(No Model.)

A. BALL.

CORE BREAKER AND LIFTER FOR ANNULAR ROCK DRILLS.

No. 315,887. Patented Apr. 14, 1885.

Fig. 8.

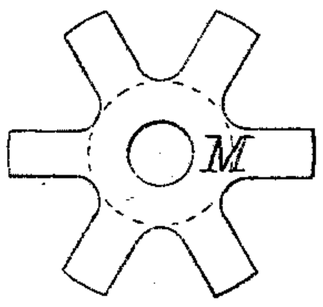


Fig. 7.

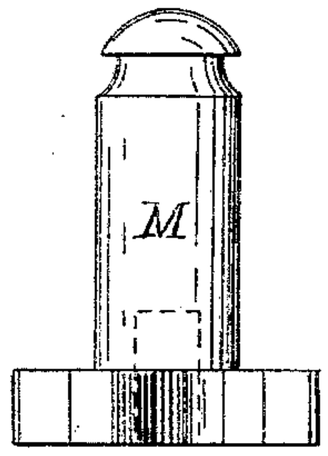


Fig. 6.

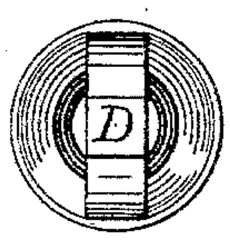


Fig. 5.

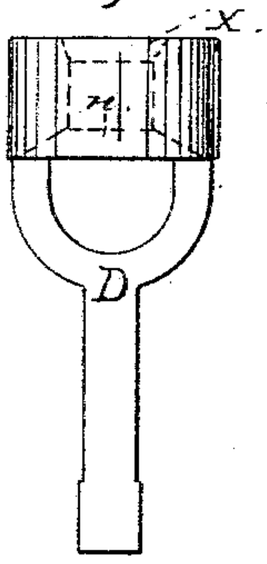


Fig. 1.

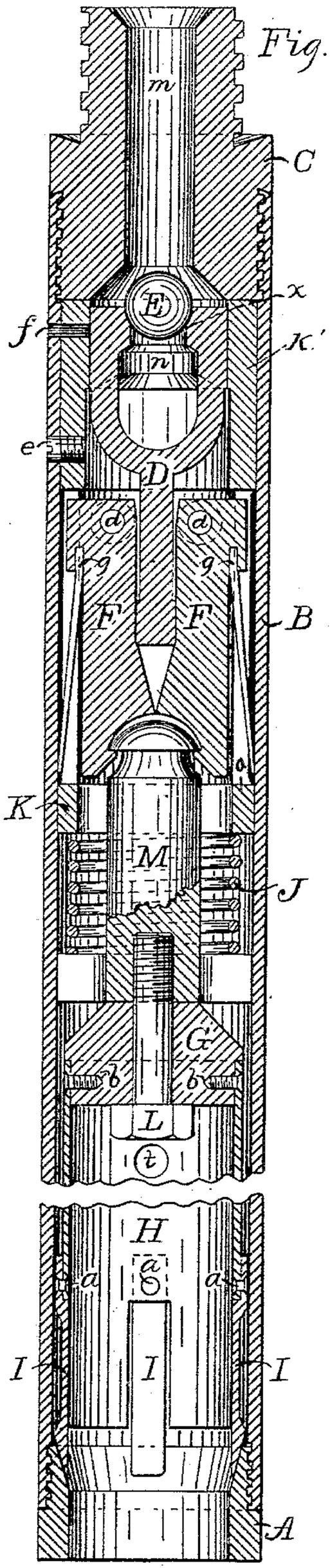


Fig. 2.

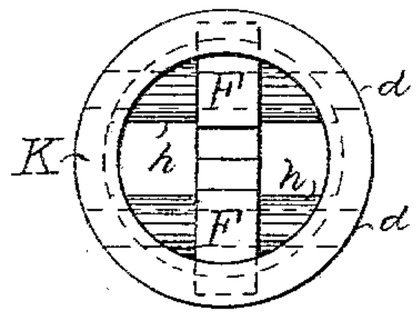


Fig. 3.

