E. A. PERKINS.

RECIPROCATING ENGINE.

APPLICATION FILED FEB. 6, 1908.

1,082,901.

Patented Dec. 30, 1913.

2 SHEETS—SHEET 1.

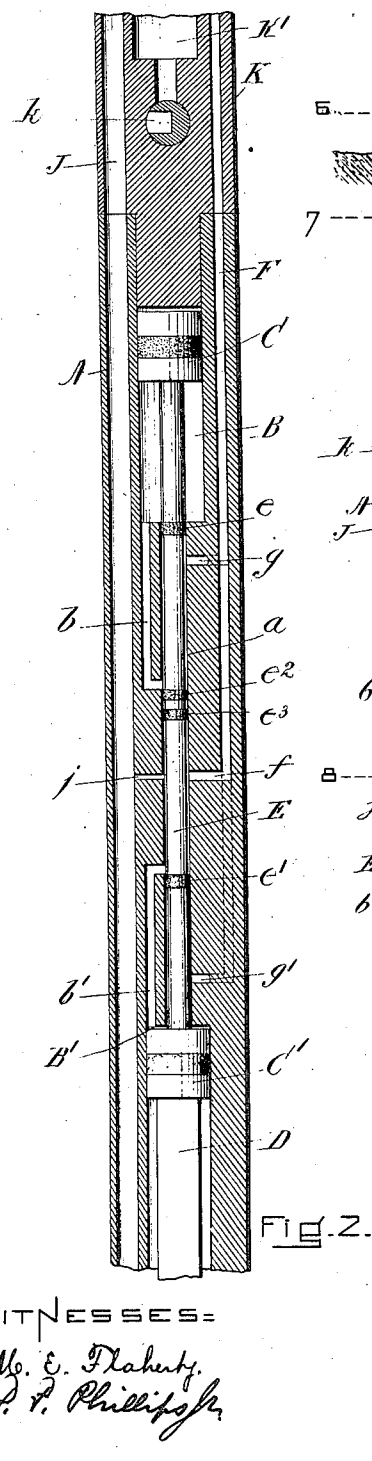


Fig. 2.

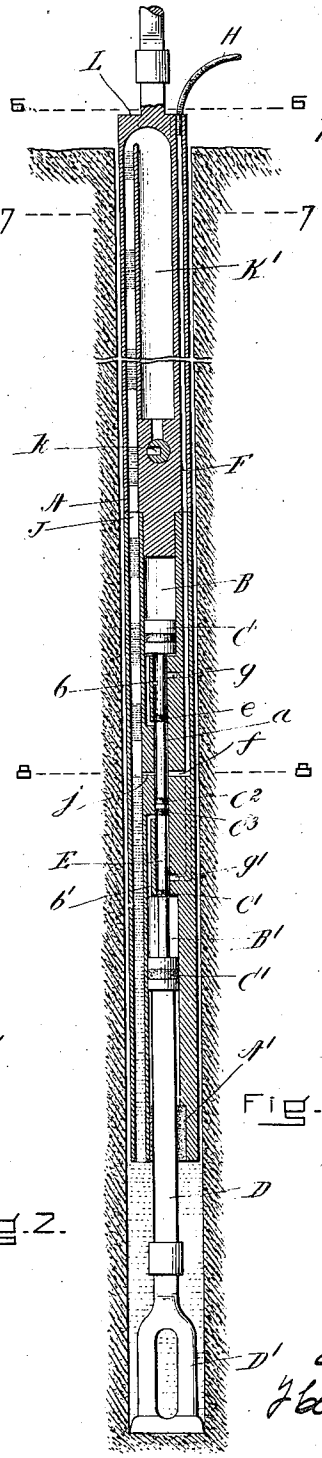


Fig. 1.

