Oct. 31, 1961 W. H. MOORHEAD 3,006,202

ROTARY AND PERCUSSIVE TOOL

Filed March 17, 1958

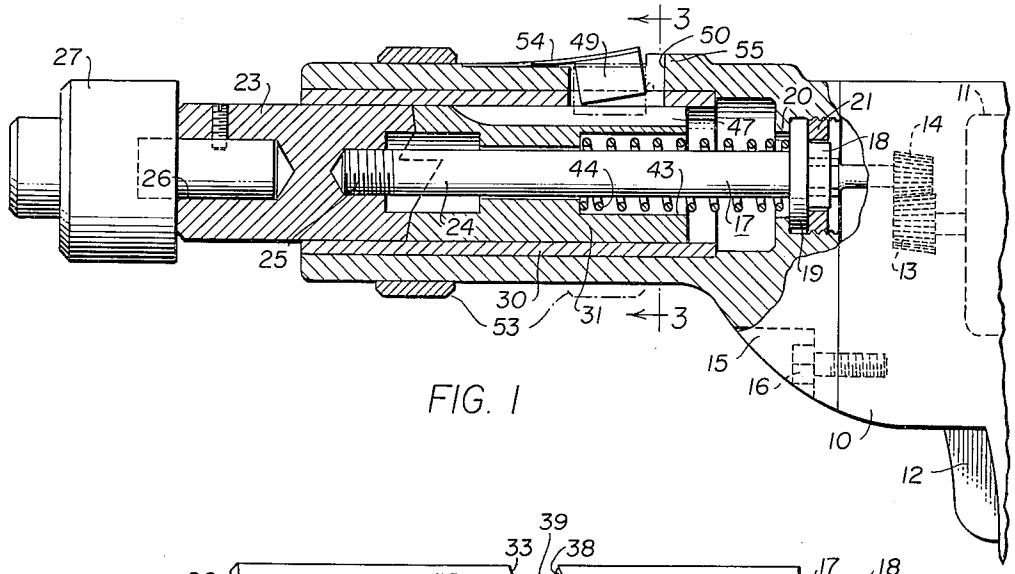


FIG. 1

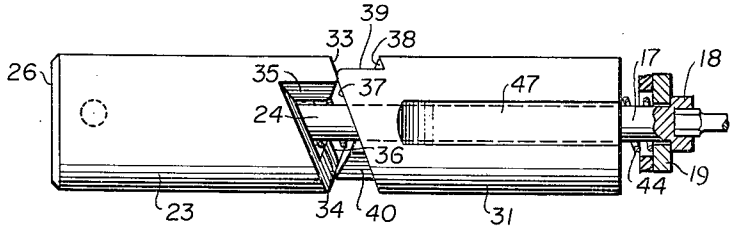


FIG. 2

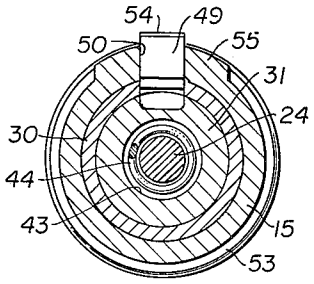


FIG. 3

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ROTARY AND PERCUSSIVE TOOL

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This invention relates to rotary percussive tools and more particularly to a rotary drill which may be used for either ordinary rotary drilling or rotary percussive drilling.

United States Patent Number 2,518,429 issued August 8, 1950, to Walter H. Moorhead for a percussive tool appliance discloses a device which may be connected to an ordinary electric drill, or the like, to selectively provide a rotating drive or a rotating impact drive for a drill bit. That device has a shaft which forms a through connection from the drive source to the drill bit or other work tool. A cam is formed between the tool holder and the drive connection end of the shaft, and a cam follower is interposed between the cam and the drive connection end. A spring urges the cam follower into resilient contact with the cam. A housing surrounds the cam follower, and the housing and the cam follower are fixed against relative rotation. Normally, the housing and the cam follower rotate with the shaft. However, the housing may be selectively held against rotation which selective holding also prevents the follower from rotating.

When the follower is held in a nonrotating position and the shaft is rotated, coaction of the cam follower and cam causes the follower to reciprocate against the action of the spring. The follower rides up on the cam surface until an abrupt axially extending shoulder at an end of the surface is reached. When the follower rides over this shoulder, it is driven down against the cam by the action of the spring to impart an impact to the cam and hence to the tool. The impact facilitates drilling of such materials as concrete and bricks.

