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Maxwell

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[54] **ROTARY IMPACT DRILL**

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[52] **U.S. Cl.** **173/109,** 173/119, 173/123

[51] **Int. Cl.** **B25d 9/00**

[58] **Field of Search** 173/48, 109, 21, 119, 120, 173/123

[56] **References Cited**

UNITED STATES PATENTS

3,123,156	3/1964	Gapstur	173/48
3,171,286	3/1965	Stewart	173/48 X
3,633,682	1/1972	Moores	173/21

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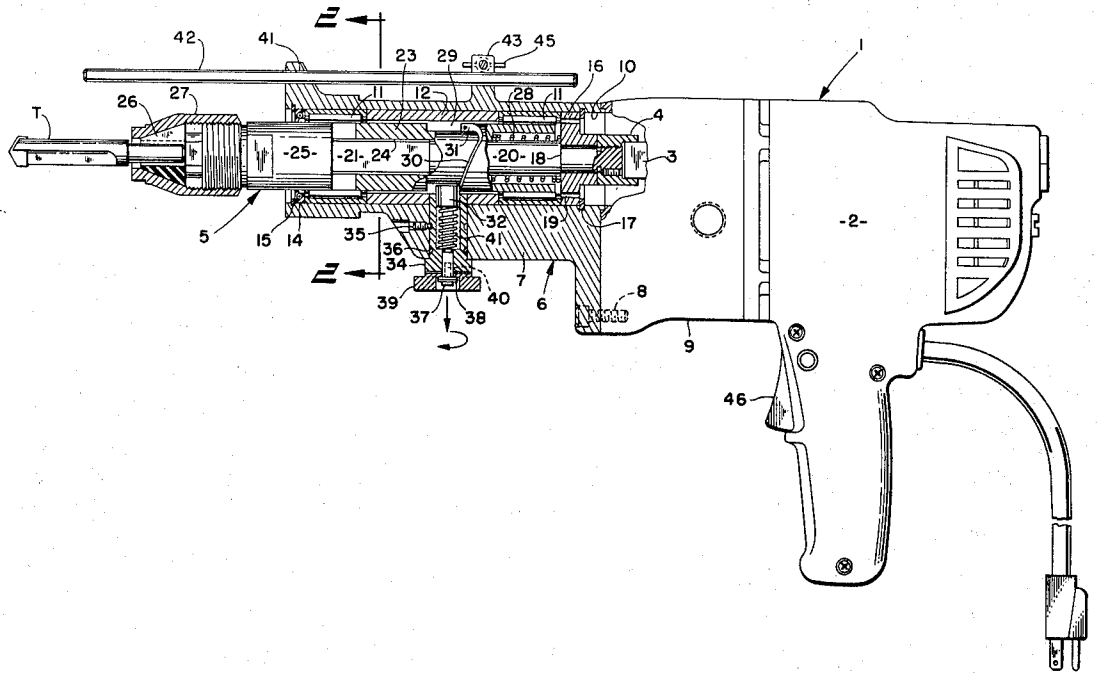
[57] **ABSTRACT**

A rotary impact drill includes spaced-apart front and rear bearings in which a hammer is rotatably and axially reciprocably supported for working against an anvil which is also supported in the same front bearing as the hammer. A coupling member is secured to the rear end of the shaft portion of the anvil for coupling to a power-driven drive shaft, and such coupling member also secures an axial thrust bearing to such shaft portion, with such thrust bearing being located between the rear bearing and a retainer. A spring is compressed between the hammer and the thrust bearing for normally biasing the hammer toward the anvil. A cam on the drill cooperates with a cam follower on the housing for reciprocating the hammer toward and away from the anvil in cooperation with the spring.

