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M. L. BEESON ET AL

2,556,163

ROTARY DRILL

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FIG. 1.

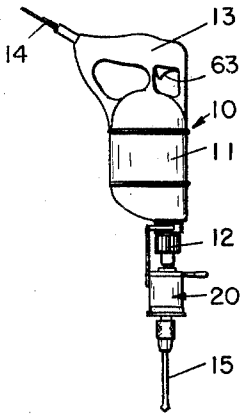


FIG. 2.

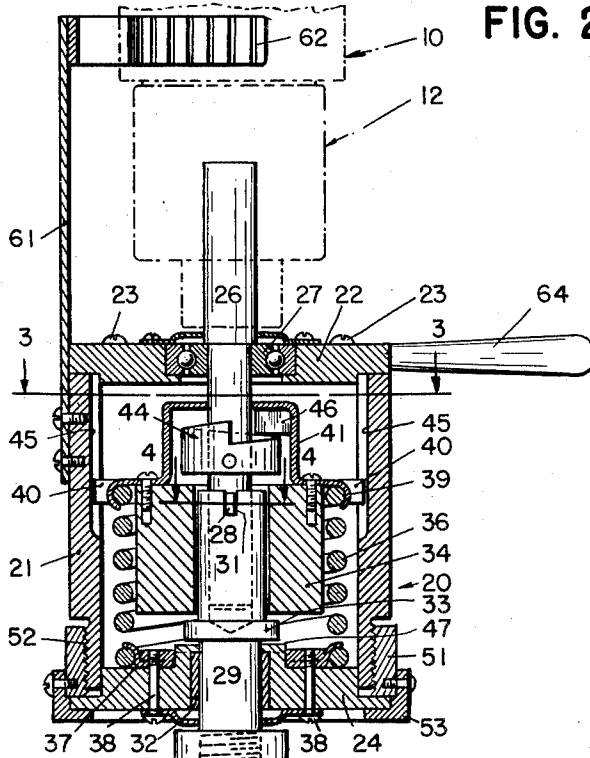


FIG. 4.

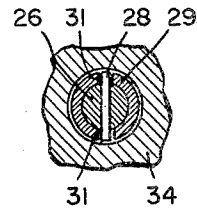
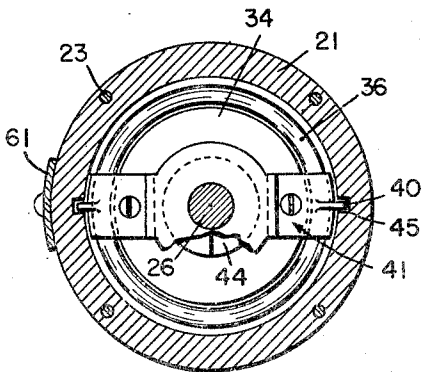


FIG. 3.



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2,556,163

ROTARY DRILL

Martin L. Beeson, South Pasadena, and William D. Sellers, Pasadena, Calif., assignors, by direct and mesne assignments, of one-twentieth to Harry D. Cummins and one-twentieth to J. Stanley Lloyd, Van Nuys, Calif.

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5 Claims. (Cl. 255-43)

1

The present invention relates to drills in general and particularly to an apparatus by which the rotary power of the drill is converted into a rotary reciprocatory movement at the tool bit. More specifically the invention comprises an attachment adapted to be connected between the driving unit and the working drill bit to transform the rotary motion of the unit shaft into a rotary and longitudinally reciprocating motion at the bit.

Rotary drills are used today in working in metals and other materials which, while less hard, are very abrasive. They find great usefulness particularly in the drilling of holes in concrete and cement. Pneumatic hammers have long been used for that purpose but are objectionable in that they are a special purpose tool of relatively great cost. Star drills are also usable but are primitive, slow, and involve considerable physical effort on the part of the worker. Until recent years rotary drills were not extensively used in the drilling of concrete and cement but with the production upon a large scale of tungsten carbide and other sintered products of great hardness it became possible to incorporate such materials in the drill bit as cutting elements to effect a material increase in the drill life. Thereupon rotary drills became very popular but there remained the objection that a relatively great pressure upon the drill was required. In order to force the drill into the material at times one worker would hold the drill, pushing against it, while a second worker pushed the first. In other applications use would be made of a lever arm by which greater force could be brought to bear upon the drill. The requirement of force results from the fact that while chipped with relative ease concrete or cement resists a cutting or shearing action.

