

[54] **HAMMER-DRILL**

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[22] Filed: **Apr. 14, 1972**

[21] Appl. No.: **243,939**

[30] **Foreign Application Priority Data**

May 7, 1971 Germany..... 2122582

[52] **U.S. Cl.**..... 173/48, 173/109, 173/123,
408/17

[51] **Int. Cl.**..... **B25d 11/00**

[58] **Field of Search**..... 173/94-97,
173/101, 109, 115, 119, 48, 47; 408/17, 48

[56]

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[57]

ABSTRACT

A drive is mounted in a housing and has a rotary output shaft connected with a tool spindle for rotating the latter. An arrangement is provided which will impart a predetermined number of longitudinally acting impacts per revolution on the tool spindle and another arrangement is provided for varying this number of impacts at the will of an operator.

9 Claims, 15 Drawing Figures

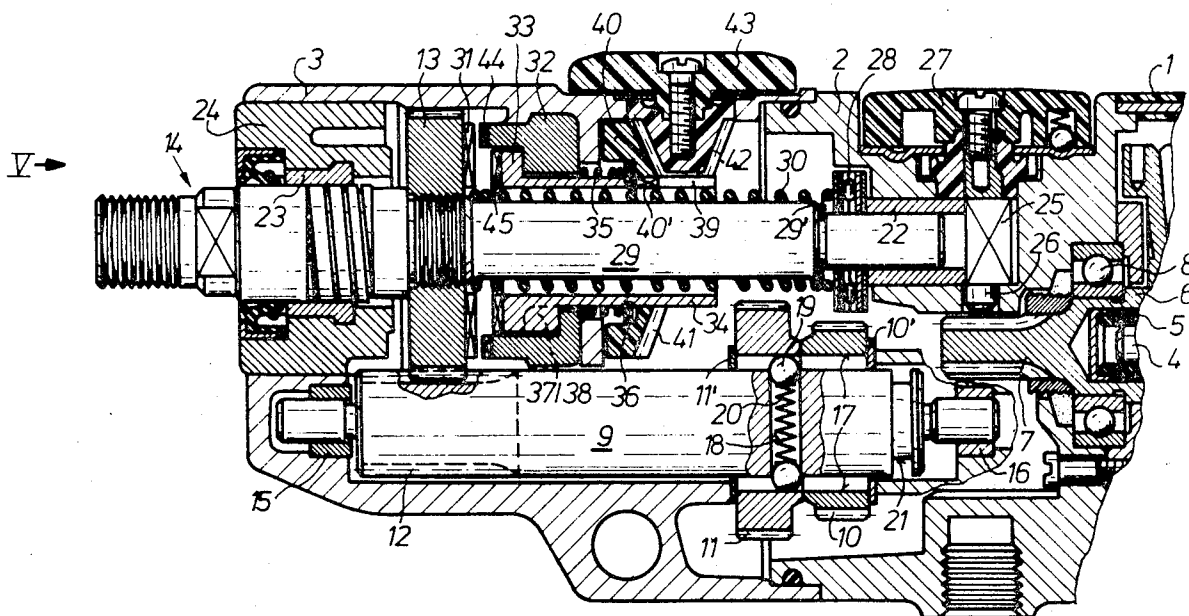


