2 Sheets—Sheet 1.

W. H. ELLIOT.

Rock-Drilling Engine.

No. 208,228. **Patented Sept. 24, 1878.**

Fig. 1.

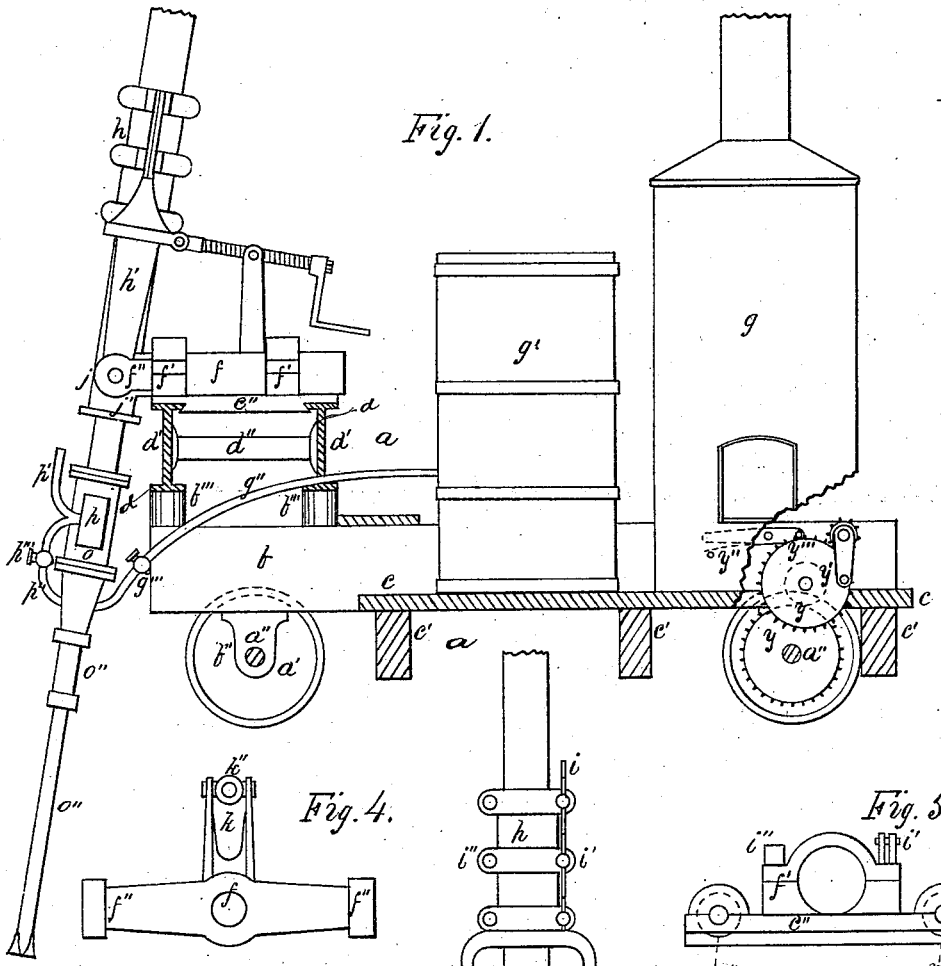

Fig. 3.

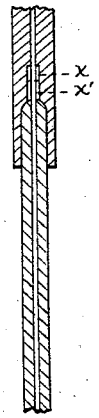

Fig. 4.

Fig. 5.

Fig. 2.

Witnesses

D. Lewis

Louis C. Moore

Inventor.