In the apparatus constructed in accordance with the present invention the shortcomings and defects of the prior art constructions have been eliminated while use has been made of their advantages. The present invention incorporates a rotary drill bit with its cutting edge or edges, as in the prior art devices, and makes use of a rotary driving unit which, in a preferred form, is electric. In addition thereto it incorporates means by which the cutting drill bit is reciprocated longitudinally under a hammer action to effect a chipping of the material in the hole so that the rotation of the drill effects not only a cutting abrasive action but in addition a chipping action. The result is faster drilling and

2

the elimination of the requirement of excessive force upon the drill.

It is an object of the present invention to provide a new drilling apparatus in which a rotary drill is rotated and reciprocated longitudinally

It is another object of the invention to provide a drilling apparatus in which a rotary drill bit is hammered into the material by the drill during the drilling operation.

A still further object of the operation is to provide a drilling apparatus in which the power of the rotary driving unit is translated into rotary power and reciprocating power at the cutting drill.

A further object of the invention is to provide an attachment adapted to be connected between the usual electric driving unit, commonly known as a rotary drill, and the cutting drill bit, which is also known as a drill, for the purpose of transforming the rotary driving power of the driving unit shaft into rotary and reciprocating motion at the cutting tool.

These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawing to which they relate.

Referring now to the drawing in which a preferred embodiment of the invention is illustrated:

Figure 1 is a side view of an ordinary electric drill unit connected to a drill bit through an attachment in accordance with the present invention;

Figure 2 is an enlarged longitudinal section through the attachment shown in Figure 1;

Figure 3 is a transverse section upon the line 3-3 of Figure 2; and

Figure 4 is a section upon the line 4-4 of Figure 2 and illustrates the means by which the two shafts of the attachment are connected for conjoint rotary movement and for relative longitudinal translation.

Referring again to the drawing, a drill comprising the power unit is indicated generally by the reference character 10 and comprises a casing 11 housing an unshown driving motor the shaft of which carries a rotatable chuck 12 at its lower end adapted to seat a suitable cutting tool, such as the bit 15. A handle 13 extends from the upper end of the casing 11 and through it pass the leads 14 conducting current to the driving motor. The cutting drill or bit is indicated generally by the reference character 15 and in the usual prior art devices would be connected to the chuck 12 of drill 10. According to the present invention, however, the attachment unit, indi-

cated generally by the reference character 20, is positioned therebetween.

The unit 20 comprises a casing including a cylindrical outer wall 21, an upper end wall 22 fixedly secured thereto as by screws 23 and a bottom wall 24 adjustable relative to cylindrical wall 21 by means which will be described. A shaft 26 is rotatably mounted in top wall 22 by means of a bearing 27 and carries a transverse pin 28 near its lower end. A second and aligned shaft 29, threaded at its lower end at 30 below the casing, is centrally bored at its upper end and slidably encloses shaft 26 being formed with diametrically spaced notches or seats 31 to seat slidably the pin 28. Shaft 29 is rotatably and slidably carried in a sleeve bearing 32 in lower end plate 24. Just inside bearing 32 shaft 29 is formed with a shoulder or enlargement 33 which functions as an anvil as it is positioned as to be contacted by the lower end of the cylindrical weight 34 also referred to as a hammer. Hammer 34 slides upon the upper end of shaft 29 and is at all times resiliently urged in the direction of the anvil by a coil spring 36, the lower end of which is seated in a retainer 37 secured to the inner face of end wall 24 as by screws 38. The upper end of spring 36 seats in the grooved periphery 39 of a U-shaped retainer 41 extending in spaced relationship to shaft 26 and provided with laterally extending keys 40 slidable in longitudinal grooves 45 to prevent relative rotation.