Fig. 1

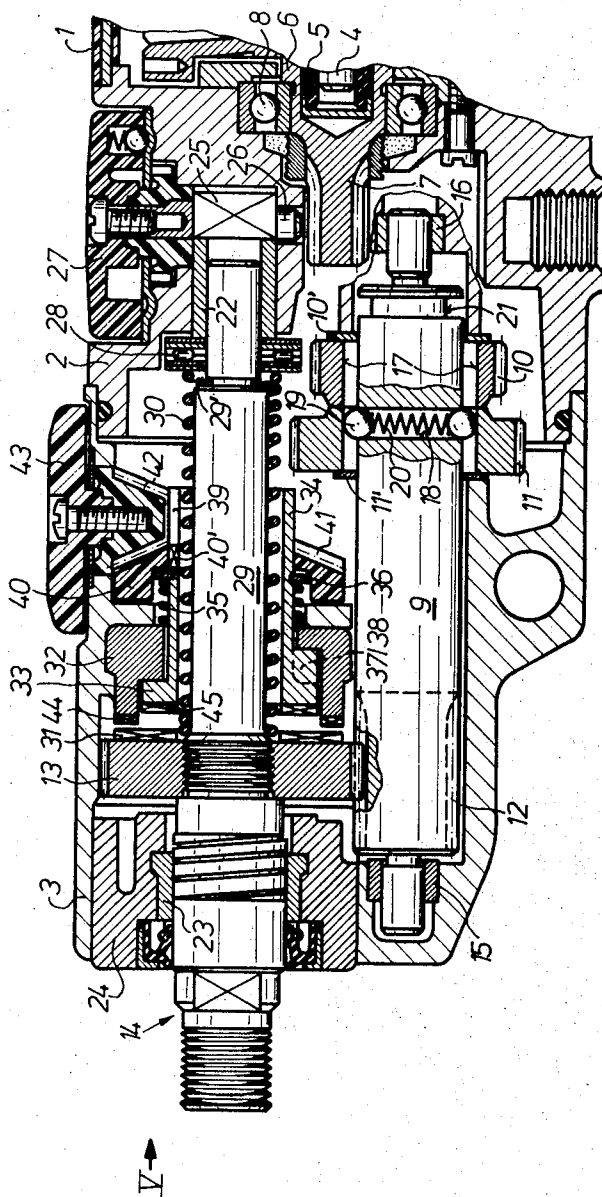


Fig. 2

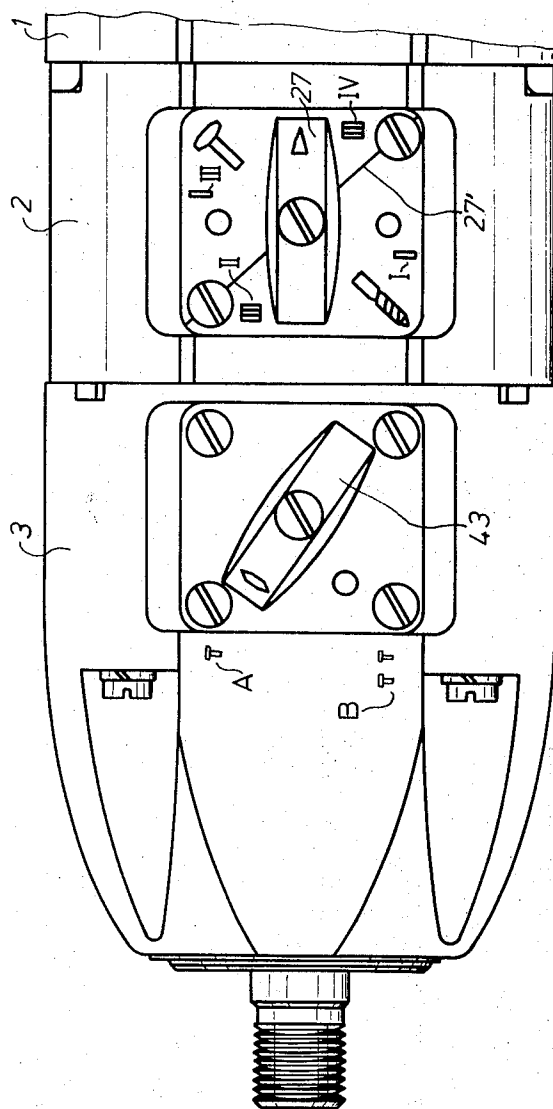


Fig. 3

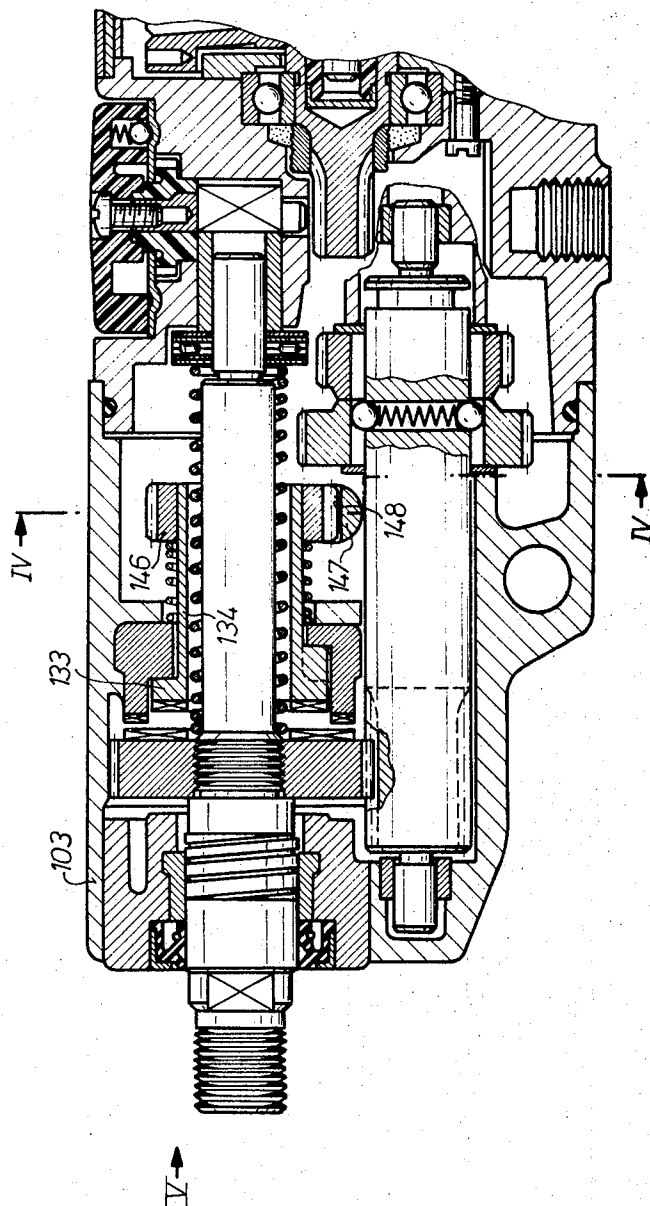


Fig. 4

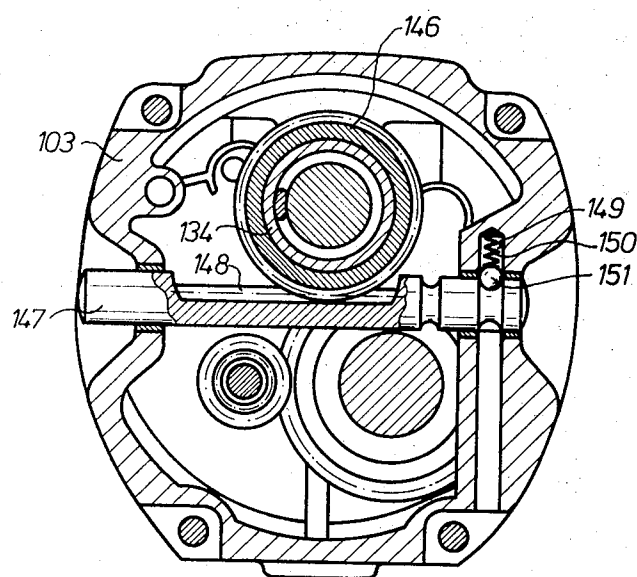


Fig. 5

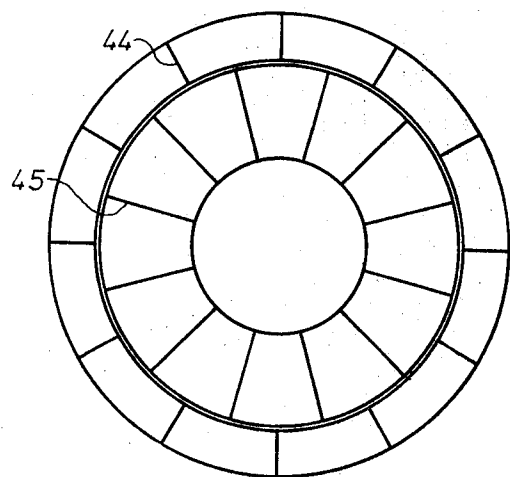


Fig. 6

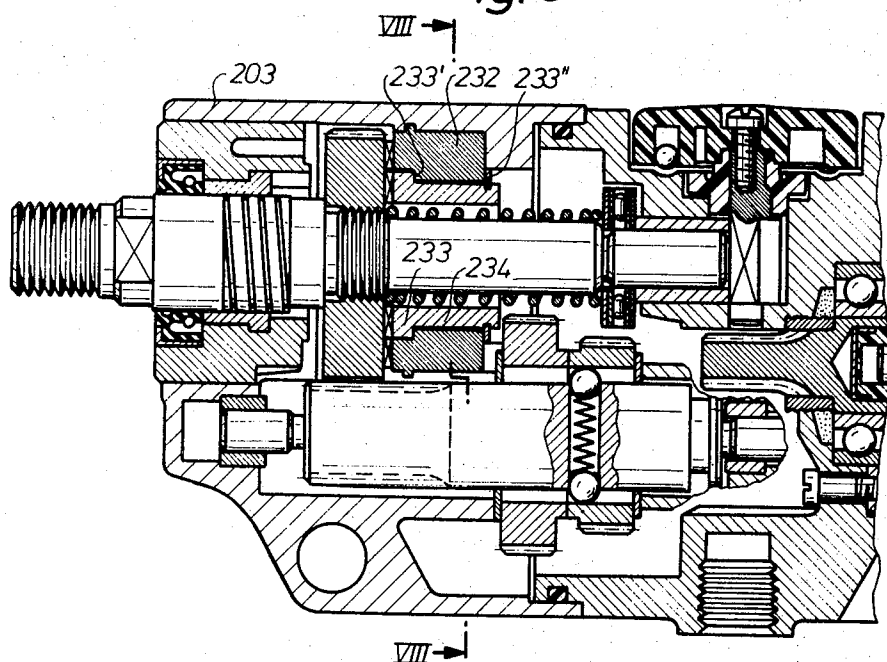


Fig. 7

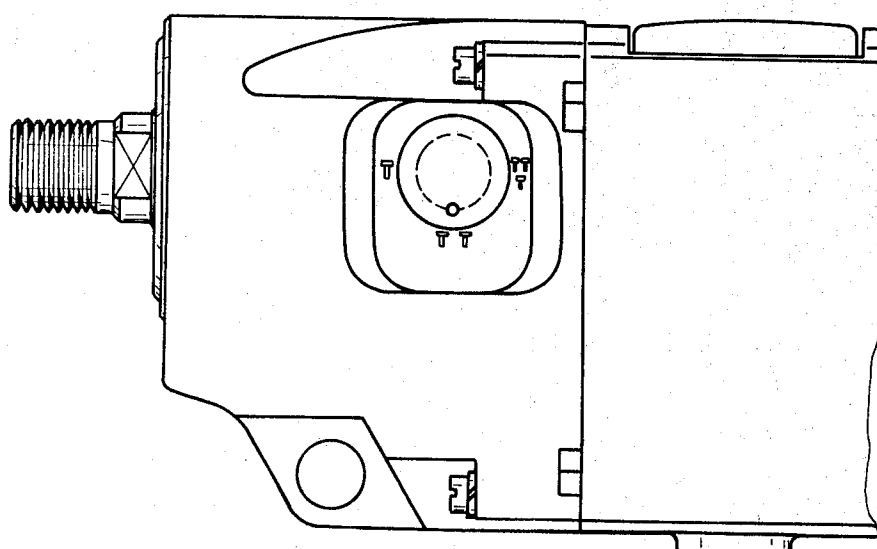


Fig.8

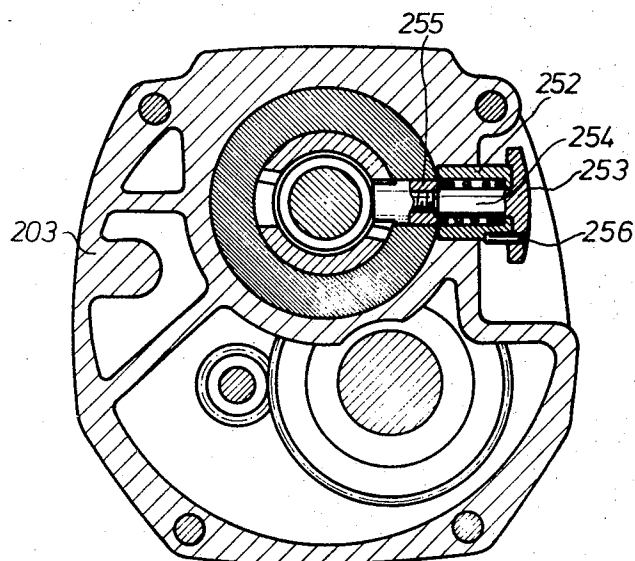


Fig.9

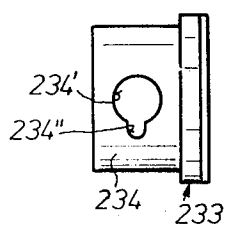


Fig.10

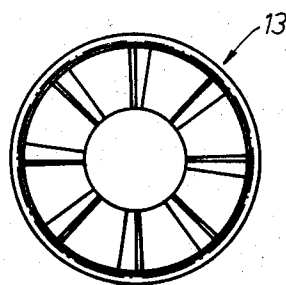


Fig. 11

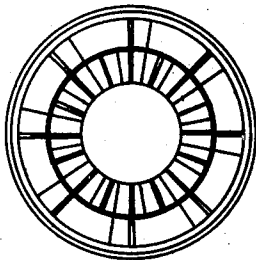


Fig. 12

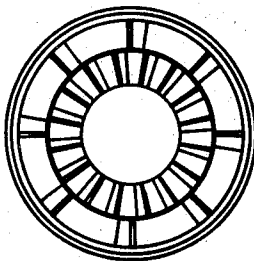


Fig. 13

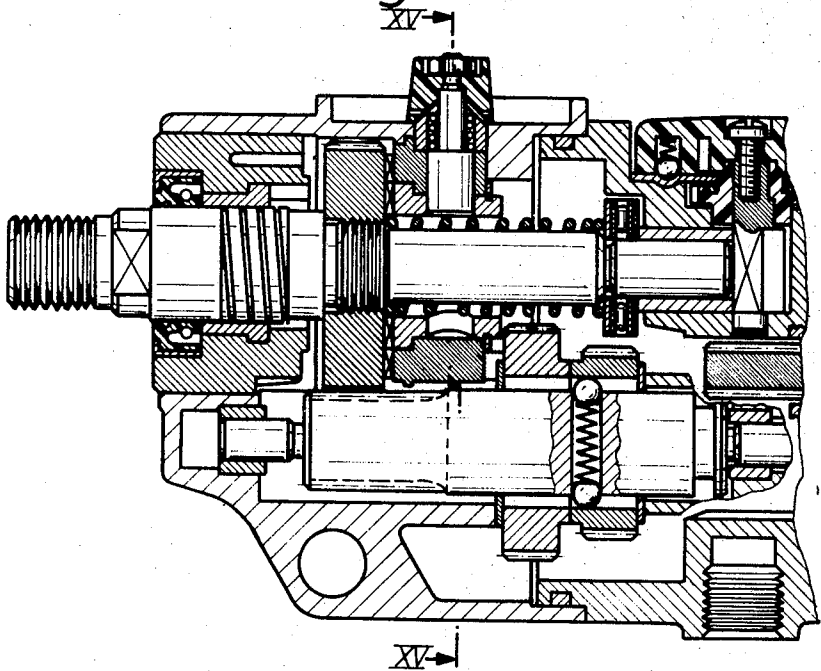


Fig. 14

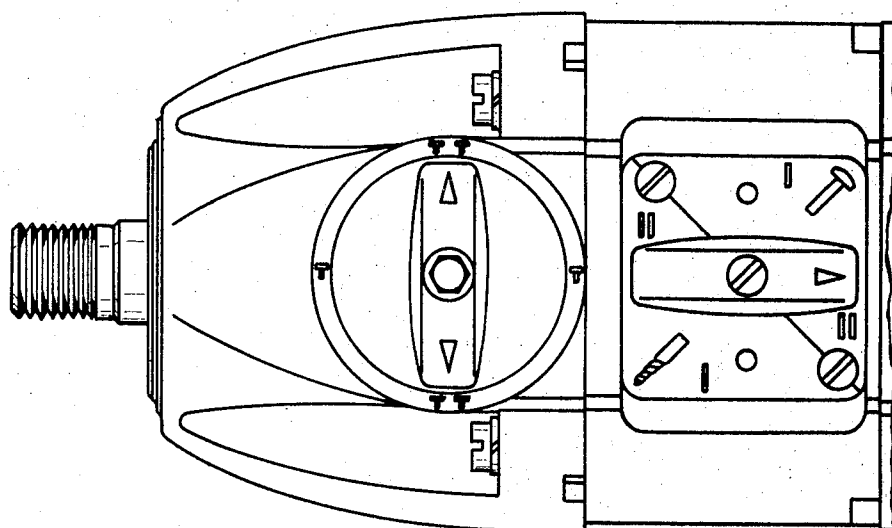
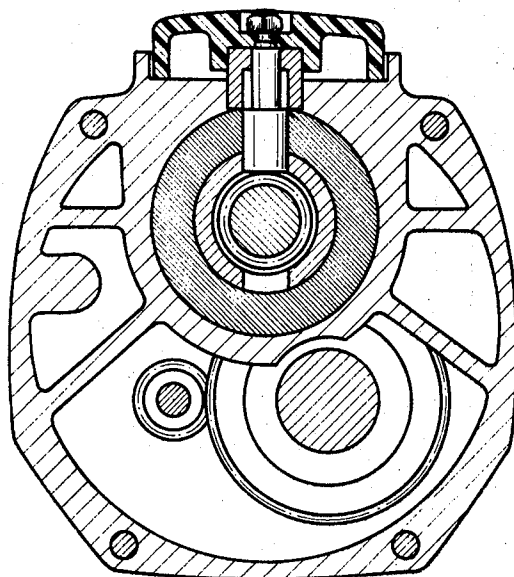


Fig. 15



HAMMER-DRILL

BACKGROUND OF THE INVENTION

