H. A. DALMAS.

ROCK DRILL.

APPLICATION FILED SEPT. 9, 1907.

956,044. Patented Apr. 26, 1910.

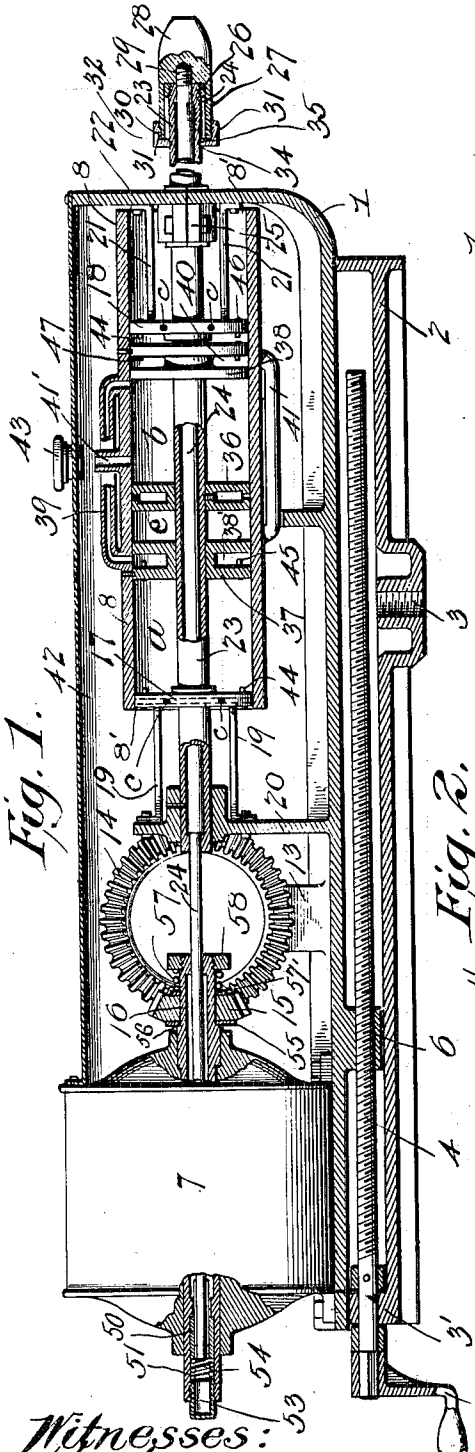

Fig. 1.

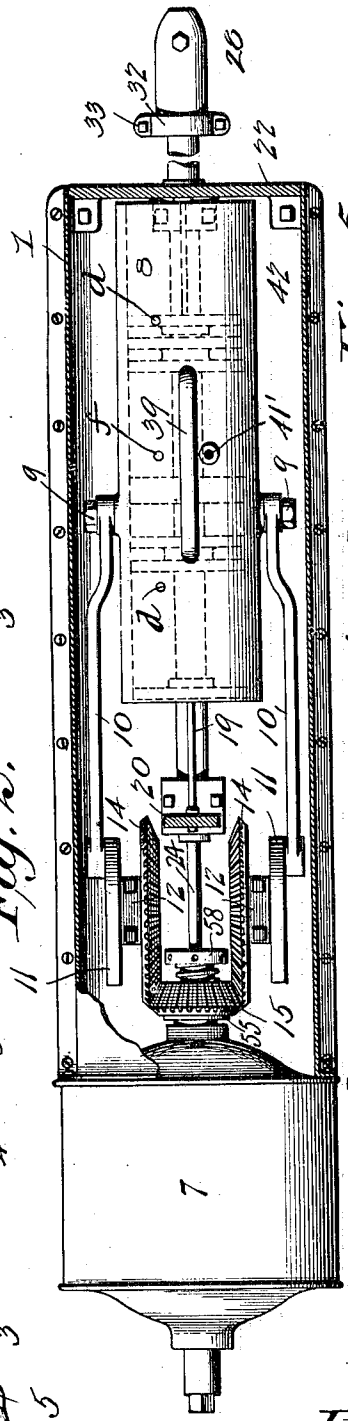

Fig. 2.

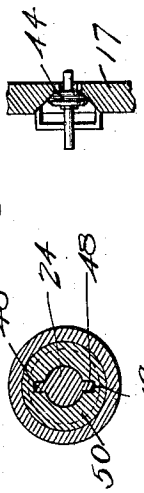

Fig. 4.

Fig. 5.