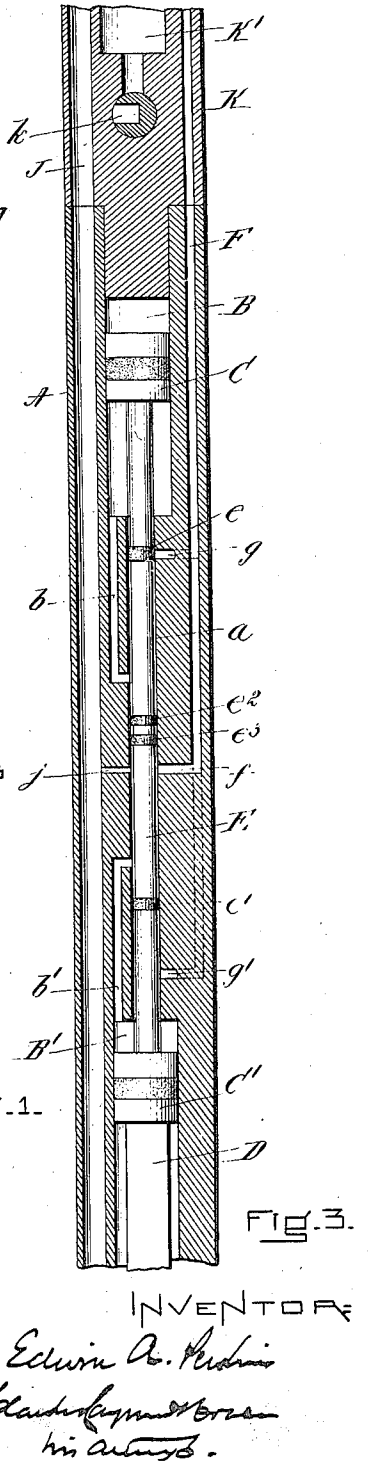


Fig. 3.

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2 SHEETS—SHEET 2.

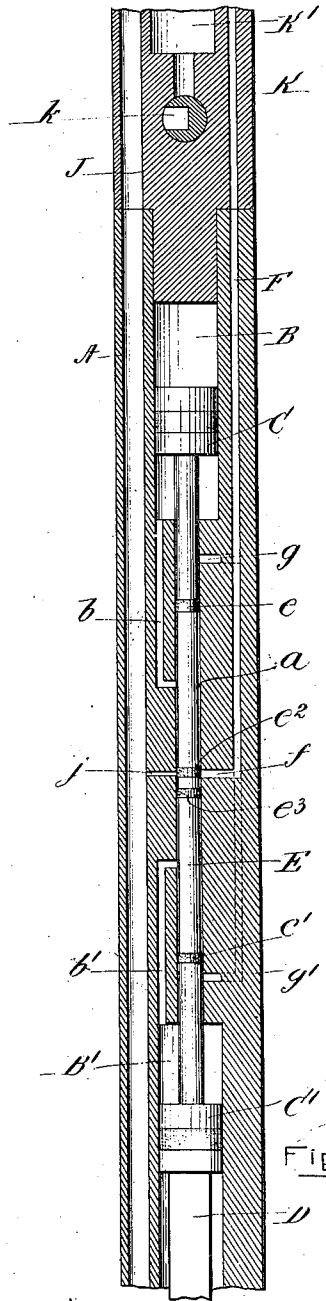


Fig. 4.

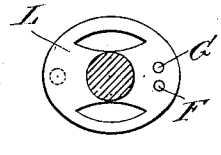


Fig. 6

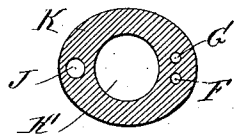


Fig. 7.

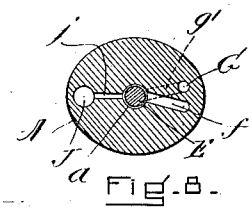


Fig. 8.