Wm. H. Elliot

2 Sheets—Sheet 2.

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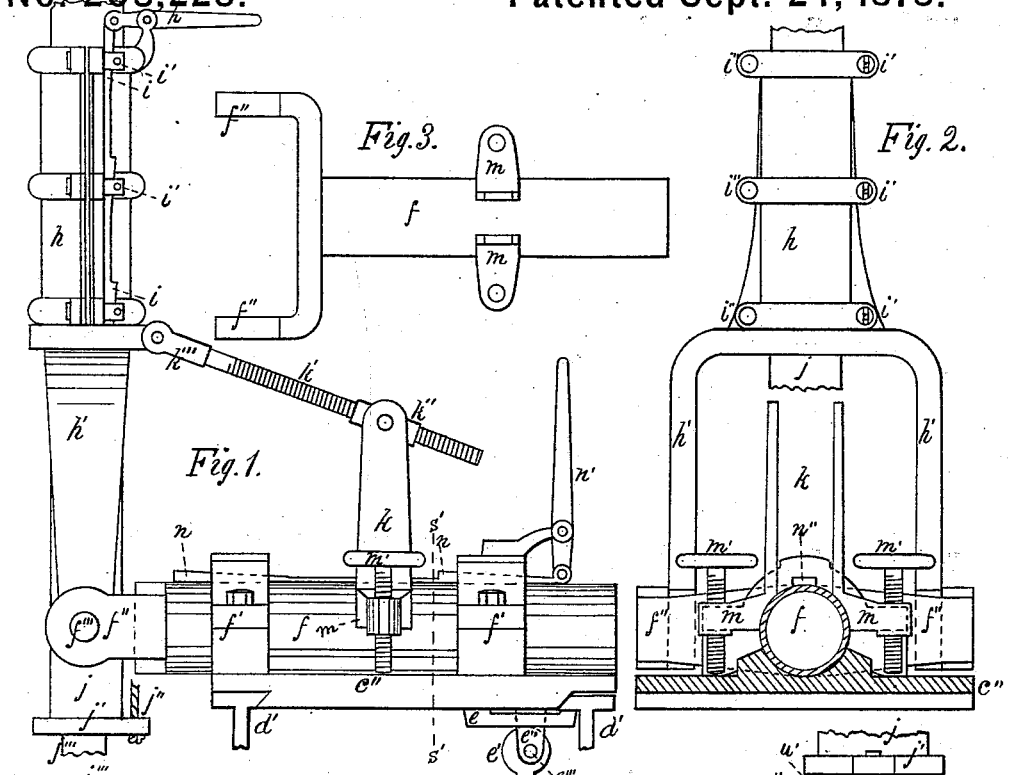

Fig. 1.

Fig. 3.

Fig. 2.

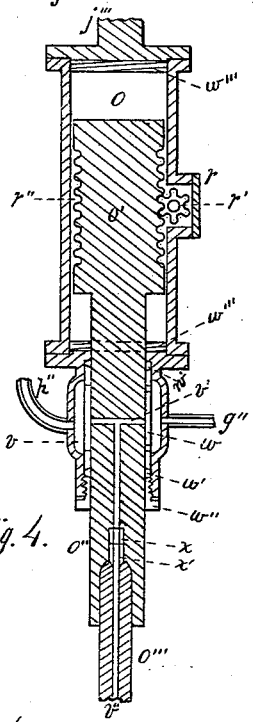

Fig. 4.

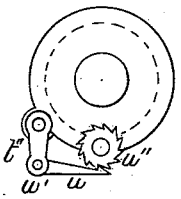

Fig. 6.

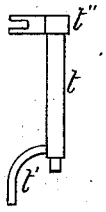

Fig. 7.

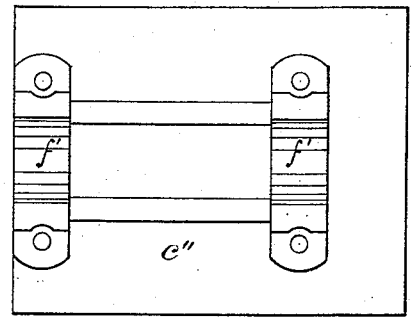

Fig. 8.

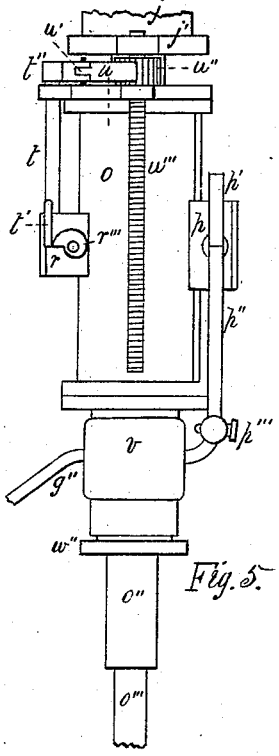

Fig. 5.