The present invention relates generally to a tool, and more particularly to a manually held tool. Still more particularly, the invention relates to a manually held hammer-drill.

Hammer-drills are already known and need not be described in detail, except to point out that contrary to conventional drills they are so arranged that when it is desired by an operator, they can be employed to transmit to the tool spindle which carries the tool (that is the drill) longitudinally acting impacts. Thus, the drill not only rotates but also is subjected to impact blows which are, of course, transmitted to the material in which the device is used for drilling.

The known hammer drills are so constructed that they will transmit to the tool spindle a fixed number of impacts per revolution of the spindle. It was originally thought that this was acceptable but it has since been found that such constructions have certain disadvantages. In particular, if drills of different diameters are utilized, such difficulties will arise. This is due to the fact that the number of impacts per revolution is predetermined by the manufacturer with respect to the use of a drill having a median diameter, that is having a diameter which is substantially midway between the largest-diameter and the smallest-diameter with which the hammer drill can be used. If, now, a drill of a larger diameter than this median diameter is to be used, sweeping a greater area than the median-diameter drill in completing a full revolution, then pieces of the material in which the hole is drilled will remain intermediate successive impacts upon the drill, and these pieces must subsequently be broken loose by the operator, via the expedient of having to constantly change the angular position of the hammer-drill with respect to the axis of the bore hole.