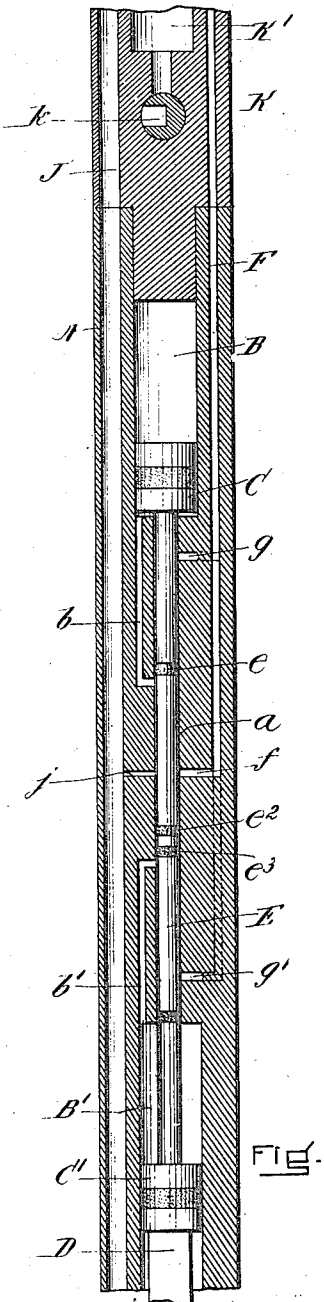


Fig. 5.

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UNITED STATES PATENT OFFICE.

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RECIPROCATING ENGINE.

1,082,901. Specification of Letters Patent. Patented Dec. 30, 1913.

Application filed February 6, 1908. Serial No. 414,486.

To all whom it may concern:

Be it known that I, EDWIN A. PERKINS, of Cambridge, in the county of Middlesex and State of Massachusetts, a citizen of the United States, have invented a new and useful Improvement in Reciprocating Engines, of which the following is a specification.

My invention relates to a reciprocating engine or tool and especially to that type of engine or tool employing reciprocating pistons connecting with one another and reciprocated by the admission of fluid pressure thereto.

The essential object of my invention is to provide an engine or tool of the above character having a simple and compact structure in which the pressure is admitted at a point between the respective pistons and directed to alternately operate upon the backs of the respective pistons for alternately impelling and retracting the same, or, in other words, effecting a reciprocating motion thereof and which is especially adapted for drills for deep boring.

My invention can best be seen and understood by reference to the drawings in which there is shown an embodiment thereof used in connection with a drill, the drill being shown for purposes of illustration attached to one of the pistons.

In the drawings: Figure 1 is a vertical section of the engine. Figs. 2, 3, 4 and 5 are enlarged vertical sections of the engine showing the different positions assumed thereby during the operation thereof. Figs. 6, 7 and 8 are sections taken, respectively, on lines 6—6, 7—7 and 8—8 of Fig. 1.

A is a casing forming the body of the engine. The casing is chambered, there being formed within it the respective piston chambers B, B^1, connecting which is an opening or passage *a*. Located within the respective chambers B, B^1 are pistons C, C^1. The piston C will hereinafter sometimes be termed the withdrawing piston and the piston C^1 the driving piston which it will be observed has attached to it, for purposes of illustration, a drill D. The two pistons are connected by a piston rod E which extends through the opening or passage *a*. The combined pistons are capable of a reciprocating movement in their respective chambers, the extent of these chambers and length of the connecting piston rod permitting of such movement. During their reciprocation the pistons are guided by the walls of their respective chambers.

Referring now to the operation of the pistons, it will be observed that the adaptation and arrangement of the parts are such that a pressure-receiving aperture or chamber is formed between the respective piston chambers. This aperture in the construction shown is formed between the wall of the aperture *a* and the piston rod extending through this passage, the central portion of the piston rod E being smaller than the bore of said passage, thereby leaving a portion of the passage open around the rod forming the pressure-receiving aperture. Only the central portion of the piston rod is made smaller than the bore of the passage through which it extends for as the piston rod at either end thereof approaches the respective pistons the rod is made of substantially the same size as the bore of the passage *a* through which it extends or so as to fit snugly therein without interfering with the longitudinal movement of the rod through the passage *a* during the reciprocation of the pistons. Inasmuch as the pressure-receiving aperture left between the piston rod and wall of the passage *a* forms actually a part of the passage *a* it will hereinafter be referred to as the pressure-receiving aperture *a*. Into this aperture the pressure is initially admitted for reciprocating the respective pistons through a supply passage F which connects with the aperture *a* by a by passage *f*.