One of the principal objects of the present invention is to incorporate a drive motor and a tool of a type disclosed in the above referenced patent in a single unitary tool which is selectively either a rotary drill or a rotary impact drill.

Another object of the invention is to provide a novel and improved device in which continuous rotation of a drill is provided and in which selective impacting can be obtained by placing a selector device in one of two adjustment positions.

The last mentioned object may be achieved by modifying the housing of the mentioned patent by fixing it to the cage of an electric drill. An adjustable selector is carried by either the follower member or the housing member. The selector is selectively connectable to the other of the members to prevent relative rotation of the members.

Another object of the invention is to provide a device made in accordance with the foregoing objectives in which a selector finger or key is carried by the housing and urged by a spring into contact with a longitudinally extending groove in the follower and in which a selector member selectively injects and retracts the key into and out of the slot.

A further object of the invention is to provide a novel and improved rotary and percussive device in which selector means are provided in the form of a leaf spring fixed to a housing, a key fixed to the leaf spring and insertable in and retractable from a slot formed in a cam follower carried in the housing, and in which an annular axially shiftable ring is peripherally carried by the housing, which ring may be shifted axially in one direction to flatten the leaf spring and force the key into the slot, and

which ring may also be shifted axially in the other direction to permit the leaf spring to retract the finger from the slot.

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

FIGURE 1 is a fragmentary sectional view of a unitary rotary and percussive drilling device;

FIGURE 2 is a plan view of the shaft including the cam, the cam follower carried by the shaft and in engagement with the cam, and a spring to urge the cam follower into engagement with the cam; and,

FIGURE 3 is a sectional view as seen from the plane indicated by the line 3—3 of FIGURE 1.

Referring to the drawings and to FIGURE 1, in particular, a rotary percussive tool is shown which has a motor cage **10**. A motor is housed in the cage **10**, a fragmentary section of the armature being shown at **11**. The motor cage may be shaped in the form of the well known pistol grip type hand drill with a trigger **12** provided to actuate the rotary and percussive device. The motor has a shaft **13** which imparts rotary force from the motor through a gear train **14** to the object being driven.

A housing **15** is suitably connected to the cage **10** as by cap screws **16**, only one of which is shown. A shaft **17** is journaled in the housing with one end **18** operably connected to the motor shaft **13** to receive rotational forces imparted from the motor. Adjacent the end **18**, the shaft **17** carries a washer **19** which serves to axially locate the shaft **17**. The axial location is accomplished by coaction of the washer **19** with a housing shoulder **20** and a locating nut **21** which is threaded into one end of the housing.

The shaft **17** has a cam part **23**. In the preferred and disclosed embodiment of the cam part **23** is a chuck cam which is threaded onto a shaft stem **24** at **25**. A tool holding portion is formed at end **26** of the shaft **17**, which end is remote from the driven end **18**. A Jacob's chuck is shown at **27** and fixed to the tool holding portion at the end **26**. It will be recognized that other tools such as concrete drills may be substituted for the well known Jacob's chuck.

The cam part **23** of the shaft **17** is journaled in a sleeve **30**. The sleeve **30** forms part of the housing and is preferably held in a press fit by the remainder of the housing **15**. A cylindrical cam or cam follower **31** is also journaled in the sleeve **30**. As will subsequently more fully appear, the cam follower is carried for selective rotation or reciprocation relative to the housing **15** and the shaft **17**.

The cam part **23** has first and second actuation cam surfaces **33, 34**. These actuation cam surfaces terminate abruptly at first and second axially extending shoulders **35, 36** respectively. It will be recognized that there may be one or more actuation surfaces terminating shoulders. The disclosed and preferred arrangement has been found to provide both the appropriate number of impacts and an appropriate impact force for optimum drilling results when the tool is in use. The cam follower **31** has first and second following surfaces **37, 38** which terminate abruptly at shoulders **39, 40** respectively. The shoulders **39, 40**, like the shoulders **35, 36**, extend axially. A relief **43** is formed in the cam follower at the end remote from the surfaces **37, 38**. The relief is preferably coaxial with the remainder of the cam follower. A spring **44** is disposed within the relief **43**. The spring coacts with the cam follower **31** and the washer **19** to yieldably urge the cam follower against the cam part **23**.