Conversely, if the operator uses a drill (of course this means a drill bit) which is of a smaller diameter than the aforementioned median diameter, such a drill will of course sweep a smaller area in completing a full revolution and as a result the impacts will follow one another so closely that the drill no longer breaks off small pieces of material (for instance rock) but will produce fine rock flour or the like which must be separately removed from the bore hole, involving additional time and labor. It is clear, therefore, that in both instances the drilling capacity and effectiveness of such a drill will be substantially reduced with respect to a device in which the number of impacts per complete revolution and the diameter of the drill bit being used, are coordinated with one another.

A further disadvantage of the prior-art hammer drills is the fact that their efficiency is reduced due to the impossibility of considering the hardness or other characteristic of the material in which a bore hole is to be produced, when the number of impacts per complete revolution is determined and fixed by the manufacturer.

All of this clearly indicates that further improvements in hammer-drill devices are desirable; however, until now such improvements have not, to our knowledge, been forthcoming.

SUMMARY OF THE INVENTION

It is, accordingly, an object of the present invention to provide a hammer-drill which has the aforementioned improvements.

More particularly, it is an object of the invention to provide such a hammer drill which is not possessed of the disadvantages outlined above with respect to the prior art and has the improvements which have been indicated as desirable.

Still more particularly, it is an object of the present invention to provide such an improved hammer drill in which the number of impacts transmitted to the drill bit during each full revolution thereof, can be varied at the will of an operator.

An additional object of the invention is to provide such a hammer-drill in which the number of impacts transmitted to the drill bit during each complete revolution thereof, can be accommodated to the diameter of the drill bit and to characteristics of the material in which a bore hole is to be formed.

In pursuance of these objects and of others which will become apparent hereafter, one feature of the invention resides in a manually held hammer-drill which, briefly stated, comprises housing means and drive means located in the housing means and having a rotary output shaft. Tool spindle means is journaled in the housing means and extends in part out of the same. Coupling means couples the spindle means with the output shaft for rotation by the latter.

Impact means is provided for transmitting to the tool spindle means a predetermined number of longitudinally acting impacts per revolution of the tool spindle means, and in accordance with the present invention there is provided varying means for varying this number of impacts at the will of an operator.

The drill according to the present invention achieves the basic purpose of providing improvements which avoid the disadvantages of the prior art.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary vertical longitudinal section through a hammer-drill according to one embodiment of the invention;

FIG. 2 is a top plan view of FIG. 1;

FIG. 3 is a view similar to FIG. 1 but illustrating a further embodiment of the invention;

FIG. 4 is a section taken on line IV—IV of FIG. 3;

FIG. 5 is an elevational view of two cooperating components used in the embodiments of FIGS. 1 and 3, as seen in the direction of the arrows in these Figures;

FIG. 6 is a view similar to FIG. 3 illustrating an additional embodiment of the invention;

FIG. 7 is an elevational view of FIG. 6;

FIG. 8 is a section taken on line VIII—VIII of FIG. 6;

FIG. 9 is a side-elevational view of a component in the embodiment of FIGS. 6 — 8;

FIG. 10 is an end-elevational view of a detail of the embodiment in FIGS. 6 — 8;

FIG. 11 is a view similar to FIG. 10 illustrating a further detail;

FIG. 12 is a view similar to FIG. 11 illustrating another detail;

FIG. 13 is a view similar to FIG. 3 of yet another embodiment of the invention;

FIG. 14 is a top plan view of FIG. 13; and

FIG. 15 is a section taken on line XV—XV of FIG. 13.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Before entering into a discussion of the individual Figures it is thought advisable, for the sake of simplicity, to establish the meaning of two terms which will be used herein. The term "tool side" will be used herein to designate that end of the hammer-drill where a tool is secured to the portion of the tool spindle which extends out of the housing of the drill; conversely, the term "operator's side" refers to the opposite end, that is the end (which is not specifically illustrated in the Figures) where the hammerdrill is provided with a conventional grip which is engaged by the hands of an operator. It is thought that this definition of terminology will facilitate the description.

With this in mind, and referring firstly to the embodiment illustrated in FIGS. 1 and 2, it will be seen that there has been fragmentarily shown a hammer-drill according to one embodiment of the invention, only the actual motor — which preferably but not necessarily is an electrically operated motor — and the hand-grip to be engaged by the hands of an operator, having been omitted. The drill has a housing 1,3 of which the housing portion 1 is fragmentarily shown and should be understood to accommodate in known manner the motor. The housing portion 3 accommodates the gearing of the drill and is separated from the housing portion 1 by a divider 2.

The motor has in conventional manner an output shaft 4 which is fragmentarily shown and which should be understood as being representative of the drive means;

the output shaft 4 carries an insulating sleeve 5, for instance of synthetic plastic material, and press-fitted on this sleeve 5 is a stub shaft 6. The end of the stub shaft 6 which faces the tool side is provided with a pinion 7 which may be formed of one-piece with the stub shaft 6 as shown, and which is journaled in the divider wall 2 by means of the anti-friction bearing 8. In non-illustrated but wellknown manner, the pinion 7 drives gears 10 and 11 which surround a shaft 9 and are retained against axial displacement relative to the housing 1,2,3 by the retaining rings 10' and 11', respectively.

The shaft 9 itself is provided at the tool side with an annulus of teeth 12 which mesh with the teeth of the gear 13, which is fixed on a further shaft 14 constituting the tool spindle. Shaft 9 is journaled at its opposite ends in sleeve bearings 15 and 16 so that it can shift axially; it is of course also rotatable.