2 Claims, 2 Drawing Figures



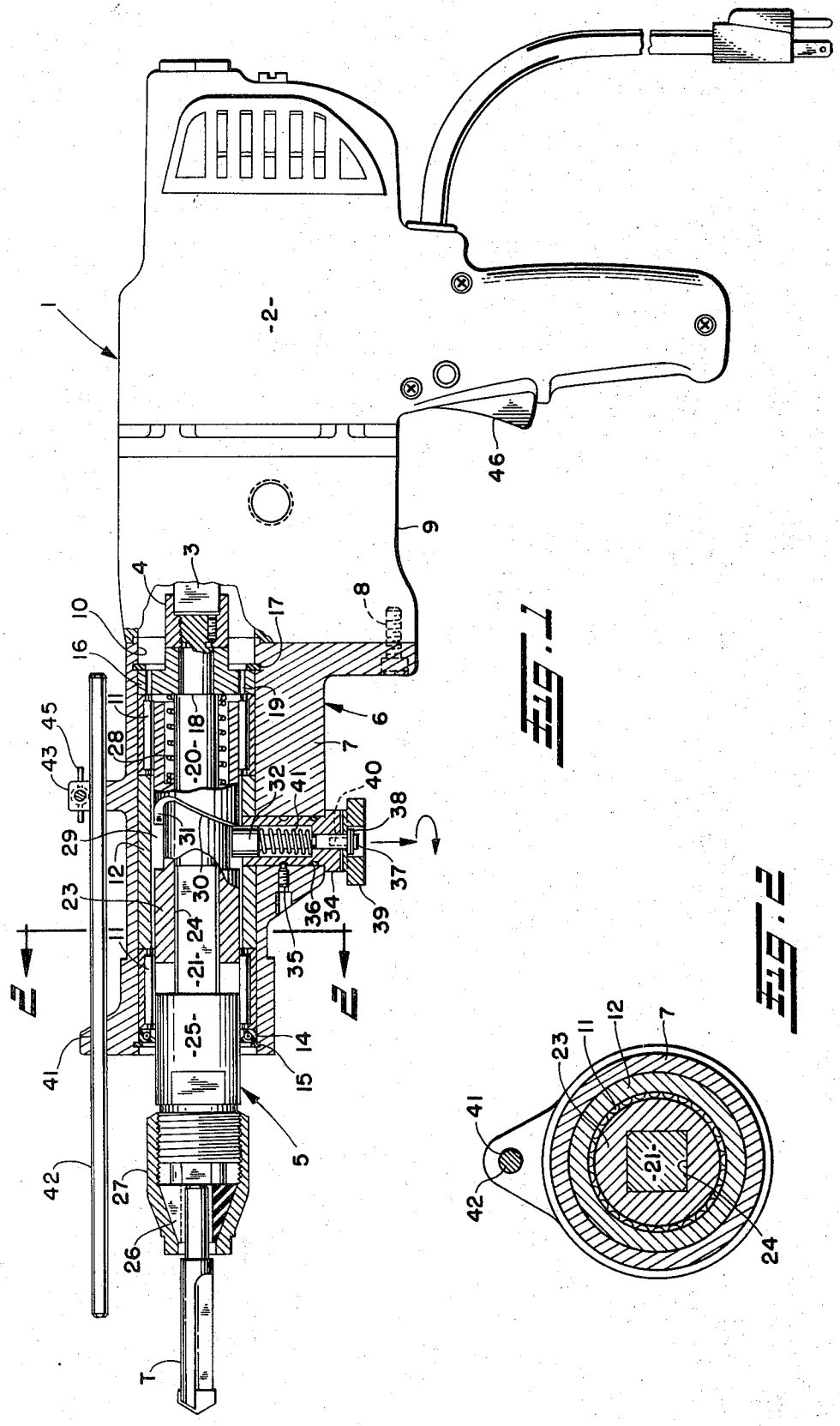

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FIG. 1

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FIG. 2

ROTARY IMPACT DRILL

BACKGROUND OF THE INVENTION

Rotary impact drills as now known generally comprise a drive-impact unit secured to a motor drive assembly, said unit including a drive shaft having one end coupled to the motor drive shaft and having axially slidably keyed on the other end thereof an anvil for limited axial reciprocation of the latter and a chuck assembly screwed onto said anvil, said chuck assembly having a screw actuated nosepiece which is operative to contract a collet into gripping engagement with the shank of a masonry drill or the like. Such known drills also have a spring and cam actuated hammer axially slidably keyed on the drive shaft to repeatedly strike the anvil thus to transmit impact forces to the masonry drill during the drilling of a hole in cement, concrete, brick or like material. Aside from the multi-part construction of the drive shaft, anvil, and chuck assembly such known rotary impact drills have numerous other parts such as a hammer spring follower on the drive shaft, an angular contact antifriction bearing on the drive shaft, and retainer rings on the drive shaft to retain said bearing in place on the drive shaft, and furthermore the housing of the drive-impact unit has a stepped bore to receive a lubricant seal and antifriction radial thrust bearing for the anvil, and a threaded counterbore for a retainer ring for the angular contact bearing and for a lock ring to lock the last-mentioned retainer ring in place in the threaded counterbore. Accordingly, such known constructions are complex and expensive to manufacture and assemble.