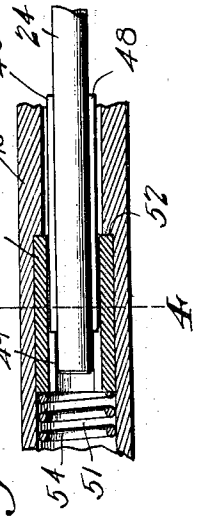

Fig. 3.

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UNITED STATES PATENT OFFICE.

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ROCK-DRILL.

956,044. Specification of Letters Patent. Patented Apr. 26, 1910.

Application filed September 9, 1907. Serial No. 391,979.

To all whom it may concern:

Be it known that I, HENRY A. DALMAS, a citizen of the United States, residing at Manassas, in the county of Prince William and State of Virginia, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification.

This invention relates to power driven drills, for drilling rock and other similar substances to adapt them for the reception of explosives or blasting charges, or for other purposes. In drills of this character, in most common use, springs are employed to lessen or relieve the shock of impact between the drill-steel or bit and the substance operated upon, but these, due to the rapid reciprocation or movement of the parts, and the intensity or suddenness of the shocks, frequently break, thus for a time disabling the drill and entailing a loss of time in repairing or replacing the broken parts.

The object of this invention is to overcome these difficulties which I do by eliminating shock relieving springs, ratchets, and other complicated mechanisms. I employ a reciprocating fluid containing cylinder, the fluid being preferably air, against which the piston or plunger within the cylinder operates to yieldingly reciprocate the drill shaft and the chuck-shaft, all as will be presently described. A further object of the invention is to provide a drill embodying a construction that will permit it to be readily and with little effort transformed into a simple boring machine, the use of which frequently becomes desirable and advantageous, where seams in the rock or other substances operated upon are met with.

Other objects and advantages resulting from the simple arrangement of the parts and the elimination of complicated means likely to get out of order, such as pawls, ratchets, etc., for turning the steel, will become apparent in the course of the following description.

The power for driving the drill is preferably an electric motor, the shaft of which I modify for connection with the chuck-shaft, but with the exception of this modification, the motor may be of any desired or improved construction, and I do not limit myself to the particular connection between the chuck-shaft and motor shaft, which is illustrated.

In the drawings illustrating the invention: Figure 1 is a central longitudinal section of a drill constructed in accordance with my invention, the motor casing being partly broken away to show the manner in which the drill parts are connected with its shaft; Fig. 2 is a top plan view of the drill, the casing being broken away; Fig. 3 is an enlarged detail sectional view showing the manner of connecting the chuck shaft to the motor shaft, the tensional gearing between these parts and the means whereby the chuck shaft, while rotating with the motor shaft is at the same time, permitted to reciprocate: Fig. 4 is an enlarged cross section taken on line 4—4 of Fig. 3; and Fig. 5 is an enlarged detail view showing a valve which I may employ in the stationary heads moving with the drill barrel and over which the reciprocating drill barrel or cylinder works.

In the drill about to be described, I provide a driving means for the chuck-shaft, and drill shaft, whereby they are reciprocated, the same being a reciprocated cylinder or fluid containing body containing fixed heads, which cylinder instead of remaining stationary as is usual, is reciprocated against suitable heads, stationarily fixed to the drill frame and a head carried by the reciprocating drill-shaft, and means for admitting air or other fluid to the cylinder and exhausting the same, and connections between the cylinder and the motor, whereby the cylinder is reciprocated uniformly, so as to impart uniform reciprocal movement to the drill and chuck-shafts.

Referring to the drawings, the numeral 1 designates the drill frame, or the frame upon which the motor and drill parts are mounted. Attached to this frame is a base 2 provided with a threaded socket 3 upon which the whole structure may be mounted upon a suitable tripod or other support. A lug 3′ is provided at one end of the base and through this the advancing and retracting screw 4 works, which screw is provided at its outer end with a crank 5. This screw passes through the internally threaded projection 6 on the bottom of the frame, the connection being the usual one or such as will result in advancing or retracting the

drill as the exigencies of the case may require, when the crank 5 is turned by the operator.

The numeral 7 designates an electric motor which may be of any approved construction modified however, in the present instance so that its shaft may be adapted to receive the chuck shaft of the drill and be so connected therewith as to continuously rotate the said shaft as well as to permit the same to be reciprocated by the mechanism to be hereinafter described. The motor is also adapted to receive the piston whereby the drill barrel or cylinder is reciprocated.