As FIG. 1 shows clearly, the inner surfaces bounding the bores in the gears 10 and 11 through which the shaft 9 extends, are provided with a plurality of angularly spaced axially extending parallel grooves 17, and the shaft 9 is provided with a transverse passage or bore

18 in which there are located two ball members (preferably of steel) 19 which are pressed outwardly away from one another by an expansion spring 20. Thus, the two ball members 19 attempt to enter into a pair of diametrically opposite grooves 17 of the gear 10 or 11, respectively. The arrangement has the purpose of permitting either the gear 10 or the gear 11 to be coupled for rotation with the shaft 9, and in the region of its end facing the operator's side the shaft 9 is provided with an outer circumferentially extending annular groove 21, into which a non-illustrated displacing member engages. This displacing member, which structurally and in its operational effectiveness is known per se, can shift the shaft 9 toward the left or towards the right in FIG. 1, so that the ball members 19 engage in the grooves of either the gear 11 as shown, or in the grooves 17 of the gear 10 if the shaft 9 is shifted towards the right in FIG. 1. Because the gears 10 and 11 are of differential size it is thus possible to drive the shaft 9 at different rotational speeds, and thereby to drive the tool spindle 14 also at different rotational speeds, inasmuch as it has motion transmitted to it via the teeth 12 and the gear 13.

At the tool side of the hammer-drill the tool spindle 14 is journaled in a sleeve 23 of a sleeve bearing 24 which is mounted in the housing portion 3; similarly, at the operator's side the spindle 14 is journaled in a sleeve bearing 22 in the intermediate wall 2. Thus, the tool spindle 14 can both rotate and shift axially, as does the shaft 9. The sleeve bearing 22 can shift axially in the intermediate wall 2, being in abutment at the operator's side with a member 25 of quadratic cross-section (the cross-section in a plane normal to the plane of FIG. 1) which has rounded edges. It should be noted that the member 25 is eccentrically mounted on a pin 26 which latter can turn with the member 25 about the axis of the pin 26, for which purpose the pin 26 is turnably journaled in the divider wall 2. A knob or similar engaging element 27 is provided at the exterior of the hammer-drill, cooperating with the members 25 and 26 to turn them to two end positions; the knob 27 also acts upon the non-illustrated element which engages in the groove 21 and effects axial shifting of the shaft 9.

The sleeve 22 abuts at its end facing the tool side of the hammer-drill against a thrust bearing 28 and is supported via the same, and a helical spring 30 surrounding a portion 29 of the tool spindle 14, with respect to the gear 13 which is fast with the tool spindle. In the illustration of FIG. 1 the member 25 is in engagement with the sleeve 22, with that surface of the member 25 which permits the sleeve 22 to slide towards the right, that is towards the operator's side, whereby the spindle 14 is not displaced as a result of pressure by the sleeve 22. However, if the knob 27 is turned through 180° from the position shown in FIG. 1, the member 25 will be similarly turned and, because it is mounted eccentrically on the pin 26, the surface of the member 25 which will now engage the sleeve 22 will cause the latter to be displaced towards the left in FIG. 1, that is towards the tool side. This causes the sleeve 22 to exert leftwardly directed pressure against the thrust bearing 28 and, via a shoulder 29' of the spindle portion 29, to displace the spindle 14 in the left-hand direction to such an extent that only sufficient axial space remains between the leftward-facing end of gear 13 and the rightward-facing end of the bearing 24 to permit rotational movement of

the spindle 14, that is sufficient axial play remains to employ the device as a drill.

The right-hand end of the gear 13, that is the one facing the operator's side, is provided with an annulus 31 of projections surrounding the axis of rotation of the spindle 14. This annulus 31 is juxtaposed with a pair of annular elements 32 and 33, which in the illustrated embodiment are concentric in that the element 33 is surrounded by the element 32. The latter is fixedly mounted in the housing portion 3 and can neither turn nor shift axially. The annular member 33 is guided in the member 32 by means of a neck portion 34, both turnably and axially displaceably. An expansion spring 35 of helical configuration surrounds the neck portion 34 and abuts with its opposite ends against the annular member 32 and a circlip 36, respectively, the circlip 36 being retained in an outer circumferential groove on the neck portion 34. Because of this arrangement the spring 35 attempts to displace the annular member 33 towards the right, that is towards the operator's side. In so doing it normally maintains the right-hand end face of the annular member 33 in engagement with the left-hand end face bounding the axial recess in the annular member 32, with both of these end faces being constructed as cam tracks 37 and 38,

An axially parallel longitudinal slot 39 is formed in the neck portion 34 and a guide projection or pin 40' of an annular member 40 made of synthetic plastic material, engages in the slot 39. The end face of the member 40 which faces the operator's side, that is the right-hand side in FIG. 1, carries a bevel gear annulus 41 which cooperates with a similar annulus 42 of gear teeth provided on a knob 43 accessible at the exterior of the hammer-drill. The knob 43 is turnably mounted on the housing portion 3 as shown.

As FIG. 1 shows the left-hand end face of the annular member 32 carries an annulus 44 of gear teeth facing towards the annulus 31 of the gear 13; a similar annulus 45 of gear teeth is provided on the left-hand end face of the inner annular member 33. When the knob 43 is turned it causes via the teeth 42 and 41 a turning of the member 40 and via the same this motion is transmitted by means of the projection 40' and the slot 39 to the inner annular member 33, causing the same to become angularly displaced. Because of the action of the cam tracks 37 and 38 the inner annular member 33 is displaced until its annulus 45 of gear teeth or projections is located in the plane of the annulus 44 from which it is normally retracted to the position shown in FIG. 1.

It will already be evident how the device illustrated in FIGS. 1 and 2 operates. When the motor is energized and the output shaft 4 rotates, the output shaft 4 drives via pinion 7, shaft 9 and gears 12 and 13 the tool spindle 14 which thus rotates. If the handle 27 is in such a position that the member 25 displaces the sleeve 22 towards the left (the opposite position from the one shown in FIG. 1), then the spindle 14 is similarly displaced towards its left-hand end position via the member 22, the thrust bearing 28 and the shoulder 29 of the spindle member 29. The working pressure which results during use of the device for drilling purposes is transmitted via the thrust bearing 28, the sleeve 22, the member 25 and the pin 26 to the divider wall 2, and thereby to the housing.