During operation the shaft **17** and the cam follower **31** rotate together relative to the housing **15** and the sleeve **30** for an ordinary drilling operation. If impact

drilling is desired, the follower 31 is held against rotation relative to the housing 15. The shaft 17 is rotated continuously and therefore the follower 31 is held in a position in which shaft rotation is relative to the follower 31 as well as the housing 15.

As the cam part 23 and the remainder of the shaft 17 rotate relative to the cam follower 31, the cam surfaces 33, 34 coact with the cam follower surfaces 37, 38 to shift the follower to the right, as seen in FIGURES 1 and 2, against the action of the spring 44. As the shoulders 35, 36 come into alignment with the follower shoulders 39, 40, the follower shifts abruptly to the left, again as seen in FIGURES 1 and 2, under the urging of the spring 44. This action slams the follower against the cam part 23. The slamming of the follower against the cam part imparts an impact which is transmitted through the cam part to the tool. Through this action a high rate of impacting is provided at the tool while constant rotation is maintained. This combination produces a very high speed drilling action in such material as concrete and brick.

One of the outstanding advantages of this invention resides in the selector means utilized to selectively permit or prevent rotation of the follower 31 relative to the housing 15. In the preferred and disclosed form of selector means, a flat is provided on the cam follower 31 which is within the cylindrical contour of the cam follower and takes the form of slot 47. The slot 47 extends axially along the cam follower 31. A shiftable finger, or key, 49 is provided which may be selectively projected through a slot 50 in the sleeve 30 and into the follower slot 47 to put the device in an impact position. The coaction of the finger 49 and the slot 47 prevents rotation of the follower 31 relative to the housing 15, and thereby causes relative rotation between the shaft 17 and the follower 31. At the same time the coaction of the finger 49 and the follower slot 47 permits the follower to shift axially relative to both the housing 15 and the shaft 17. A retainer member, or selector ring, 53 is provided which may selectively be shifted to the right as seen in FIGURE 1 to urge a leaf spring 54 inwardly. As the spring 54 shifts inwardly, it urges the connected key or finger 49 toward and into the follower slot 47. It will be seen that the ring, the spring, and the key together form selector means. When the selector or member 53 is shifted to the left as seen in FIGURE 1 from a closed selection position to the open selection position of FIGURE 1, the leaf spring will retract to the position shown in FIGURE 1, thus drawing the key 49 from the slot 47.

The selector means disclosed herein has the distinct advantage of permitting an operator to slide the selector ring 53 toward the slot 50 to compress the spring. He may then rotate the shaft 17 and associated parts, and the key 49 will snap into the slot 47. Thus, the operator may operate the drill without first being required to align the follower slot 47 and the finger 49. The follower 31 will rotate in a normal fashion until the finger 49 and slot 47 are in contact and then the finger will snap into engagement with the follower slot 47. The operator may then shift the ring 54 further to the right and against a stop 55.

Another of the outstanding advantages of this invention is obtained through the unitary construction of the device. The operator can operate the drill with one hand leaving the other hand free to perform other functions such as steadying the material being drilled. Further, the light weight rugged construction disclosed assures proper alignment of the shaft 17 without any fear of damaging or breaking the shaft.

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

What is claimed is:

1. A rotary impact tool comprising a housing member, a constantly rotatable shaft journaled in the housing member and having first and second ends, the shaft first end being formed to provide a tool holder rigidly rotatable with said second end, the shaft second end including means for driving connection to a source of rotative force, said shaft having a cam surface formed intermediate the ends, a cam follower member disposed between the cam surface and the shaft second end, resilient means urging said follower member into contact with said cam surface, selector means carried by one of the members and operably connectable directly to the other of the members, said selector means having first and second adjustment positions, said selector being in said first adjustment position when relative reciprocation of said cam surface and said follower member is permitted, and said selector means being in said second adjustment position when relative reciprocation between said cam surface and said cam follower member is prevented.