A cam 44 is fixedly secured to shaft 26 immediately above hammer 34 within the cup 41, its upper face being contoured to provide a gradual lift leading up to an abrupt cut-off. A cam follower 46 is fixed within the upper end of cup 41 and rides upon the upper surface of cam 44 as the latter rotates and in doing so raises hammer 34 against the tension of spring 36. Upon reaching the cut-off point the spring snaps the follower and the attached weight element 34 downwardly, the latter striking the anvil 33 and driving it downwardly. To prevent the anvil from striking the bearing 32 in the absence of an abutting surface at the lower end of shaft 29 the seat of bearing 32 in plate 24 extends inwardly, as indicated at 47, to form a shock-receiving abutment.

To vary the force with which the hammer 34 strikes the anvil 33 means are provided to adjust the tension of spring 36 by moving end plate 24 toward or from the opposite end plate 22. This adjustment comprises a sleeve 51 seated in threaded relationship at 52 upon the lower end of cylinder casing 21 and carrying an L-sectioned bracket ring 53 extended under the edge of adjacent plate 24.

The threaded lower end of shaft 29 carries a chuck 55 rotatable therewith and adapted to receive and seat the shank of the drill bit 15 which carries a suitable cutting tip at its lower end adapted to work in concrete and cement. This chuck may be of the type adapted to open and close upon being turned relative to its supporting shaft or, if preferred, may be of the key-operated type, it being requisite only that it retain its adjustment in the presence of continued and relatively violent vibration.

It is essential that the attachment casing be fixed with respect to the casing of drill 10 in order that it not rotate with the driving shaft. To accomplish this result casing member 21 is provided with a bracket comprising a spring arm 61 extended upwardly and carrying at its upper end a serrated U-shaped seat 62 adapted to en-

close partially the lower end of the casing 11. If preferred, or if the bracket 61 does not properly engage the drill casing 11, the attachment can instead be held against rotation by means of a laterally extending handle 64 preferably connected to the top wall 22.

In the operation of the present invention the closing of the control switch 63 results in the flow of current through the leads 14 to the driving electric motor of the drill 10, whereupon the motor rotates and with it the chuck 12 positioned at its lower end. This rotation is transmitted to connected shaft 26 of unit 20 which rotates in its bearing 27, the casing being prevented from rotation by the bracket 61 which frictionally holds the casing of drill 10.

Shaft 26 carries the cam 44 and the rotation of the latter effects the longitudinal displacement of follower 46 and with it the hammer 34 fixedly connected thereto. Each displacement under the action of the cam tensions the spring 36 whereupon the latter effects the return of the hammer 34 with a snap action as the follower 46 rides over the cut-off of the cam. The hammer 34 strikes the anvil 33 a sharp blow resulting in the longitudinal displacement of shaft 29 relative to the driving shaft 26. It is seen that no longitudinal force is transmitted by this blow back through the shaft 26 to the driving motor because of the presence of the pin and slot connection at 28 and 31 between shafts 26 and 29.

The blow transmitted to the shaft 29 is directly effective through the chuck 56 on the drill bit 15 to drive the lower cutting end thereof into the material. It is sometimes desirable to vary the force of the blow struck and this can be done by the manual adjustment of the sleeve ring 51 upon the casing 20, the rotation thereof in one direction providing a greater tension in spring 36 and resulting in the striking of a harder blow, while its rotation in the reverse direction results in the opposite result.

With the drill 15 lifted from contact with the surface being worked upon, the force of the blow delivered to the anvil 33 is transmitted to the shoulder 47 on the bottom plate 24. The latter is so positioned that the downward travel of the anvil is stopped in time to prevent the follower 46 from transmitting the blow to the cam 44.

