SIDNEY F SHELBOURNE & CHAS E EMERY.

IMPROVED ENGINE FOR DRILLING ROCK AND OTHER PURPOSES.

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WITNESSES

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Fig. 3.

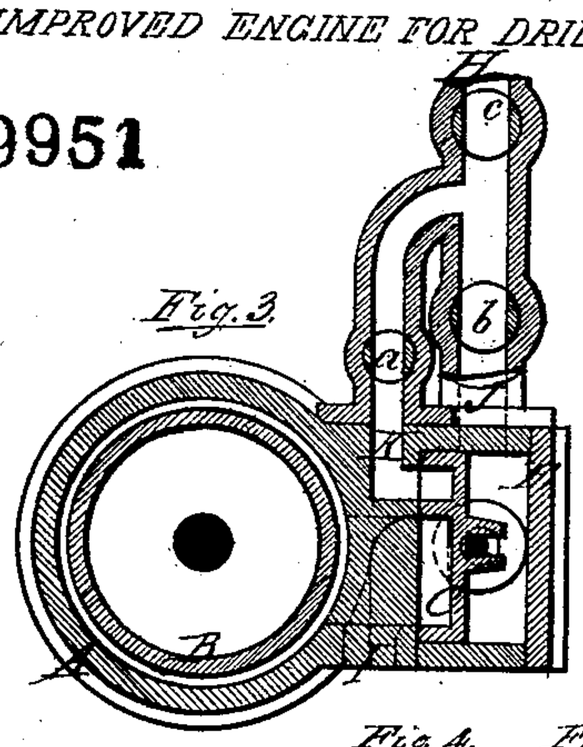


Fig. 4.

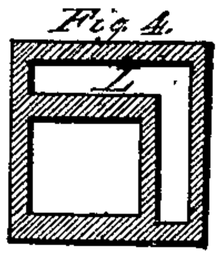


Fig. 5.

Fig. 1.