The numeral 8 designates the drill barrel which is preferably cylindrical in form and open at both ends as indicated at 8'. This barrel is provided with trunnions 9, to which are connected the pitman rods 10, whose rear ends are connected with stud shafts on crank wheels 11, which wheels have short shafts mounted in suitable bearings 12 in standards 13 within the frame and each shaft carries on its inner end a bevel gear wheel 14, which are in gear with pinion 15 tensionally held upon the motor shaft 16. The manner of tensionally holding this wheel upon the shaft will be later described in its proper connection. The rotation of the motor shaft will impart through the gear wheels 14 crank wheels 11 and pitmen 10 a reciprocatory movement to the drill barrel 8.

The numerals 17 and 18 designate two pistons which are stationarily held, the piston 17 being supported upon the rods 19 connected with the standard 20, and the piston 18 is supported upon rods 21 which are in turn connected to the front piece 22 of the frame as shown.

The numeral 23 designates a reciprocatory drill shaft which is made tubular for the passage of the chuck shaft or rod 24. The shaft passes through suitably packed openings in the pistons 17 and 18 and is supported and guided at its rear end in the standard 20, while at its forward end it passes through a suitable bearing 25. Its forward end is threaded to receive a collar 26, which fits within the bore 27 of the chuck 28, which chuck is attached to the chuck rod by threads 29 and rotates with said rod. The periphery of the chuck is provided with a suitable groove 30 into which extends the tongues 31 of two bands 32 which are bolted together as shown at 33 so they will clamp the chuck. These bands are angular in cross section, and their inner edges are provided with tongues 34, which enter a groove 35 in the drill shaft. By this connection the chuck may rotate upon the drill shaft when driven by the chuck rod, and said chuck rod caused to reciprocate with the drill shaft.

The numeral 36 designates a piston head conforming to the interior of the drill barrel and fitting snugly therein. This head is rigidly attached to the drill shaft, and it is against this that the reciprocatory movements are given said shaft, during the operation of the drill.

The numerals 37 and 38 designate cross heads which are permanently fixed within the cylinder. The head 37 is recessed so that an annular space or narrow chamber 38' will be formed which communicates through a conduit 39 with the chamber in which the piston head 36 fast to the drill shaft works, and likewise, the head 38 is recessed to form an annular space or chamber 40 which communicates through a conduit 41 with the central chamber on the opposite side of the piston head 36. I provide an exhaust opening 41' in the drill barrel or cylinder through which the air after it has served its purpose within the barrel, is exhausted, not directly into the open air, but within a casing 42, which I preferably employ to protect the drill mechanism. This casing is closed, with the exception of a small opening closed by a plug 43, which may have a screened opening therethrough.

The pistons 17 and 18 are provided with inwardly opening valves 44, which, for instance in the case of the piston 17, when the cylinder moves forward will permit air to be drawn into the rapidly increasing space *a* within the barrel and upon the opposite movement of the cylinder it will be compressed against the inwardly opening valves 45 which establish communication between the chamber *a* and the recess 38' within the cross head 37. In the piston 18, I provide valves 46 similar to those in the piston 17 and in cross head 38 I provide valves 47, similar to those in cross head 37.

As better shown in Fig. 3, I provide the chuck shaft 24 with two oppositely disposed splines or keys 48, which are received within grooves 49 within the sleeve 50, which fits snugly in the bore 51 of the motor shaft and abuts at its inner end against an annular shoulder 52 in said shaft. Interposed between the sleeve and a screw cap 53 is a spiral spring 54, the tension of which may be varied by turning the cap in one direction or the other, as the case may require, which obviously varies the tensional connection between the motor shaft and the chuck shaft, in that the motor shaft, which revolves continuously, may be revolved independently of the chuck shaft, as when the drill encounters a seam in the rock or other obstacle offering unusual and great resistance. In a case of this sort, the sleeve would remain stationary and the motor shaft revolve as usual, there being not enough friction between the sleeve 50 and the shoulder 52 of the motor shaft to carry both of said parts together, in the face of such unusual resistance. By reason of the spline and groove connection between the chuck shaft and the sleeve 50, the proper de-

gree of reciprocatory movement of said shaft is permitted.

The pinion 15 is held frictionally against a plate 55 which is interposed between the rear face of the pinion and a shoulder 56 on the motor shaft by a spiral spring 57 which abuts against the face of the washer 57′ at one end and against a nut 58 at the other. By tightening this nut, the tension of the spring is increased to the extent necessary to reciprocate the cylinder through the miter gears 14, but when it is desired to convert the drill into a boring machine, this nut is loosened, so diminishing the degree of friction between the pinion 15 and the motor shaft, that the pinion will not rotate with said shaft and consequently no motion will be imparted to the miter wheel 14 and hence no motion will be given the drill barrel or cylinder.