Witnesses

D. Lewis

Louis E. Moore

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Wm. H. Elliot

UNITED STATES PATENT OFFICE.

WILLIAM H. ELLIOT, OF NEW YORK, N. Y.

IMPROVEMENT IN ROCK-DRILLING ENGINES.

Specification forming part of Letters Patent No. **208,228**, dated September 24, 1878; application filed July 5, 1878.

To all whom it may concern:

Be it known that I, WM. H. ELLIOT, of the city and State of New York, have invented a new and Improved Rock-Drilling Engine, of which the following in a specification:

The object of my invention is to provide a simpler and more durable rock-drill and a more practical method of adjusting and supporting the same, and also to provide a simpler and cheaper method of removing the rock-mud from the drill-hole; and the nature of my invention consists in the use of certain appliances and methods to further the above objects, which are fully set forth in the following specification and claims.

On Sheet 1, Figure 1 is a side elevation of my improved rock-drilling engine. Fig. 2 is a front elevation of the same. Fig. 3 is a vertical section of a piston-rod and drill-tool, showing a packing between them. Fig. 4 is a front elevation of a cylindrical slide or carriage. Fig. 5 is a front elevation of a drill-carriage.

On Sheet 2, Fig. 1 is a side elevation of the several devices used for adjusting the vertical shaft. Fig. 2 is a vertical section of the same. Fig. 3 is a top view of a cylindrical carriage. Fig. 4 is a vertical section of an improved rock-drill. Fig. 5 is a front elevation of the same. Fig. 6 is a top view of the same, showing feeding device. Fig. 7 is an elevation of the same. Fig. 8 is a plan of the drill-carriage.

a is the car; *a'*, the wheels; *a''*, the axles; *a'''*, grooves in the wheels; *b*, timbers composing the wheel-frames; *b'*, connecting-pieces between the timbers *b*; *b''*, boxes; *b'''*, supports or pillars for the drill-frame; *c*, platform; *c'*, timbers supporting the same; *c''*, drill-carriage, which slides upon the drill-frame *d*; *d'*, wrought-iron **I**-beams composing in part the drill-frame; *d''*, connecting-pieces between the beams; *e*, Fig. 1, Sheet 2, gib for holding the carriage *c''*; *e'*, cam; *e''*, support for the same; *e'''*, pivot of the cam to the supports; *f*, oscillating and sliding cylindrical carriage; *f'*, boxes for the same on carriage *c''*; *f''*, arms for the support of the jacket *h*; *f'''*, pivots or bearings between jackets *h* and drill-carriage *c''*; *g*, Fig. 1, Sheet 1, boiler; *g'*, water-tank; *g''*, flexible pipe; *g'''*, stop-cock; *h'*, legs of the jacket *h*; *h''*, lever for operating the compound wedge *i*; *i'*, Fig. 2, Sheet 2, screw-heads split for the reception of the wedge; *i''*, screws which serve to hold the two parts of the jacket together; *j*, vertical shaft; *j'*, Fig. 5, Sheet 2, collar on the lower end of the same; *j''*, rope for raising and lowering the vertical shaft by means of a windlass; *j'''*, shank of the rock-drill; *k*, vertical arm on carriage *f*; *k'*, screw for adjusting the vertical drill-shaft; *k''*, pivoted nut for the same; *k'''*, sleeve pivoted to the jacket in which the screw *k'* rotates; *m*, horizontal arms on carriage *f*; *m'*, screws for adjusting the vertical shaft; *m''*, Fig. 5, Sheet 1, wheels under the carriage *c''*; *n*, Fig. 1, Sheet 2, compound wedge operated by lever *n'*; *n''*, grooves in the caps of the boxes *f'* for the reception of the compound wedge *n*; *o*, rock-drill cylinder; *o'*, piston; *o''*, piston-rod; *o'''*, drill-tool; *p*, steam-chest; *p'*, exhaust-pipe; *p''*, branch of the same leading to the piston-rod; *p'''*, stop-cock in the same; *r*, pinion-box; *r'*, pinion with cogs working in grooves *r''* in the piston; *r'''*, cam on one or both ends of the pinion-shaft outside of the pinion-box for giving movement to the feeding device, and also for giving movement to the steam-valve, if desired; *t*, rock-shaft; *t'*, arms by which the cam oscillates the rock-shaft; *t''*, arm on the upper end of the rock-shaft, which is pivoted to pawl *u* at *w'*, which gives movement to ratchet-nut *u''*; *v*, chamber in the neck of the rock-drill; *v'*, passage through the piston-rod; *v''*, passage through the drill-tool; *w*, sleeve which presses at each end upon the packing in the boxes *w'* by the action of screw-cap *w''*; *x*, elastic ring which forces out the metallic packing *x'*; *y*, train of gears for moving the car; *y'*, crank of the same; *y''*, locking-lever and spring; *y'''*, point of locking-lever.