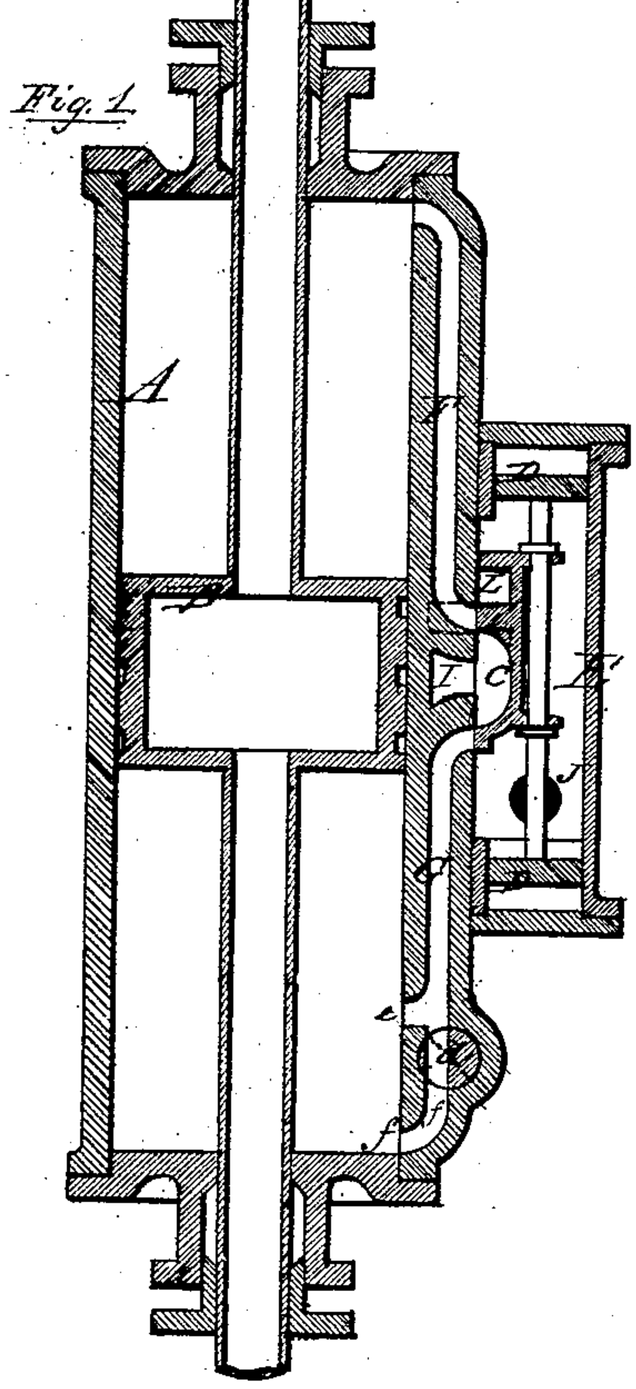
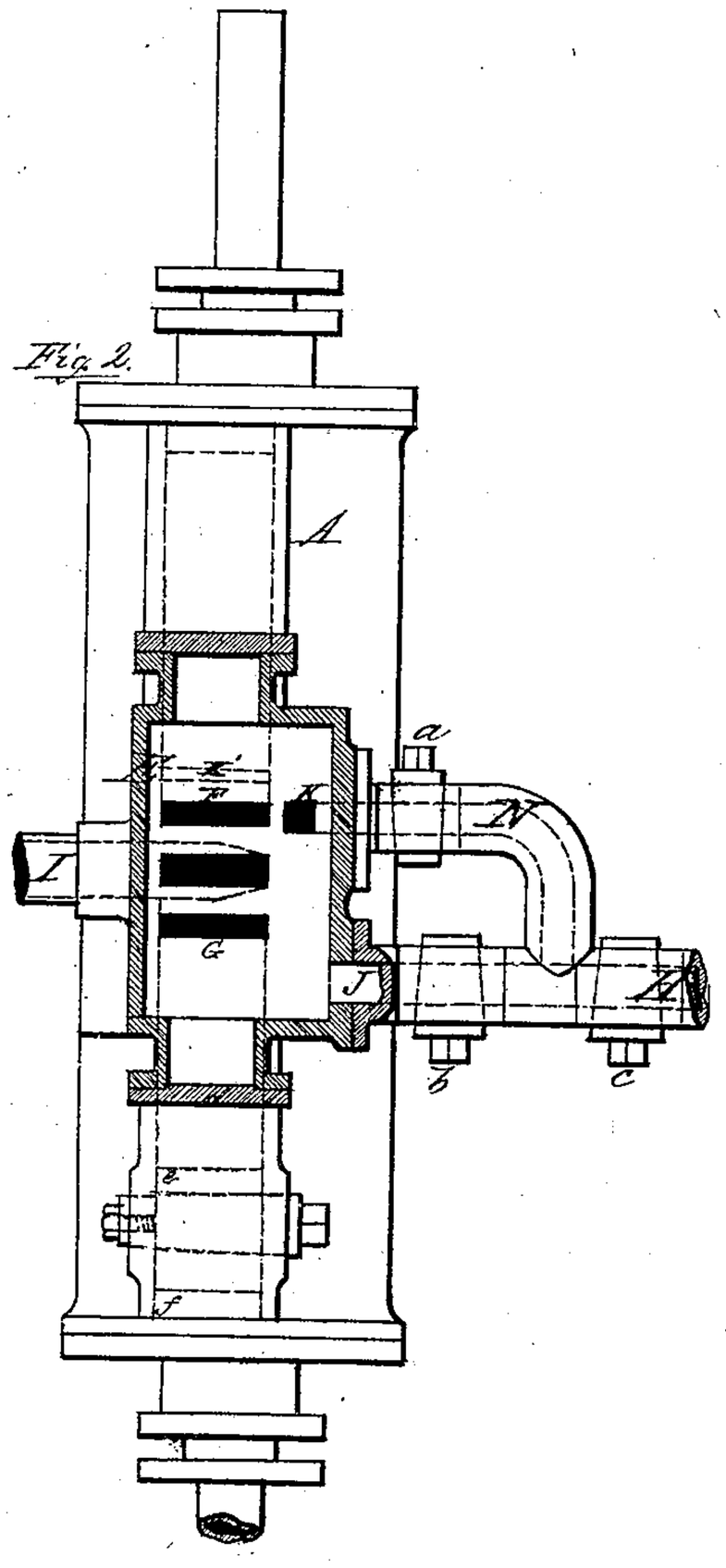


Fig. 2.



United States Patent Office.

SIDNEY F. SHELBOURNE, OF NEW YORK, AND CHARLES E. EMERY, OF BROOKLYN, NEW YORK.

Letters Patent No. 109,951, dated December 6, 1870; antedated November 28, 1870.