If, now, the handle 27 is turned to permit the member 25 to move to the position shown in FIG. 1, then the

spindle 14 — which continues to be held in the lefthand position via the members 22, 28 and 30 — now can axially and resiliently yield in the direction towards the operator's side. Thus, when pressure is exerted by the operator in the direction towards the left in FIG. 1, that is towards the rock or other material in which a hole is to be produced, the spindle 14 can yield to a sufficient extent for the projections of the annulus 31 to come into engagement and mesh with the projections 44 of the member 32. Relative rotation of the member 13 with respect to the member 32 will now result in the transmission of axially directed impacts upon the tool spindle 14 and a drill bit carried by it, this being too well known to require any further explanation.

This operation assumes that the handle 43 is in such a position that the annular member 33 is in the axially withdrawn position shown in FIG. 1. If, however, the knob 43 is turned in such a manner that it displaces and maintains the annular member 33 in its axially advanced position in which the projections of the annulus 45 are located in the general plane of the annulus 44, then the projections of both annuli 44 and 45 will cooperate with the projections of the annulus 31.

As shown in FIG. 5, the projections of the annulus 45 may correspond in number to the projections of the annulus 44, but be angularly offset with respect to successive projections of the annulus 44 by half the distance between such successive projections. In that case, the cooperation of the projections of both annuli 44 and 45 with the projections of the annulus 31 will assure that the number of impacts transmitted to the tool spindle 14 during each complete revolution thereof, is double the number which is transmitted to the tool spindle if only the projections of the annulus 44 cooperate with the projections of the annulus 31.

It goes without saying that by appropriate configuration of the cam track 37 and 38 it is also possible to displace the inner annular member 33 forwardly in direction towards the tool side beyond the general plane of the annulus 44, and to support it in such a position. In this case the number of projections of the annulus 45 could be made to differ from the number of projections of the annulus 44 and when the projections of the annulus 45 along would then cooperate with the projections of the annulus 31, a still further variation in the number of impacts transmitted to the tool spindle 14 during each complete revolution thereof, could be obtained.

The top plan view of FIG. 2 is of the embodiment of FIG. 1 and shows the handles 27 and 43. It will be seen that the handle 27 can be turned to four operative positions, namely the positions I and II, on the one hand, and the positions III and IV, on the other hand. The two groups of positions are separated visually for easy identification by the line 27'. When the knob 27 is in the position I, the device is used for drilling at low rotational speed (no impacts are transmitted to the spindle 14); when the knob 27 is in the position II the device is used for drilling at high rotational speed. On the other hand, when the knob 27 is in the position III, the device drills at low rotational speeds and impacts are transmitted to the tool spindle, and in the position IV the device drills at high rotational speed and impacts are again transmitted to the tool spindle. The number of impacts transmitted per complete revolution of the tool spindle can be varied, as already indicated with the knob 43 which has two operative positions A and B.

When the knob 43 is in the operative position A the number of impacts transmitted to the tool spindle per complete revolution will be low (only the annuli 31 and 44 will cooperate) and when the knob 43 is in the position B the number of impacts will be higher (the annuli 31, 44 and 45 will all cooperate). The position A may for instance be utilized when the device is used with a drill bit having a diameter of 10 mm., and the position B may be utilized when the device employs a drill bit having for instance a diameter of 16 mm.

In FIGS. 3 and 4 we have illustrated a further embodiment which corresponds essentially to the embodiment in FIGS. 1 and 2, with like reference numerals identifying like components to the extent necessary.

The embodiment in FIGS. 3 and 4 differs essentially from that in FIGS. 1 and 2 in that the device for effecting the variation in the number of impacts per revolution is differently constructed. Here, the inner annular member is identified with reference 133 and has the neck 134 which is provided at its end facing the operator's side with an annulus of gear teeth 146. A rack 147 has teeth 148 which engage with the annulus 146; the rack 147 extends transversely to the axis of the tool spindle and can be shifted longitudinally. The housing portion 103 has a bore 149 in which a ball member 151 (see FIG. 4) is located, being biased outwardly by a spring 150. The ball member 151 can snap into one of two grooves provided in the rack 147, thereby providing an arresting means for the two possible positions of the inner annular member 133. In other respects this embodiment is the same as the preceding one, and this includes the possibility of affording still a third position for the member 133, as discussed with respect to FIGS. 1 and 2.

FIG. 5 is of course self-explanatory, showing a view of the annuli 44 and 45 as seen in the direction of the arrow V in FIG. 1, and also in FIG. 3.

Coming to FIGS. 6 - 15 it is pointed out that these Figures show two arrangements in which the varying of the number of impacts per rotation is achieved by making the inner annular member turnable but preventing it from axial displacement, and preventing it at the will of the operator from rotation with the annulus on the gear which rotates with the gear spindle.

Discussing firstly the embodiment in FIGS. 6 - 9 it will be seen that the outer annular member is identified with reference numeral 232, being fixedly mounted in the housing portion 203 as by casting. It should be pointed out that to the extent necessary, like elements corresponding to those in preceding embodiments have been identified with like reference numerals.

The inner annular member 233 is provided with a shoulder 233' which prevents it from displacement towards the right, that is towards the operator's side. Displacement towards the left that is towards the tool side is prevented by means of a circlip 233''. Neck 234 has a bore 234' (FIG. 9) which merges with a slot 234''. A sleeve 252 is mounted in the housing portion 203 and a bolt 254 provided with a handle 253, is turnable and shiftable in the sleeve 252. A member 255, having in this embodiment a cylindrical form with two opposite flat facets, is connected to that end of the bolt 254 which is remote from the handle 253, for instance by cooperating screw threads. A spring is located in the sleeve 252 and presses the bolt 254 in direction inwardly of the housing portion 203. A pin 256 is provided in the knob 253 in parallelism with the bolt 254 and is juxtaposed

in the sleeve 252 with one flat and two deep recesses or bores which are offset through 90° with reference to one another.

It is clear, therefore, that the bolt 254 and with it the member 255 can assume three positions, one in which it is pulled out and in which the member 255 does not interfere with the inner annular member 233, so that the latter can turn with the turnable annulus of projections on the tool spindle. A second position is provided in which the maximum dimension of the member 255 extends in parallelism with the axis of the tool spindle and in which the bore 234' of the neck of the inner annular member 233 can accommodate the member 255. Finally, there is a third position in which the maximum dimension of the member 255 extends transversely to the axis of rotation of the tool spindle and can enter into the slot 234''. In the latter case, it would usually happen that the member 255 will initially enter into the bore 234', but because the inner annular member 233 is taken along by the tool spindle and turns with respect to the housing portion 203, the member 255 will eventually enter into the slot 234'' and prevent further turning.