I describe in this specification a rock-drill which is intended to be operated by steam. It is obvious, however, that the devices herein described will work with equal facility when operated by any other medium of force, and I employ on each rock-drilling engine one or more rock-drills, each being adjusted and supported upon devices independent of the others,

but all arranged and moving upon one drill-frame.

The car of my improved engine may be described as composed of four principal parts, which are: two wheel-frames, one platform, and one drill-frame. Each wheel-frame is made up of two timbers, *b b*, connected together by the blocks *b'*, and have a wheel at each end, the axles of which find a bearing in the boxes *b''*, one box under each end of each beam. The two wheel-frames are connected together by the platform *c*, which is composed of the flooring and several beams, *c'*. Upon the forward end of the wheel-frames are placed eight pillars, in two lines, across the front end of the car. Upon these pillars rests the drill-frame *d*, composed of beams *d'*, which rest upon four pillars in line. The rear line of pillars, for the support of the rear or second beam, are composed wholly or in part of rubber, while the front row, for the support of the front beam, are composed of non-elastic material.

This construction of the car has the advantage of supporting the jacket at a proper height above the rail, while the platform for the support of the the boiler, tank, and coal is brought near the ground.

Some of the beams *c'* may, if necessary, be provided with truss-rods, and the car may be held square by tie-rods. Sheet-rubber may also be used between the wheel-frames and the timbers *c'*, that the car may more readily conform to the irregularities of the track, so as to bear equally at all times upon all the wheels, while the drill-frame, having, by its construction, great rigidity, and being supported upon one side by elastic pillars, will not be twisted out of line by the yielding of the lower part of the car to the irregularities of the rails.

The wheels are provided with broad flat faces, which have a groove in the center of each of sufficient width and depth to adapt them to run safely upon the rails, while at the same time they are equally adapted to run upon plank or upon pavements.

A car for street improvement having wheels so constructed may readily be moved from one street to another without being taken apart for the purpose.

The carriage *c''* is fitted to slide upon the beams *d'*, the bearings of which are so shaped that, when the carriage is held down by means of the cam and gib *e* and *e'*, a portion of the carriage is forced partly under the flange of the front beam, by which means the carriage is firmly held at both ends upon the drill-frame. In the bearings or boxes *f'* on the carriage *c''* the cylindrical carriage *f* slides and oscillates. At the forward end of the cylindrical carriage are the arms *f''*, for supporting the jacket, and at the sides, midway, are the arms *m* and screws *m'*, for limiting and adjusting the oscillating movement, while they in no way interfere with the sliding movement, of the carriage. On the top, over the arms *m*, are the vertical arms *k*, which support the nut *k''* of screw *k'*. This screw gives to the vertical shaft any desired inclination, in a line parallel with the work, independently of the sliding and oscillating movements of the carriage.

The legs of the jacket *h* are pivoted at *f'''* to the arms *f''*. The upper or cylindrical portion of the jacket is divided vertically through the center, one half being cast upon and making one piece with the legs, the two halves being held together by the screws *i'* and *i''*. The two halves of the jacket are forced together, so as to grasp and hold the vertical shaft firmly, by compound wedge *i* and lever *h''*. The screws *i'* pass loosely through the loose half of the jacket, and screw firmly into the half which is attached to the legs. These screws are split for the reception of the compound wedge, and they have pins put through their heads, between which and the loose half of the jacket the wedge *i* is forced by lever *h''*, which brings the two halves of the jacket together upon the vertical shaft.

The rock-drill is supported upon the lower end of the vertical shaft by means of a shank, *j'''*, and at all times has its axis in the axis of the vertical shaft. The jacket *h* is made to oscillate upon the pivots *f'''* by means of screw *k'*. This screw also holds the jacket in any position required.

