one end of said casing, an anvil comprising a shank rotatably mounted in said bearing and a narrow elongate head arranged in said casing and having a part constituting a jaw, and an axially yieldable impact element rotatably mounted in said casing, connected with said shaft for rotation thereby and having a part arranged to engage said jaw and impart rotatory movement to said anvil and to yield axially and move over said paw when excessive resistance is offered to the rotation of said anvil.

MELVORNE J. McCOMBS.