In the aforementioned second position in which the member 233 is held via the bore 234', some of the projections of the member 233 will be located in the same angular positions as projections of the outer annular member, whereas in the third position (in which the inner member 233 is retained via the slot 234'') the projections of the member 233 will be located oppositely interstices between the projections of the outer annular member, and vice versa. The number of effective projections for transmitting impacts to the tool spindle can be seen from FIGS. 10, 11 and 12. In the case of FIG. 10, eight impacts will be transmitted to the tool spindle per revolution of the same when the inner annular member rotates, in FIG. 11 there will be sixteen such impacts and in FIG. 12 there will be twentyfour such impacts per revolution.

The embodiment illustrated in FIGS. 13 - 15 is essentially similar to that of the preceding Figures, except that the arrangement for retaining the inner annular member is constructed as a turnable handle or knob which, when it is turned, will be raised via a cam track to such an extent that a detent member is withdrawn from a transverse bore in the neck of the inner annular member.

It will be appreciated that in the embodiments in FIGS. 6 - 15 it is also possible to use two axially parallel concentric inner annular members, whereby additional flexibility is obtained in selecting the number of impacts which can be transmitted to the tool spindle per revolution of the same. Furthermore, the outer annular member can of course be made turnable in and with respect to the housing portion, rather than being made stationary, and the switching between the number of impacts transmitted can be effected in various different ways. In particular, the switching can be associated with the turning-on and turning-off of impact transmission in such a manner that both inner and outer annular members can be made adjustable in their rotation and can be fixed at selected angular positions.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a hammer-drill, it is not intended to be limited to the details shown since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in particular in the appended claims.

We claim:

1. In a manually held hammer drill, in combination, housing means; drive means in said housing means and having a rotary output shaft; tool spindle means journaled in said housing means and extending in part out of the same; coupling means coupling said tool spindle means with said output shaft for rotation by the latter; impact means for transmitting to said tool spindle means a predetermined number of longitudinally acting impacts per revolution of said tool spindle means, said impact means comprising a first element fixedly mounted in said housing means, and a second element mounted on said tool spindle means, said elements having juxtaposed surfaces provided with inter engaging annuli of projections which surround the axis of rotation of said tool spindle means; control means for effecting and terminating the interengagement of said projections at the will of an operator; varying means for varying said number of impacts at the will of an operator, said varying means comprising at least one additional element coaxially surrounded by said first element and also having an annulus of projections, said additional element being turnable about the axis of said tool spindle means but being fixed against displacement longitudinally of said axis; and arresting means for arresting said additional element against turning in at least one angularly displaced position of said additional element relative to said axis.

2. In a hammer-drill as defined in claim 1, wherein the number of projections on said first and additional element is identical.

3. In a hammer-drill as defined in claim 1, said arresting means being operative for arresting said additional element against turning in at least one further angularly displaced position of said additional element relative to said axis, at least some of the projections of said additional element being in the same angular orientation relative to said axis in one of said positions as corresponding projections of said first element.

4. In a hammer-drill as defined in claim 3; and comprising two further elements each provided with projections and being arrestable independently of one another in respective angular positions.

5. In a hammer-drill as defined in claim 1, wherein the number of projections on said additional element differs from the number of projections on said first element.

6. In a manually held hammer drill, in combination, housing means; drive means in said housing means and

having a rotary output shaft; tool spindle means journaled in said housing means and coupled with said output shaft for rotation therewith; impact means for transmitting to said tool spindle means a predetermined number of longitudinally acting impacts per revolution of said tool spindle means, said impact means comprising a first element fixedly mounted in said housing means, and a second element mounted on said tool spindle means, said elements having juxtaposed surfaces provided with interengageable annuli of projections; control means for effecting and terminating the interengagement of said projections at the will of an operator; varying means for varying said number of impacts at the will of an operator, said varying means comprising at least one additional element coaxial with said first element and also having an annulus of projections, said additional element being turnable about the axis of said tool spindle means but being fixed against displacement longitudinally of said axis; and arresting means for arresting said additional element against turning in at least one angularly displaced position of said additional element relative to said axis.

7. In a manually held hammer drill, in combination, housing means; drive means in said housing means and having a rotary output shaft; tool spindle means journaled in said housing means and extending in part out of the same; coupling means coupling said tool spindle means with said output shaft for rotation by the latter; impact means for transmitting to said tool spindle means a number of longitudinally acting impacts per revolution of said tool spindle means, said impact means comprising a first element fixedly mounted in said housing means, and a second element mounted on said tool spindle means, said elements having juxtaposed surfaces provided with interengageable annuli of projections which surround the axis of rotation of said tool spindle means and are each located in a plane normal to said axis; varying means for varying said number of impacts at the will of an operator, said varying means comprising at least one axially movable additional element coaxially surrounded by said first element and having one additional annulus of projections surrounding said axis of rotation; and control means operative for selectively and at the will of an operator moving said additional element between a first position in which said projections of said additional element are disengaged from those of said first element when the projections of said first and second elements are engaged with one another, a second position in which the projections of said additional element are engaged with those of said first element when the latter are disengaged from the projections of said second element, and a third position in which the projections of said additional element are engaged with those of said first element when the latter are also engaged with the projections of said second element.

8. In a hammer-drill as defined in claim 7; further comprising guide means cooperating with said additional element for preventing rotation but permitting displacement of the same axially of said tool spindle means, and for axially retaining said additional element in at least one displaced position thereof.

9. In a hammer-drill as defined in claim 8, wherein said guide means guides said additional element for displacement of said additional annulus longitudinally of said tool spindle means away from and to one side of the general plane of said first element, and for displacement into and axial retention in said general plane.

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