In the excavation of sewers and cellars it is always necessary to give the drill-tool a lift in two directions. Inclination of the axis of the drill-tool and the direction of the lift are determined by the direction of the excavation, and of the strata of rock. One lift must be in the line of the excavation, and is called a "parallel lift." The other is across the excavation, and is called a "lateral lift;" and both are designed to assist in freeing the rock broken off from the rock unbroken. The lateral lift is given to the drill-tool or drill-hole by swinging the vertical shaft on the axis of the cylindrical carriage by means of screws *m'*, and the parallel lift is given by swinging the vertical shaft on the axis *f'''* by means of screw *k'*, and it is desirable when the amount of inclination in either direction has been determined that it be not altered, if possible, to avoid it; but during the process of drilling to the great depth required for sewers, seams and rock of different degrees of hardness are frequently met with. In either case the drill-tool is liable to be turned out of its true course. When this occurs its position has to be changed to correspond with the change in the drill-hole. Very often a slight change in the inclination will make the drill-tool work freely; but oftener a movement of the vertical shaft bodily in a direction at right angles to its axis without changing the lift is required, and this is effected by sliding the carriage *c''* on ways *d'* if the movement is required across the excavation. It is accomplished by sliding the carriage *f* in the boxes *f'* if the movement is required parallel with the excavation, and sometimes a movement in both directions becomes necessary. By these means a double lateral or a double parallel movement, or both com-

bined, may be given to the vertical shaft; and if the first attempt to make the drill-tool cut freely fail, it can readily be put back to the exact position it was moved from, and then other efforts made to free it by moving it in other directions. It is impossible to tell always without trial in what direction the drill-tool requires to be moved. Often both double movements combined are required.

The double movements in either direction may be obtained by swinging the vertical shaft in each direction upon two pivoted joints, instead of one pivoted and one sliding joint, as herein shown; but the latter method is preferable, as its operations are simpler and less liable to confuse the mind of the drill-tender.

The two carriages in my engine are moved by a lever, the castings being so constructed that the lever may readily be applied in a manner similar to that shown in my patent of April 26, 1870. They may, however, be moved by a chain and windlass or by a screw.

I move my engine upon the track by means of a train of gears and a crank, y and y', and the car is held stationary by the locking-lever and spring y'', the lever having a point, y''', which falls between the teeth of one of the large gears, which effectually prevents the car from moving.

I employ on my improved engine a rock-drill in which the feeding devices are operated by a pinion in manner similar to that for moving the steam-valve shown in my patent of April 16, 1878.

By reference to Sheet 2, Figs. 4 and 5, it may be seen that the pinion r' is inclosed in a pinion-box, r, on the side of the cylinder, and that the teeth of the pinion work in grooves r'' turned in the piston, which gives to the pinion a rotary or oscillating movement. The shaft upon which the pinion is supported passes through the sides of the pinion-box, and is provided with packing-boxes at these points. On one end of the pinion-shaft, outside of the box, I place the cam r'''.

The feed-screw has its bearing in and is attached to collar j' on the lower end of the vertical shaft, and as the feed-nut is turned by the pawl u the rock-drill slides down upon the shank j''', as shown in my former patents.

On the other end of the pinion-shaft, also outside of the pinion-box, may be placed another cam or eccentric for operating the steam-valve; or the pinion may, with equal facility, be placed within the steam-chest with a rotary valve, and made to operate the same. In any case it should be of such diameter that a full stroke of the piston will not turn the pinion a full revolution. For these connections I prefer cams, cranks, or eccentrics to levers.

As the drill-hole deepens and the piston continues to fall lower and lower, the oscillating motion of the cam increases until it gives sufficient movement to the rock-shaft to feed one notch.

The cam, rock-shaft, and pawl u have a continued oscillation or vibrating movement, and do their work noiselessly and without violence to themselves or the other devices. These cams for operating the feeding devices may be placed within the pinion-box, by the side of the pinion, if desired; and they could be made to operate by means of rods or stems passing through the sides of the box, and provided with packing-boxes, as valve-stems are employed, and the cams may be made to operate by their disks or by their peripheries, as most convenient.