2. A rotary impact tool comprising a housing member, a constantly rotatable shaft journaled in the housing and having first and second ends, the shaft first end being formed to provide a tool holder, the shaft second end including means for driving connection to a source of rotative force, said shaft having a cam surface formed intermediate the ends, a cam follower member disposed about said shaft between the cam surface and the shaft second end, resilient means urging said follower member into contact with said cam surface, and selector means carried by one of the members and engageable with the other of the members, the selector means having first and second adjustment positions, said cam follower being nonrotatable and nonreciprocal with respect to said shaft when said selector means is in said first position and said cam follower member being both rotatable and reciprocal with respect to said shaft when said selector means is in said second position and said shaft is rotated.

3. A rotary impact tool comprising a motor cage, a motor carried in said cage, a housing member connected to said cage, a constantly rotatable shaft journaled in said housing member and having a first end in driving connection with said motor, the shaft having a second end formed to provide a tool holder, said shaft having a cam surface formed between its ends, a cam follower member disposed about said shaft between said cam surface and said first shaft end, resilient means urging said follower member into contact with said cam surface, and selector means carried by one of the members and engageable with the other of the members, the selector means having first and second adjustment positions, said cam follower being nonrotatable and nonreciprocal with respect to said shaft when said selector means is in said first position and said cam follower being both rotatable and reciprocal with respect to said shaft when said selector means is in said second position and said shaft is rotated.

4. A rotary impact tool comprising, a housing, a constantly rotatable shaft journaled in the housing, said shaft having a drive end and a tool holder end, said shaft having a cam surface formed between said ends, a cam follower disposed within said housing and about said shaft, a spring urging said cam follower into contact with said cam surface, said follower having a cylindrical contour and a selector coacting surface formed within said contour, and selector means carried by and movable relative to said housing between two positions for selective contact in one position with said coacting surface to prevent the follower from rotating relative to the housing and thereby cause the follower to reciprocate relative to the shaft and the housing under the urging of the spring and the cam surface when the shaft is rotating and for disengagement with said coacting surface in the other

position for permitting relative rotation between said follower and housing.

5. A rotary impact tool comprising, a housing, a constantly rotatable shaft journaled in the housing, said shaft having a drive end and a tool holder end, said shaft having a cam surface formed between said ends, a cam follower disposed within said housing and about said shaft, a cam follower spring urging said cam follower into contact with said cam surface, said follower having a cylindrical contour and a longitudinally extending slot formed within said contour, a radially shiftable selector finger carried by the housing and engageable with said slot to prevent rotation of said follower relative to said housing and thereby cause the cam follower to reciprocate relative to said shaft and said housing under the urging of said spring and cam, a spring radially urging said finger into said slot, and a selector member in operable connection with said finger to cause the finger to shift to and from the slot selectively.

6. Apparatus of the type described, comprising in combination, a housing, a rotatable chuck cam, a selectively controlled rotatable and percussive cylindrical cam disposed within said housing, a driving shaft rotatably cooperating with said chuck cam and rotatable with respect to said cylindrical cam, said shaft having a driving end and a tool holder end rigid against axial relative movement, each of said cams having cam surfaces at one end yieldably opposing each other in an axial alignment, resilient means telescopically mounted on said rotatable shaft between said driving end and cam surfaces and positioned in cooperative percussion-imparting relation with said cylindrical cam, and control means cooperating with said cylindrical cam, said control means operable in selective control of the rotatable and percussive action of said cylindrical cam.

7. In a selective percussion and drilling appliance the combination comprising a housing, a rotatable chuck cam partially positioned therein and partially extending outside said housing for rigidly carrying a tool chuck therewith, a rotatable and percussive imparting cylindrical cam within said housing, a cam driving shaft within said cylindrical cam and cooperable with said chuck cam, said shaft being rotatable with respect to said cylindrical cam, a plurality of abrupt shoulder surfaces on one end of each of said cams, said surfaces opposing and yieldably engaging each other, a coil spring surrounding said shaft and in cooperating percussive imparting relation with said cylindrical cam, and key means for selectively controlling the rotatable and percussive movement of said cylindrical cam.