SUMMARY OF THE INVENTION

In contradistinction to the foregoing known forms of rotary impact drills, the present rotary impact drill is of simple easy-to-assembly construction which is efficient in operation in that the drive member of the drive-impact unit is integrally formed with a drive shaft portion, and an anvil-chuck body portion, in that the hammer has a polygonal bore which is axially slidable on the drive shaft portion without keys or the like, and in that a ring retained on the drive shaft portion by a drive coupling member defines with the drive member a cartridge which is insertable into and removable from the housing with the ring aforesaid constituting a spring follower for the hammer actuating spring and an axial thrust bearing disposed between the adjacent antifriction bearing in the housing and a snap ring retainer in a uniform diameter bore in the housing.

It is a principal object of this invention to provide a rotary impact drill of the character indicated in which the cartrdige of the drive-impact unit in which the drive member having an integral shaft portion and anvil portion has a hammer axially reciprocable on the shaft portion with the anvil portion and hammer being journaled in antifriction radial thrust bearings contained in a uniform diameter bore in the housing.

Other objects and advantages will appear from the ensuing description.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a central longitudinal cross-section view of a rotary impact drill embodying the present invention; and

FIG. 2 is a transverse cross-section view on enlarged scale taken substantially along the line 2—2, FIG. 1.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The rotary impact drill **1** herein comprises a variable speed electric drive motor **2** having a drive shaft **3** which is operatively connected by the coupling member **4** secured on the end of the drive member **5** of the drill drive-impact unit **6.** Said unit **6** comprises a housing **7** secured as by screws **8** to the gear housing **9** of the drive motor **2,** said housing **7** being piloted as shown in the gear housing **9** to locate the bore **10** coaxial with the motor drive shaft **3.**

Press fitted in the bore **10** are roller bearings **11** with a spacer **12** therebetween and adjacent the front bearing **11** is a lubricant seal **14** retained by the snap ring **15,** and adjacent the rear bearing **11** is a thrust bearing ring **16** retained by the snap ring **17,** the thrust bearing ring **16** being retained on the drive member **5** between the shoulder **18** and the coupling member **4.** The ring **16** has holes **19** for flow of lubricant from the gear housing **9.**

The drive member **5** is integrally formed with a shaft portion **20** carrying the coupling member **4** and axial thrust bearing ring **16** as already explained and having axially slidably keyed on the elongated square section **21** a hammer **23,** the square section **21** being closely slidably fitted in the square bore **24** through the hammer **23;** and with a radially enlarged anvil and chuck body portion **25** against which the shank end of a masonry drill or like tool T is abutted and gripped by a collet **26** which is actuated by a nosepiece **27** having threaded engagement with said chuck body and anvil portion **25.** By way of illustrative example, the collet **26** comprises a circular series of radial blades bonded to intervening segments of rubber-like material, the blades having tapered outer surfaces engaged with the tapered bore of the nosepiece **26.** Compressed between the hammer **23** and the thrust bearing ring **16** is a spring **28** which is effective to cause the hammer **23** to strike the anvil portion **25** thus to deliver repeated impact blows to the anvil portion **25** and to the masonry drill T which is gripped by the collet **26** with the shank end in abutting engagement with the anvil portion **25.**

The hammer **23** is provided with a peripheral groove **29,** one side of which is formed with one or more generally helically extending cam surfaces **30** and a corresponding number of generally axially extending surfaces **31** whereby, during rotation of the drive member **5,** the cam surfaces **30** engaged with the cam follower **32** causes movement of the hammer **23** in a direction away from the anvil portion **25** thus to compress the spring **28** whereupon, when the surfaces **31** pass the follower **32,** the hammer **23** is released for spring actuation to deliver successive hammer blows to the anvil portion **25.**