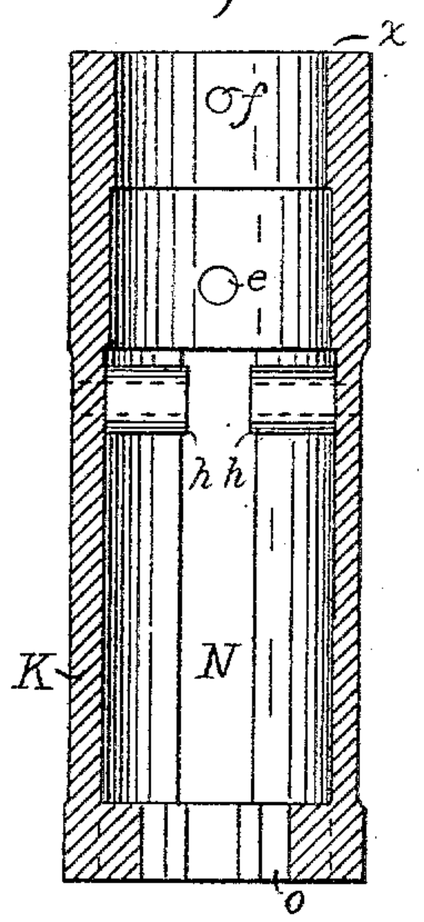
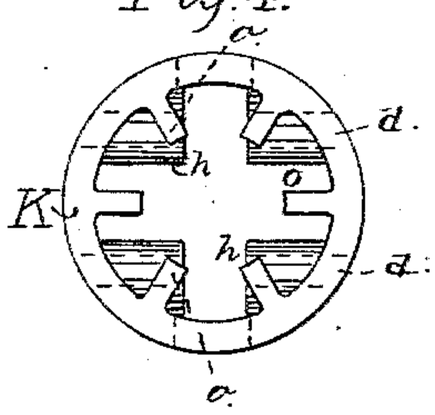


Fig. 4.



WITNESSES

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UNITED STATES PATENT OFFICE.

ALBERT BALL, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNOR TO THE SULLIVAN MACHINE COMPANY, OF SAME PLACE.

CORE BREAKER AND LIFTER FOR ANNULAR ROCK-DRILLS.

SPECIFICATION forming part of Letters Patent No. 315,887, dated April 14, 1885.

Application filed December 20, 1884. (No model.)

To all whom it may concern:

Be it known that I, ALBERT BALL, of Claremont, in the county of Sullivan and State of New Hampshire, have invented a new and Improved Core Breaker and Lifter for Annular Rock-Drills; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention relates to improvements in prospecting or boring annular drills; and it has for its purposes the attainment of the longest and most perfect core and to the breaking off of the same and its removal in the most effective manner.

Among the many core grasping, breaking, and raising devices employed for similar purposes, whether wedges, annular, or otherwise, rings, springs, jaws, or eccentrics, it will be found that in all of them, as the boring-head with its proper tube descends in its work, these various devices, which are in all instances connected with this tube more or less directly, descend with the tube and pass down with it over the core and always in contact with it.

In the act of raising the boring-rod and the tube referred to, the core, if unbroken, of course being stationary, the various grasping devices named, by a change of the angle of contact with the core, grasp the same so firmly that by the further raising of the boring-tube the core is broken and grasped firmly, so that it is raised with the boring-tube to the surface, and is ready for inspection. In the use of all of these annular boring-drills a constant supply of water under pressure around the boring-head is essential, which serves to keep the same cool and to aid in expelling the detritus or débris. By the joint action of the water laden with detritus and débris and of the constant friction of the grasping devices with the core, and by their partially filling up the water-channel, and by the revolution of the drill, the core, particularly in the softer rocks, is worn away and cut to such an extent that it breaks while the work of boring is going on, and, by the act of breaking, frequently binds and jams and chokes up the tube to such a degree as would injure or destroy the grasping devices if the boring were continued, or stop the effective work of the boring-head, necessitating the frequent removal of the entire tubing and drill-rods, and involving, particularly in deep boring, a wasteful expenditure of time.

My improvement, seeking to obviate these defects and inconveniences, has for cardinal ideas the removal of the grasping devices from contact with the core while the work of boring progresses, and at the same time a provision for a clear open uniform space around the core throughout its desired length for the passage-way of the water, and devices for operating the grasping devices at will from the surface of the ground before the tubing is raised; and the novelty and invention therein consists in placing the grasping devices, when not in use, so that they shall not extend into this uniform space between the core and the interior of the tube, and in employing spring-pressure to operate the grasping device, and in actuating such spring-pressure from the surface of the ground, and in the novelty of the various devices employed and their several operative combinations, all as more specifically hereinafter described and claimed.

For the better comprehension of my invention, reference should be had to the accompanying drawings, in which—

Figure 1 shows a central vertical sectional view of the drill-head, the length of tubing nearest to the drill-head, and the coupling which connects this length of tubing and the one adjoining, of the small working size, with a part broken out and in position for operation. Fig. 2 is a top view of the cylinder K shown in Fig. 1; and Figs. 3 and 4, respectively sectional and lower end views of the same. Fig. 5 is a side view of the valve and stem D indicated in Fig. 1, and Fig. 6 is an end view from below of the same. Fig. 7 is a side view of the plunger-pin M indicated in Fig. 1; and Fig. 8 an end view of the same.