8. A rotary impact tool comprising a housing, a constantly rotatable shaft journaled in the housing, said shaft having a drive end and a tool holder end constructed to secure a tool rigidly to said shaft, drive means rigid relative to said housing and drivingly connected to said drive end, a blow receiving member in said housing and rigid with said tool holder end of said shaft, a rotatable and percussive cylindrical cam member disposed within said housing and slidable on said shaft in position to strike against and to move away from said blow receiving member, said cylindrical cam member lying between said driving connection and said blow receiving member, spring means in said housing urging said cam member into contact with said blow receiving member, cam means including a cam surface on said cam member for periodically urging said cam member away from said blow receiving member to load said spring means and then releasing said cam member for movement against said blow receiving member impelled by said spring means, and cam member controlling means including a control member mounted on said housing and accessible from outside said housing, said control member having one position compelling reciprocation of said cam member as said shaft rotates and having another position permitting said cam member to rotate without reciprocation.

9. A rotary impact tool as set forth in claim 8 wherein said cam surface on said cam member is on the end thereof toward said blow receiving member, said cam means includes a coacting cam surface on the adjacent end of said blow receiving member, and said cam member controlling means includes a longitudinally extending slot formed in the outer surface of said cam member and a radially shiftable selector finger carried by the housing and movable into and out of said slot, said movement into said slot preventing rotation of said cam member relative to said housing thereby causing said cam means to provide percussive blows, and said movement out of said slot permitting said cam member to rotate without percussive blows.

10. A rotary impact tool, as set forth in claim 8, with said shaft constructed to rigidly connect a tool at said tool holder end with said drive means at said drive end so that said shaft positively rotates said tool in said one position during reciprocation of said cam member.

11. A percussive tool assembly, comprising a housing, a shaft constructed to be driven by a driven portion at one location by a driving motor and to drive by a drive portion at another location a tool rotatably by the motor, said shaft having a shoulder located axially between and rigid with the shaft and the portions at said locations with said shoulder located to receive impact blows transmitted to said tool, a hammer, and means responsive to rotation of said shaft for vibrating said hammer to deliver impact blows against said shoulder through said shaft to said tool, said last mentioned means including manually operable control means for operatively connecting or disconnecting said hammer and housing for controlling said impact blows by controlling the relative rotational movement between said hammer and housing.

12. A rotary impact tool comprising a housing, a constantly rotatable shaft journaled in the housing, said shaft having a driven end and a tool holder end constructed to carry a tool holder rotatably with said shaft, said tool holder end having a blow receiving portion, a rotatable and percussive cam member disposed within said housing and telescopically slidable on said shaft in position to strike against and to move away from said blow receiving portion, said cam member lying between said driven end and said blow receiving portion, spring means telescoped over said shaft and urging said cam member into contact with said blow receiving portion, cam means including a cam surface on said cam member for periodically urging said cam member away from said blow receiving portion to load said spring means and then releasing said cam member for movement against said blow receiving portion impelled by said spring means, and cam member controlling means including a control member accessible from outside said housing and movable relative to said housing, said control member having one position compelling reciprocation of said cam member as said shaft rotates and having another position permitting said cam member to rotate without reciprocation.

13. A rotary impact tool comprising a housing, a constantly rotatable shaft journaled in the housing, said shaft having a driven end and a tool holder end constructed to carry a tool holder rotatably with said shaft, said ends being rigid against axial relative movement during impact action of said tool, said tool holder end having a blow receiving portion, a percussive cam member disposed within said housing and telescopically slidable on said shaft in position to strike against and to move away from said blow receiving portion, said cam member lying between said driven end and said blow receiving portion, spring means telescoped over said shaft and urging said cam member into contact with said blow receiving portion, cam means including a cam surface on said cam member contiguous to said blow receiving portion for periodically urging upon rotation of said shaft said cam member for urging movement away from said

blow receiving portion to load said spring means and then releasing said cam member for releasing movement against said blow receiving portion impelled by said spring means, and controlling means for said periodic urging and releasing movements including a control member accessible from outside said housing and movable relative to said housing, a portion of said controlling means coacting with said control member in one of its positions for compelling reciprocation of said cam member as said shaft rotates and in another of its positions for permitting said tool holder end to rotate without repircoation of said cam member.

References Cited in the file of this patent

UNITED STATES PATENTS

1,356,556	Payne	Oct. 26, 1920
2,484,471	Shinn	Oct. 11, 1949
2,518,429	Moorhead	Aug. 8, 1950
2,556,163	Beeson et al.	June 12, 1951
2,630,723	Gridley	Mar. 10, 1953
2,775,898	Baier	Jan. 1, 1957
2,794,621	Beeson	June 4, 1957