From the foregoing it is clear that the drill and attachment constructed in accordance with the present invention operates with the advantages characterizing the prior art and in addition thereto insures a more effective operation through providing a reciprocating action characteristic of the pneumatic hammers. In the preferred form illustrated the reciprocating force is provided by the same power source providing the rotational force but other accepted power sources could be used, as for example the hammer 34 could be reciprocated by an electric solenoid, or pneumatically.

While the particular apparatus herein shown and described in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

We claim:

1. In a drill construction, a driving shaft, an aligned driven shaft, means carried by said driven shaft to seat a working tool, means connecting

said driving and driven shaft for conjoint rotation and independent longitudinal displacement, a cam carried by said driving shaft, an anvil carried by said driven shaft, a hammer exterior of said driving and driven shafts movable relative to said cam to strike said anvil, and means including a cam follower connected to said hammer to effect the reciprocation of said hammer to deliver a striking blow to said anvil.

2. In a drill construction, a casing, a driving shaft extending into said casing, a cam carried by said driving shaft within said casing, a driven shaft aligned with said driving shaft, connected to the end thereof, and extended into said casing, an anvil on said driven shaft in said casing, a chuck carried by said driven shaft outside of said casing adapted to seat a working drill, means connecting said driving and driven shafts for conjoint rotation and independent longitudinal displacement, a hammer exterior of said driving and driven shafts movable in said casing to strike said anvil to deliver a blow through said driven shaft to said working drill, and means including a cam follower and a tension spring to effect the reciprocation of said hammer upon the rotation of said cam.

3. In an attachment for drills a casing, a drive shaft extended from said casing and adapted to be connected to the rotating shaft of a drill, a driven shaft adapted to be connected to a drill bit aligned with and abutting said drive shaft, means connecting said drive and driven shafts for conjoint rotation and independent longitudinal displacement, bearings rotatably supporting each of said drive and driven shafts in said casing, cam and follower means mounted for relative rotation upon the rotation of said drive shaft, a longitudinally displaceable hammer positioned radially outside said driven shaft and connected to said cam and follower means to be displaced thereby, an anvil carried by said driven shaft at one end of said hammer, and spring means acting upon said hammer to force it against said anvil upon the release of said hammer by said cam and follower means.

4. In an attachment for drills, a casing, a drive shaft extended from said casing and adapted to be connected to the rotating shaft of a drill, a driven shaft adapted to be connected to a drill bit aligned with and abutting said drive shaft, means connecting said drive and driven shafts for conjoint rotation and independent longitu-

dinal displacement, bearings rotatably supporting each of said drive and driven shafts in said casing, cam and follower means mounted for relative rotation upon the rotation of said drive shaft, a longitudinally displaceable non-rotating hammer slidably mounted in said casing for movement parallel to the axes of said shafts, said hammer being connected to said cam and follower means for displacement thereby in one direction, an anvil carried by said driven shaft and positioned as to be contacted by said hammer, and spring means acting upon said hammer and opposing its displacement by said cam and follower means, said spring means exerting a force to drive said hammer against said anvil upon the release of said hammer by said cam and follower means.

5. In an attachment for drills, a casing, a bracket extending from said casing adapted to seat upon the adjacent end of a drill to prevent relative rotation between said casing and drill, a drive shaft extended from said casing and adapted to be connected to the rotating shaft of a drill, a driven shaft adapted to be connected to a drill bit aligned with and abutting said driven shaft, means connecting said drive and driven shafts for conjoint rotation and independent longitudinal displacement, bearings rotatably supporting each of said drive and driven shafts in said casing, cam and follower means mounted for relative rotation upon the rotation of said drive shaft, a longitudinally displaceable hammer positioned radially outside said driven shaft and connected to said cam and follower means to be displaced thereby, an anvil carried by said driven shaft at one end of said hammer, and spring means acting upon said hammer to force it against said anvil upon the release of said hammer by said cam and follower means.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
953,651	West	Mar. 29, 1910
2,299,881	Demo	Oct. 27, 1942
2,353,321	Snodgrass	July 11, 1944
2,457,565	Kott	Dec. 28, 1948