In the drawings the parts are shown in the position they assume when the drill barrel has reached its extreme limit of its forward movement. In going to this point, it has drawn air through the valves in the piston 17, which air which is now within the chamber *a* will be compressed as the cylinder returns and will enter the recess 38′ in the cross head 37 through the valve 45 and be forced through the conduit 39 into the chamber *b* wherein it becomes a cushion for the piston head 36 and is liberated or exhausted out of the cylinder through the exhaust 41′.

As the cylinder moves toward the position opposite that shown, air will be drawn into the opposite end of the cylinder through the valves 46 and will occupy the increased space which has come between the piston 18 and its adjacent cross head, so that upon an opposite movement, the air will be compressed and forced into recess 40 through conduit 41 to the opposite side of the piston head 36 in the chamber *b*.

It will be understood in drilling up and down, the weight of the piston increased by the drill steel tends to force the piston head 36 through the air cushion formed in the chamber *b* at either end, close to the cross heads 37 and 38. However, contact at these points between said cross heads and piston is prevented by reason of the fact that each stroke of the drill increases the density of the air in the low side gradually lifting the piston away from cross heads 37 and 38 as the case may be. The excess air exhausts at port 41′ when the piston 36 becomes central in the chamber *b*. The air on the up side in the chamber *b* passing "free" until brought in use by change of position, thus bringing about a positive automatic or self-regulating condition without the use of additional valves or small working parts likely to get out of order or fail in their functions. The desired condition remaining positive under all changes of drill positions, thus keeping the piston 36 central at all times. This is accomplished by having the air from the up stroke forced into the chamber *b* on the down side and held by the back pressure valves 45 and 46 in cross heads 37 and 38, the density of the air being increased on each stroke until exhaust takes place, as heretofore described.

The stationary heads 17 and 18 are hollow and communicating with their hollow interior are a number of oil inlet holes *c* which register at times with the oil holes or inlets *d* in the drill barrel or cylinder. When it is desired to fill these holes with oil they are so positioned in the barrel or cylinder that the holes *c* will come opposite the holes *d* when oil may be freely put within the heads. The holes *c* are placed at intervals around the periphery of the heads 17 and 18 so that the oil put into the heads through the cylinder barrel will find its way to all parts of the interior of the cylinder or barrel, and aside from lubricating the parts it forms a liquid seal between them. The piston 36 on the drill shaft is also hollow as shown and is provided with a number of apertures *e* which may be reached through a correspondingly shaped aperture *f* in the barrel, whereby this head is filled with oil in a manner similar to that employed with the heads 17 and 18, lubricating this part and producing a liquid seal.

Claims.

1. In a rock drill, the combination with a motor, of a chuck carrying shaft rotatably and slidably connected with the motor shaft, a reciprocatory fluid containing body, and means operated by said body, whereby the chuck shaft is reciprocated.

2. In a rock drill, the combination with a motor, of a chuck carrying shaft rotatably and slidably connected with the motor shaft, a reciprocatory fluid containing body, and a drill shaft connected with the chuck-shaft and operated by the fluid-containing body to cause its reciprocation.

3. In a rock-drill, the combination with a motor, of a chuck-carrying shaft rotatably and slidably connected with the motor-shaft, a fluid-containing body, means for reciprocating said body, and a drill-shaft passing through said body and connected with the chuck-carrying shaft, whereby said shaft is reciprocated.

4. In a rock-drill, the combination with a motor, of a chuck-carrying shaft rotatably and slidably connected with the motor-shaft, a reciprocatory fluid-containing cylinder, a hollow drill-shaft passing through said cylinder and connected with the chuck-carrying shaft, said drill-shaft being provided with piston-heads, whereby the fluid pressure causes the drill-shaft to reciprocate the chuck-carrying shaft.

5. In a rock-drill, the combination with a

motor, of a chuck-carrying shaft rotatably and slidably-connected with the motor-shaft, a drill-shaft sleeved on said chuck-carrying shaft, a fluid-containing cylinder mounted on the drill-shaft, said drill-shaft being connected with the chuck-carrying shaft and provided with piston-heads, and means for reciprocating the cylinder to cause the fluid to reciprocate the drill-shaft and thereby the chuck-carrying shaft.