IMPROVEMENT IN DIRECT-ACTING ENGINES.

The Schedule referred to in these Letters Patent and making part of the same.

Be it known that we, SIDNEY F. SHELBOURNE, of the city, county, and State of New York, and CHARLES E. EMERY, of Brooklyn, in said State, have invented a new and improved Engine for Drilling Rock and Other Purposes; and we do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing making part of this specification.

Our improvements are especially applicable to engines in which the work is much greater during one stroke than the other, such, for instance, as are employed for lifting rock-drills which fall by gravity, and those operating single acting-pumps. Such engines usually have vertical cylinders, and the adaptation shown in the drawing is more particularly designed for drilling purposes, in which the greater work is done on the up-stroke of the piston.

Our invention has for its object to furnish means for separately regulating the amount of steam admitted to each end of the cylinder without in any way interfering with the free escape of the exhaust-steam; also to furnish means for checking the descent of the main piston when near the end of its stroke.

Our invention consists—

First, in constructing the main valve of the engine with a steam-chamber which communicates with the upper end only of the steam-cylinder, and receives steam through a separate passage regulated by a throttle-valve.

Second, in the combination of the above-named throttle-valve with two others, in such manner that the speed of the piston in either or both directions can be regulated readily and efficiently.

Third, in a novel combination of a throttle-valve with a passage leading from the lower main cylinder-port to a cushion chamber in the bottom of the cylinder.

In the drawing—

Figure 1 represents a vertical cross-section through the cylinder, piston, and main valve;

Figure 2 is a front elevation of the cylinder, showing the steam-chest in section;

Figure 3 is a horizontal cross-section through the cylinder, valves, and pipe;

Figure 4 is a view of the bottom of the main valve; and

Figure 5 is a longitudinal cross-section of the same.

A is the main cylinder;

B, the main piston;

C, the main valve;

D D, valve-operating pistons;

E, steam-chest;

F, upper cylinder-port;

G, lower cylinder-port;

H, main steam-pipe; and

I, the exhaust-pipe.

The piston B is represented in the drawing as it is constructed for drilling purposes, and has connected to it two hollow piston-rods, one extending up and the other down, through stuffing-boxes in the heads of the cylinders.

The main valve is constructed like an ordinary valve, with the addition of a chamber, L, which extends along the top and side of the valve, and covers the additional opening K in the valve-seat.

Steam is admitted through main steam-pipe H, passes through a cock or valve, *c*, and enters the steam-chest through a pipe, J, containing a valve or cock, *b*.

Steam also passes through a branch pipe, N, and valve or cock *a* to passage K in the valve-seat.

The main valve C is operated by auxiliary pistons D and D, as shown, or by a valve-stem extending through one end of the chest in a well-known manner.

It will be observed that as the main valve is moved in either direction, the exhaust-steam passes through the central cavity to the exhaust-port and pipe I in the usual way.

When valve C is moved up steam enters port G directly from the steam-chest E.

When valve C is moved down steam enters port F from the chamber L, being supplied to the same from opening K, as before explained.

The bottom cylinder-port G is divided into two branches, one of which, *f*, extends to the bottom of the cylinder, and the other, *e*, enters the cylinder several inches above the bottom.

The piston B is made quite thick in a vertical direction, and is preferably packed with a number of small rings so arranged that one of them, at least, is above the opening *e* when the piston is on the bottom of the cylinder.

In the branch *f* of the lower cylinder-port is placed a throttle-valve, *d*, by means of which the available area of *f* may be reduced to any desired extent.

The particular arrangement shown in the drawing was designed for drilling rock. The drill-rod passes upward through the hollow piston-rods, and a lifter attached thereto is lifted by a cross-head placed on the top of the upper piston-rod.