The housing **7** is provided with a radial hole aligned with a hole in the spacer **12** to receive a cam follower bushing **34** therein which is retained in place as by means of the set screw **35,** said bushing **34** having a sealing ring **36** therearound to seal lubricant in the housing. The cam follower **32** is provided with a stem portion **37** slidably sealed in bushing **34** and extending through the bushing **34** and having secured thereon as by snap ring **38** a knob **39** having tongues **40** engaged in a diametrically extending groove across the end of the bushing **34.** A spring **41** compressed between the

cam follower **32** and the bushing **34** urges the cam follower **32** to its operating position as shown in FIG. **1** and when it is desired to operate the drill **1** without impact, the operator grasps the knob **39** and pulls the cam follower **32** radially out of the groove **29** in the hammer **23** and rotates the knob **32** when the tongues **40** are axially disengaged from the bushing groove, whereupon the cam follower **32** will be retained in its retracted position so that the drive member **5** will rotate the drill T without impact. As known in the art, in the use of a rotary impact drill it is not desired to employ the impact feature when the drill encounters metal such as a reinforcing bar in concrete.

A further feature of the present invention is that the housing **7** is provided with a guide hole **41** for a drill gauge rod **42** and a split clamp **43** operated by the thumb screw **45** so that the gauge rod **42** may be adjusted parallel to the axis of the drive shaft **3** and drive member **5** so that its front end is spaced a desired distance from the cutting end of the masonry drill T. Such gauge rod **42** thus constitutes an adjustable stop to determine the depth of the drilled hole.

In the operation of the rotary impact drill **1** herein the operator will cause the drill to be driven at a desired speed by manipulation of the trigger **46** while applying axial thrust pressure to cause the drill to advance into the material being drilled. As the drive member **5** is rotated, the hammer **23** rotates in unison therewith and the cam surfaces **30** engaging the follower **32** will cause the hammer **23** to move to the right as viewed in FIG. **1** compressing the spring **28** and as the surfaces **31** pass the cam follower **32,** the spring **28** will actuate the hammer **23** to the left to repeatedly strike the anvil portion **25** to thus deliver hammer blows to the drill T which is in abutting engagement with the anvil portion **25.** In the use of the present rotary impact drill it has been found that a one inch diameter hole may be drilled through 12 inches concrete in 45 seconds at a speed of 1,250 r.p.m. with two hammer blows per revolution whereas with known rotary impact drills it takes several minutes to drill such hole.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A rotary impact drill comprising a drive assembly having a drive shaft; a drive-impact unit having a housing detachably secured to said assembly and a drive member axially detachably coupled to said drive shaft; said housing having axially spaced apart front and rear radial thrust roller bearings in a uniform diameter bore therethrough and having a spacer tube therebetween; said drive member having integral shaft and anvil portions respectively including a coupling member at the end of said shaft portion for coupling to said drive shaft and a chuck at the end of said anvil portion for gripping a masonry drill and the like; said shaft portion having a non-circular cross-section portion adjacent said anvil portion; a hammer rotatably and axially reciprocably supported in said bore and having a complemental non-circular cross-section bore axially but non-rotatably slidable on said non-circular cross-section portion and having a peripheral groove therearound of which the side facing said anvil portion has a stepped cam surface including circumferentially successive helically and generally axially extending surfaces; a cam follower in said housing extending radially into said peripheral groove for engagement by said helically extending surface; spring means biasing said hammer toward said anvil operative to permit yielding movement of said hammer away from said anvil portion during rotation of said hammer and drive member while said helically extending surface is engaged with said cam follower and to drive the hammer axially into impacting contact with said anvil portion as said generally axially extending surface passes said cam follower; said impact blows thus repeatedly delivered to said anvil portion by said hammer being transmitted to the masonry drill gripped by said chuck; the improvement comprising: SAID hammer being rotatably and axially reciprocably supported in said front and rear bearings and said anvil portion also being rotatably supported in said front bearing; axial thrust bearing means retained on said shaft portion by said coupling member and being disposed in axial thrust relation between said rear bearing and a retainer in said bore, and said spring means being compressed between said hammer and said axial thrust bearing means.

2. The rotary impact drill of claim **1** wherein said retainer in said bore for said axial thrust bearing means comprises a snap ring engaged in an internal groove in said bore in rearwardly-spaced relation to said rear bearing; said aixial thrust bearing means comprising a ring having an inner peripheral portion between said coupling member and a shoulder on said shaft portion, and an outer peripheral portion between said rear roller bearing and said snap ring.

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