The pressure from the pressure-receiving aperture *a* is alternately supplied to the backs of the respective pistons for effecting a reciprocating movement thereof as follows: There are provided through the wall of the casing two passages *b*, b^1. The passage *b* extends from the pressure-receiving aperture *a* at one end thereof through the wall of the casing and connects with the chamber B back of the piston therein. The passage b^1 extends from the other end of the pressure-receiving aperture *a* through the wall of the casing and connects with the chamber B^1 back of the piston C^1 located within this chamber. It is through these passages *b*, b^1 that the pressure is supplied to the backs of the respective pistons; to the piston C for effecting a retracting movement of the engine and to the piston C^1 for effecting a driving movement thereof. There also connects with the pressure-

receiving aperture *a* an exhaust passage G. This passage G connects with the aperture *a* by separate by passages *g*, *g*¹, which are so arranged that both by passages will not be in simultaneous communication with the aperture *a*, but will alternately have communication therewith only as the pistons are reciprocated and the piston rod has accordingly a longitudinal movement. In other words, the exhaust by passages *g*, *g*¹ open onto the piston rod at points respectively between the passages *b*, *b*¹ and the respective piston chambers with which they connect and accordingly are farther separated from one another than the length of the aperture *a* so that said aperture will only have communication with said exhaust by passages as the rod is moved longitudinally during the reciprocation of the pistons.

In order that the fluid pressure may be directed from the pressure-receiving aperture *a* to enter the piston chambers B, B¹, through the passages *b*, *b*¹, and exhaust therefrom through the by passages *g*, *g*¹, and main exhaust passage G in proper alternation, the piston rod E is provided with a series of enlargements or rings *e*, *e*¹, *e*², *e*³ which move with the piston rod and in so far as my invention is concerned form a part thereof although in practice these rings may be in the nature of auxiliary rings or washers applied to said rod. The particular arrangement of these enlargements or rings in their relationship to the other passages can only be understood in the light of the operation of the engine.

It will be assumed that the engine is in the position shown in Fig. 2, or at the end of its retraction, in position to be impelled by the pressure for effecting its working stroke. At this time the arrangement of the enlargements or rings *e*² is such that they will lie above the pressure inlet passage *f* on which account the pressure cannot pass by reason of the enlargement of the rod above these rings through the aperture *a*, but will be directed to pass downward through the aperture and enter the passage *b*¹ and chamber C¹ back of the piston B¹ therein, thereby acting to drive down the piston and effect the working stroke of the engine. At this same time the pressure cannot enter the exhaust *g*¹ by reason of the fact that the piston rod between the entrance into the passage *b*¹ and the chamber C¹ is made of sufficient size to fill the pressure-receiving aperture *a* and so close the exhaust. The effect of this air pressure in the passage *b*¹ is illustrated in Figs. 3, 4 and 5, Fig. 3 showing the first effect where the piston C¹ has been driven down part way carrying with it of course the piston C and the piston rod E which connects the two pistons as well as the enlargements or rings *e*, *e*¹, *e*² and *e*³. In Fig. 4 there is illustrated a further movement of the piston and the parts connected thereto and in Fig. 5 the extreme movement. It will be noted that in Fig. 4 the ring *e*² is just passing the opening of the aperture in the passage *f* and in Fig. 5 the rings *e*² and *e*³ have passed the opening *f*. During this period it will be noted that, presupposing the pistons have been lifted by pressure on the rear of the piston C and that the chamber B is full of compressed air, this compressed air will have an outlet through the passage *b*, the aperture *a* and the exhaust passage *g*, this relieving the immediate pressure until such time as the enlargement *e* closes the outlet *g* as shown in Fig. 3 after which time, during the further descent of the ring *e* the air has an opportunity of escaping through the upper part of the aperture *a* where it connects with the chamber B and down through the said aperture and out through the outlet *g*.