When so constructed the operation is as follows:

Suppose the piston to be at the bottom of the cylinder. In practice there would be, in this position of the piston, a little distance between the cross-head on the top of piston-rod and the lifter on the drill-rod. The valve C being raised, and valves *b* and *c* opened, steam enters the lower end of the cylinder through vale *d* and port *f*, port *e* being closed by the piston. In practice, the valve *d* is kept very nearly closed, so that the steam enters slowly and lifts the

piston slowly, until it passes the port *e*, when a full opening is obtained, and the piston rises rapidly. At or about the time the bottom of the piston passes port *e* the cross-head on piston-rod strikes the lifter on drill-rod, giving it a blow or "jar" which loosens the drill from the rock. The intensity of this jar may be regulated in two ways, first, by adjusting the valve *d* so as to cause the piston to rise at first with greater or less rapidity, and second, and preferably, by adjusting the position of the lifter on the drill-bar so that the cross-head strikes it after the piston has moved the proper distance above *e* to gather the required momentum. The drill is lifted at the desired speed by regulating-valve *b*, and, when the piston approaches the top of the cylinder, the valve C is moved down by appropriate means, and the piston is forced down by steam admitted through L and K, and the speed of descent may be regulated by means of valve *a*. Practically, we prefer to admit sufficient steam to cause the piston to descend with greater speed than the drill-rod, so that the latter is in no way hindered by the former, but is free to fall by gravity and give a full and effective blow. As the piston descends rapidly, the exhaust-steam passes out freely until said piston passes port *e;* then the steam remaining below *e* is rapidly compressed and can only escape through valve *d*, which is, as before said, kept very nearly closed, and the back pressure thus produced forms a "cushion" which gradually brings the piston to rest. This action is assisted by causing the main valve to be lifted at or immediately after the time that the piston closes the port *e*, so that the escape of the compressed exhaust-steam, through *d*, is retarded by live steam from the chest, which afterward enters through *d* and lifts the piston again, as before explained.

Valve *d* may be easily adjusted so that the piston will never commence its up-stroke so quickly as to catch the drill-bar in its descent.

It is not new to make a cylinder-port in two branches, like *e* and *f*. In Barrett's patent the two branches are shown, and in the longer one is a check-valve, closing to pressure from the cylinder and opening to pressure from the steam-chest. Such a check-valve would then, when in order, close the passage corresponding to *f* tightly as the piston approaches the same, and open wide during the return stroke of the piston. The arrangement shown in the drawing is an important improvement for the reason that it checks the motion of the piston in both directions, which is what is desired in a drilling-engine, and, besides, the throttle-valve *d* cannot get out of order. Check-valves often "stick," and, at other times, do not "seat," on account of the accidental introduction of foreign substances. Such an accident in an engine operating as herein described, would cause the piston to break out the bottom cylinder-head, and perhaps destroy the cylinder.

When our invention is used for a pumping-engine the main valve is made substantially as shown and described. The piston-rods may be of ordinary kind, and for slow-working engines the cylinder-ports may be of the ordinary construction. In quick-working engines of any kind the double passages *e* and *f* and valve *d* may, with advantage, be introduced on one or both ends of the cylinder.

The speed of the piston during its up-stroke being regulated by valve *b*, and during the down-stroke by valve *a*, the absolute speed of both ends may be regulated by means of valve *c* without changing the relative speed in the two directions. For instance, if the engine makes sixty double strokes a minute, and *a* be adjusted to cause the piston to descend twice as fast as it rises, then *c* may be adjusted to reduce the number of double strokes to, say, thirty per minute, but still the piston will descend about twice as fast as it is raised.

The engine is stopped by shutting *c* or both *a* and *b*. In some cases we prefer that *c* remain open when the engine is working, that *a* be set to give the piston the proper descending speed, the difference in speed being regulated entirely during the up-stroke by means of *b*.

The opening K in the valve-seat is sometimes put above F, as shown at K′, and the valve-seat is raised so that steam can be brought in from the side to said passage. In such case the chamber L is elongated vertically to cover said port at all times, and the side branch shown is omitted.

The valves *a b c* can be placed in any convenient positions in their respective pipes so long as they bear the same relations to each other as are shown. In some cases the branch-pipe N is omitted, and the throttle-valve applied within or at the side of the chest to throttle the steam directly from the steam-chest before it enters K. In such case the valve *c* is unnecessary, and the speed of the piston in both directions will be changed by adjusting *b*.

We claim as new, and desire to secure by Letters Patent—

1. The combination of a main valve, provided with the chamber L, a throttle-valve *a*, and a valve-seat, provided with the passages or ports F and K, whereby the quantity of steam admitted to one end of the cylinder may be regulated as desired, and independently of that admitted to the other, substantially as herein specified.

2. The combination and arrangement of the valves *a*, *b*, and *c* with each other, the main steam-pipe H, and cylinder-ports F and G, substantially as described.

3. The throttle-vale *d*, arranged in passage *f*, and constructed and operating substantially as described.

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