For removing the rock-mud from the drill-holes, I employ exhaust-steam and water, in manner similar to that shown in my said patent of April, 1878. In this improvement a branch of the exhaust-pipe p'' conducts a portion of the exhaust-steam to the chamber v, from whence it passes through the passages v' and v'' in the piston-rod and drill-tool.

The branch exhaust-pipe p'' has a stop-cock, p''', so as to lead the flow of exhaust-steam to the bottom of the drill-hole under the control of the drill-tender. In holes of shallow or medium depth the flow of exhaust-steam has sufficient force to keep the rock-mud agitated and prevent it from settling around the bit of the drill-tool.

Independently of the use either of live or exhaust steam, I employ on my improved engine a water-tank, g', provided with a flexible pipe, g'', leading to the chamber v, and having a stop-cock, g''', to control the amount of water used. By this arrangement of devices the drill-tool pumps its own water from the tank when water is required, whether the tank be placed above or below the rock-drill.

In soft rock mud accumulates rapidly, and soon begins to form a ring of putty-like consistency around the lower end of the drill-tool, just above the bit. This ring sometimes covers several feet of the lower end of the drill-tool, and often becomes so compact that it is impossible to withdraw the drill-tool by any known means, and they have to be blasted out. As soon as the mud ring is formed, the water at the top of the hole ceases to be agitated by the movement of the drill-tool, for the reason that the ring is formed above the point to which the bit of the drill-tool rises in its upward movement, and, the ring being fixed at that point, the drill-tool plays through it into the space below, and consequently does not raise or lower the column of water in the drill-hole by its action.

When the drill-tool rises it leave a vacuum below it, which, by my improvement, is filled by a flow of water from the tank or other supply through the drill-tool. Even in the absence of a solid mud ring water heavily charged with mud will not descend between the lips of the bit fast enough to fill the space left by the drill-tool at the bottom of the hole when the rock-drill is running at full speed. Even air pumped into the bottom of the hole by the above means will do much to prevent the mud ring from forming; but it is not effectual in keeping the holes in the lower end of the drill-

tool free from the débris. These devices may be applied with equal facility to rock-drills having a tripod or any other suitable means of support.

For the purpose of making a steam-tight joint between the piston-rod and head of the drill-tool, I employ packing x and x'. The upper portion of it, x, may be composed of rubber, while the lower portion, x', should be composed of metal, the metal portion being forced down against the head of the drill-tool by the elastic portion; or it may be entirely composed of rubber.

The chamber v need not necessarily be long enough to afford a constant flow of steam, air, or water from the stationary to the moving parts of the rock-drill. Its office is to serve as a kind of junction between the passages p'' or q'' and the passage v'.

Having described my invention, what I desire to have secured to me by Letters Patent of the United States is—

1. In a rock-drilling machine, the packing x and x', in combination with a piston-rod and drill-tool having the passages v' and v'', substantially as specified.

2. In a rock-drilling engine, the combination of the several joints herein described for obtaining the double parallel and double lateral movements of the rock-drill, said double movements being independent of each other, substantially as and for the purpose specified.

3. In a rock-drilling engine, the oscillating and sliding carriage f, in combination with the carriage c'', jacket h, and vertical shaft j, substantially as and for the purpose described.

4. The train of gears y, crank y', and locking-lever y'', in combination with a rock-drilling engine, substantially as and for the purpose set forth.

5. In a rock-drilling engine, a car composed of two wheel-frames supported at each end upon independent wheels, a platform bolted to the under side of the wheel-frames, and a drill-frame secured upon the top of said wheel-frames, substantially as and for the purpose specified.

6. In a rock-drilling engine, the arms m and screws m', in combination with the sliding and oscillating carriage f and carriage c'', whereby the carriage f is adjusted and rigidly held in its oscillating movement, while it is left free in its sliding movement, as set forth.

7. In a rock-drilling engine, the combination of the adjusting-screw k' with the oscillating and sliding carriage f and the jacket h, pivoted together at f'''', whereby a parallel lift is given to the rock-drill independently of the oscillating and sliding movement of said carriage, as and for the purpose set forth.

WM. H. ELLIOT.

Witnesses:
D. LEWIS,
LOUIS E. MOORE.