In the different drawings like letters refer to corresponding parts.

A represents the drill-head, which is attached by the usual screw-thread to the last length of the drill-tube B, usually called the "core-barrel." The inside of the drill-head is preferably made with a bevel to receive the points

of the grasping and breaking wedges I I I. These wedges are preferably made spring-wedges, and are arranged to keep back out of the way of the core when not in use, and at uniform distance from it at every point. They may be of any desired number and length. For economical replacement, if broken or worn, I prefer to make them short, and to rivet them to the outer lower part of cylinder H by the rivets *a a a*, as shown, where the upper front ends of the wedges are cut away a depth equal to the thickness of the walls of said cylinder, and the back upper ends serve to hold the lower end of the cylinder in position. H, as shown in Fig. 1, is a cylinder extending nearly the whole length of the core-barrel. It is not necessarily a cylinder, but can consist of longitudinal sections of a cylinder or strips of metal, or the wedges I I I can extend the whole length; but the form of cylinder is preferred as being stronger. If cylindrical, it is provided with holes *t* to give free passage of the water to and from the core. It is made of thin metal, so as to take the least space inside of the core-barrel, and is uniform and smooth throughout its length, leaving a clear uniform space at all points between it and the core, so that it may not obstruct the flow of water, or cause the cutting away of the core by the water and detritus which would result from any obstacle. It is important that there should be free passage of the water from the inside of the cylinder H, so as not to impede the progress of the core nor the advance of the breaking-wedges attached to said cylinder when it is thrown forward. Besides serving to hold the wedges in their proper place when not in actual use, it serves to carry them forward to their work, as will be explained.

There may be equivalent devices for accomplishing both purposes named, which will be shown more in detail in another application for Letters Patent intended to be filed simultaneously herewith.

G is a head fastened by screws or rivets to the upper end of cylinder H. The upper part of this head is made beveling, so as not to obstruct the passage of the water from the plunger-pin M down through the core-barrel.

L is a screw which passes centrally through the head G, and holds the top end of the cylinder H in central position within the tube, and also holds said head to the plunger-pin M. It allows the head G to revolve on the smooth shank of the screw, and thus prevent the wearing of the latches F F by the head of the plunger-pin M turning on them. Ordinarily, the gravity and the friction will cause the whole device just named to revolve with the drill rod and head; but it sometimes happens that the core, as in soft rock and at seams, separates and would become wedged enough to overcome the force of this gravity and friction, and thus this freedom of independent revolution becomes important. This plunger-pin M fits at its lower end loosely in the core-barrel B, and is there cut away, as shown in Fig. 8, to allow free passage to the water. The top end is grooved to allow the hooks of the latches F F to catch and hold the plunger-pin in position to keep the spring J under tension (for a purpose which will be explained) and the cylinder H and wedges I up out of the way and in position during boring, as shown in Fig. 1. The spring J shown as a spiral spring, and in Fig. 1 shown under tension, surrounds the body of the plunger-pin M, and is properly held at its upper and lower coils between the lower end of the cylinder K and the lower part of the plunger-pin, respectively, and when the latches F F release the plunger-pin this pin is forced down by the expansion of the spring. The latches F F, pivoted at *d d* to cylinder K, have inclines on which the valve-stem D works to open them, and in opening to unlatch them from the plunger-pin. The springs *g g*, when not forced back, keep the latches up to their work in catching and holding the plunger-pin.

K is a cylinder extending from the lower end of the drill-tube coupling C to the coil-spring J. It forms the top bearing of the spring. In the lower end are guides *o*, Figs. 3 and 4, which hold the plunger-pin M in place.

N, Fig. 3, shows one of two slotted openings in cylinder K, to insert latches and hold the springs *g g* in place. *h h*, Figs. 2, 3, and 4, are projections through which the pins pass to hold the latches F F.

D (see Figs. 1, 5, and 6) is a sliding valve annular at its upper end which fits into a casing, K′, secured to the inner walls of the cylinder K. It has an opening through it, and a projecting stem downward, which is preferably rectangular, the end of which works on the inclines of the latches F F, thereby opening them when it is forced downward. As it allows the water to pass freely through its upper part when the drilling is being done, it has then no downward pressure except its own weight, (and may be called a "balanced valve" as to pressure;) but by the insertion of a ball or plug, E, (I prefer an india-rubber ball,) which is larger than the water passage or opening through the valve, the water-passage is closed, and the whole force of the stream of water is brought against the ball and the valve, which are thereby forced down.

X is the valve-seat; *n*, an opening at its bottom; *e*, a screw to hold the valve-casing in place, and *f* a hole through the valve-casing K′ and core-barrel K. This hole is covered by the valve D when the drill is at work; but when the valve is forced down the hole *f* is uncovered and allows the water in the drill-rods above the valve to drain off as the rods are raised.