When the parts have reached the position shown in Fig. 5 a similar situation is presented to that above described, viz: The ring *e*¹ has passed the outlet aperture *g*¹ so that the pressure in the chamber B¹ is relieved, this pressure expanding itself downward through the passage *b*¹ into the aperture *a*¹ around the piston rod E and down and out through the exhaust aperture *g*¹ and the exhaust passage G. When in this position, however, it will be also noted that the inlet *f* now connects with that portion of the aperture *a* which is above the enlargement or ring *e*² so that the pressure is applied through the passage *b* to the under side of the piston C thus tending to lift it and this lifting by direct pressure continuing until the ring *e* has passed the opening *f* when expansion and the momentum of the piston will carry the piston back to the original position shown in Fig. 2, the air in the chamber B¹ during this period being exhausted as above described first through the passage *b*¹, aperture *a* and outlet *g*¹ and then after the ring *e*¹ has passed the outlet *g*¹, through the passage around the piston rod below the ring *e*¹. This returns the parts into the position shown in Fig. 2 and the operation is repeated.

In addition I have shown in Fig. 1 attached to the top of the casing A a shell K through which the passages F and G are continued to the top thereof as above described. This shell also contains a chamber K¹. Down through the side of this shell and through the casing as well is a passage J which is connected with the aperture *a* by the passage *j* so that there is practically a continuous leakage of compressed air The top of the shell K is provided with openings *k* and the crossbar L between these openings provides a means for attaching the jars to the apparatus. This portion of the apparatus will not be further described

except to say that it is useful as an automatic pump for the purpose of lifting the cuttings and mud loosened by the drill, when the engine is used for driving a drill.

I have described above the simplest form of my invention known to me, but it may be otherwise embodied or applied to other uses than that shown in the drawings.

What I claim as my invention is:—

1. A reciprocating engine having a body or casing and formed therein separate chambers with a passage connecting said chambers, pistons located within said respective chambers and a piston rod connecting said pistons by extending through said passage, said rod for a portion of its length having a diameter less than the diameter of said passage leaving an opening between the wall of said passage and said rod, said engine and parts thereof being also provided with a fluid inlet passage communicating with said opening and with by-passages in constant communication with said opening on opposite sides of said inlet passage and leading to the adjacent ends of said chambers, and with exhaust passages connecting with portions of said opening on opposite sides of said inlet passage, said parts being adapted and arranged also whereby fluid pressure admitted as aforesaid may be alternately supplied to said opening on opposite sides of said inlet passage and to the adjacent ends of said respective chambers and exhaust therefrom through said opening and said exhaust passages as said exhaust passages become successively uncovered during the reciprocation of said pistons.

2. A reciprocating engine having a body or casing and formed therein separate chambers with a passage connecting said chambers, pistons located within said respective chambers and a piston rod connecting said pistons by extending through said passage, said piston rod for a portion of its length having a diameter less than the diameter of said passage leaving an opening between the wall of said passage and said rod, said engine and parts thereof being also provided with a fluid inlet passage communicating with said opening, and with by-passages on opposite sides of said fluid inlet passage in constant communication with said opening and leading to the adjacent ends of said chambers, and with exhaust passages on opposite sides of said fluid inlet passage removed from one another a distance longer than the length of the opening between the wall of said passage and the contracted portion of said rod as aforesaid and connecting with some portion thereof as said pistons are reciprocated, said parts being adapted and arranged also whereby fluid pressure admitted as aforesaid may be alternately supplied to said opening on opposite sides of said inlet passage and to the adjacent ends of said respective chambers and exhaust therefrom through said opening and said exhaust passages as said exhaust passages become successively uncovered during the reciprocation of said pistons.

EDWIN A. PERKINS.

Witnesses:
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