6. In a rock-drill, the combination with a motor, of a chuck-carrying shaft rotatably and slidably-connected with the motor-shaft, a drill-shaft sleeved on said chuck-carrying shaft, a fluid containing cylinder mounted on the drill-shaft, said drill-shaft being connected with the chuck-carrying shaft and provided with piston-heads, means for reciprocating the cylinder, and means for throwing the cylinder out of commission, whereby the device may be used as a rotatable drill.

7. In a rock-drill, the combination with a motor having a hollow shaft, of a sleeve within said shaft, a spring holding said sleeve in rotatable contact with the hollow-shaft, and a chuck-shaft, rotatable with said shaft and slidably connected with the sleeve, whereby said chuck-shaft is capable of both a rotary and a reciprocatory motion.

8. In a rock-drill, the combination with a motor having a hollow shaft, a sleeve, a spring for tensionally connecting said sleeve to said shaft, and a chuck-shaft, rotatable with said shaft and slidably connected with said sleeve, of a drill-shaft sleeved on the chuck-shaft, a fluid-containing body mounted on said drill-shaft, and means for reciprocating said body.

9. In a rock drill, the combination with a suitable motor, of a reciprocating fluid containing hollow body, a drill shaft passing through said hollow body and having a piston located in said body, a chuck shaft passing through the drill shaft, and slidably and rotatably connected with the motor shaft, and a chuck or drill holder carried by the chuck shaft, and means for alternately admitting air on each side of the piston on the drill shaft, said cylinder having means for exhausting the air when it has served its function in the cylinder.

10. In a rock drill, the combination of a motor, a reciprocating fluid containing hollow body, connections between the motor and hollow body whereby said body is reciprocated, stationary cross heads within the hollow body, and having valve controlled openings therethrough, a drill shaft suitably supported in the frame, a chuck shaft passing through the drill shaft and slidably and rotatably connected with the motor shaft, a stationary piston adapted to work in each end of the cylinder and having valve controlled fluid inlet openings therein, a piston carried by the drill shaft and operating between the two stationary cross heads in the cylinder, conduits, one leading from a chamber within one cross head to a point on one side of the piston head, and the other leading from a chamber in the opposite cross head to a point within the cylinder to the opposite side of the piston, and a suitable chuck carried by the chuck shaft.

11. In a rock drill, the combination with a motor having a hollow shaft, a reciprocating fluid containing hollow body, a pinion tensionally geared with the motor shaft, bevel gears supported in suitable bearings within the frame and meshing with the pinion, connections between said gears and the hollow body, whereby the said body will be reciprocated when the motor shaft is revolved, a drill shaft suitably mounted in the frame and passing through said hollow body, a piston on said shaft working in the body, a chuck shaft passing through the drill shaft and connected slidably and rotatably with the motor shaft, means for pumping air into the hollow body from either end as it reciprocates, stationary chambered cross heads carried by said hollow body and having valve controlled openings therein, a conduit leading from the chamber of one cross head to a space on one side of the piston carried by the drill shaft, and a second conduit communicating with the chamber of the opposite cross head, and adapted to deliver air on the opposite side of the piston, said second head being provided with valve controlled openings, and a chuck or steel holder carried by the chuck shaft.

12. In a rock-drill, the combination with a motor having a hollow shaft, of a sleeve in said shaft, a spring for holding said sleeve in frictional contact with said shaft, said sleeve being provided with internal grooves, and a chuck-shaft passing into the sleeve and provided with keys which enter said grooves, all so constructed and arranged that the chuck-shaft may have both a rotary and reciprocatory motion.

13. In a rock-drill, the combination with the hollow-shaft of a motor, of a chuck-shaft rotated by said motor, a drill-shaft sleeved on said chuck-shaft and connected thereto, a fluid-containing body mounted on said drill-shaft, mechanism driven by the motor-shaft for reciprocating said body, and means for putting said mechanism out of commission, whereby the drill is converted into a boring machine.

14. In a rock-drill, the combination with the motor-shaft, of a motor, of a chuck-carrying shaft rotated by said motor, a reciprocatory fluid containing body, a pinion mounted on the motor shaft, gearing driven by said pinion to reciprocate the fluid-containing body, and means for disconnecting the pinion to put said body out of commission,

thereby converting the machine into a boring machine.

15. In a rock-drill, the combination with the motor-shaft, of a chuck carrying shaft rotated by the motor, a reciprocatory fluid-containing body, a pinion mounted on the motor shaft, gearing driven by said pinion to reciprocate the fluid-containing body, a tensioning device whereby the pinion may be disconnected to put said body out of commission to convert the machine into a boring machine.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY A. DALMAS.

Witnesses:

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