C is the coupling connecting the core-barrel with the section of drill-rod next above. The hole through the coupling *m* is preferably enlarged at the ends for the more free passage of the ball E.

The operation of my invention is as follows: The core-cylinder being raised to the surface and the ball E retained above under control of the operator, the plunger-pin M is drawn up into the grasp of the latches F F, thereby compressing the spring J, (which may be as stiff as desired for the work to be done,) and thereby bringing the spring-wedges I I I up from the smaller hole in the drill-head A and away from possibility of contact with the core, and the tubing and drill-rod are then lowered to position for work. There is then free passage for the water that is pumped down through the drill-rod, passing from the coupling C through the valve-opening *n*.

When it is desired to stop drilling, and to break and raise the core which will have passed up into the cylinder H, the ball E is dropped into the top of the drill-rod and passes rapidly down through the rods to the valve, stopping the passage of the stream of water through the valve and the core-barrel, and causing the full pressure of the water to bear upon the ball and valve D until it shall have unlocked the latches F F. Thereupon the spring J is released and its force transmitted to the wedges I I I, which are driven downward and forward with sufficient force to break the core or to hold it so firmly that it must be broken when the rod is pulled up. This construction also makes the core-barrel practically an air-tight cylinder below the valve, and tends to prevent the falling out of the core or borings when the tubing is raised. If the material worked in be unusually soft, the wedges can be so constructed and driven as almost to close the hole through the drill-head. When the valve has been driven far enough to open the latches, the hole *f* is thereby opened. This is sufficiently large to allow the water that is in the drill-rods to drain off as they are drawn up, thereby avoiding discomfort to the operators.

It is apparent that in the organization above described the length of core in suitable rock may be as great as the length of the cylinder between the boring-head A and the head G, or several feet in length.

I disclaim in this application the combination of the ball, the valve, the latches, the plunger-pin, and the wedges, and the combination of the ball, the valve, the latches, the plunger-pin, the head, and the wedges set out in my application No. 150,852, filed December 20, 1884, for improvement in core breakers and lifters for annular rock-drills, and also the combination, in the core-barrel, of an annular drill, the channels C, and the wedge-arms *e*, carrying wedges; also, the combination, with the annular drill-head and the core-barrel, of the plunger-pin, the drop-rod, the latches, and the wedges; also, the combination of the drop-rod, the latches, the plunger-pin, the spring, and the wedges, and the combination of the drop-rod, the plunger-pin, the latches, the spring, and the breaking and lifting wedges I I, as set out in my application No. 150,853, filed December 20, 1884, for improvements in core breakers and lifters for annular rock-drills.

Having thus described my improvement and its mode of operation and to some extent its advantages, what I claim as my invention, and desire to secure by Letters Patent, is as follows:

1. The combination, with an annular drill-head and core-barrel, of core grasping and lifting wedges I I, connected with the interior thereof, a clear space at all parts being left between said wedges and the exterior of the core, substantially as described.

2. The combination, with an annular drill-head and core-barrel, of the wedges I I within the core-barrel, the head G, with which said wedges are connected, the plunger-pin M, connected with the head G, and the latches F, engaging with said plunger-pin, substantially as and for the purposes set forth.

3. The combination, with an annular drill-head and core-barrel, of the cylinder H within the core-barrel, provided with water inlets and outlets, the wedges I I, attached to said cylinder, the head G, attached to said cylinder, and the plunger-pin M, attached to the head G by the bolt L, and the latches F, engaging with said plunger-pin, substantially as and for the purposes set forth.

4. The combination, with an annular drill-head and core barrel, of the cylinder K, the coil-spring J, having a bearing against said cylinder, the plunger-pin M, operated by said spring, the latches F F, engaging with said plunger-pin, the head G, attached to said plunger-pin, and the wedges I I, connected with said head, substantially as and for the purposes set forth.

5. The combination, with an annular drill-head and core-barrel, of the plunger-pin M, the valve D, connected with said plunger-pin, the latches F, engaging with said plunger-pin, the spring J, operating the same when disengaged from the latches, and the head G, connected with said plunger-pin and adapted to carry the connected wedges I I, substantially as and for the purposes set forth.

6. The combination, with an annular drill-head and core-barrel, of the ball E, adapted to close the opening to the valve D, the valve D, operating upon the latches F, the plunger-pin, the spring J, operating the same when disengaged from the latches, and the head G, connected with said plunger-pin and carrying the connected wedges I I, substantially as and for the purposes set forth.

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

ALBERT BALL.

Witnesses:
JOHN R. SHAW,
FRANK A. BALL.