O. B. DOWD.

Tunneling Machine.

No. 167,442. Patented Sept. 7, 1875.

Fig. 1

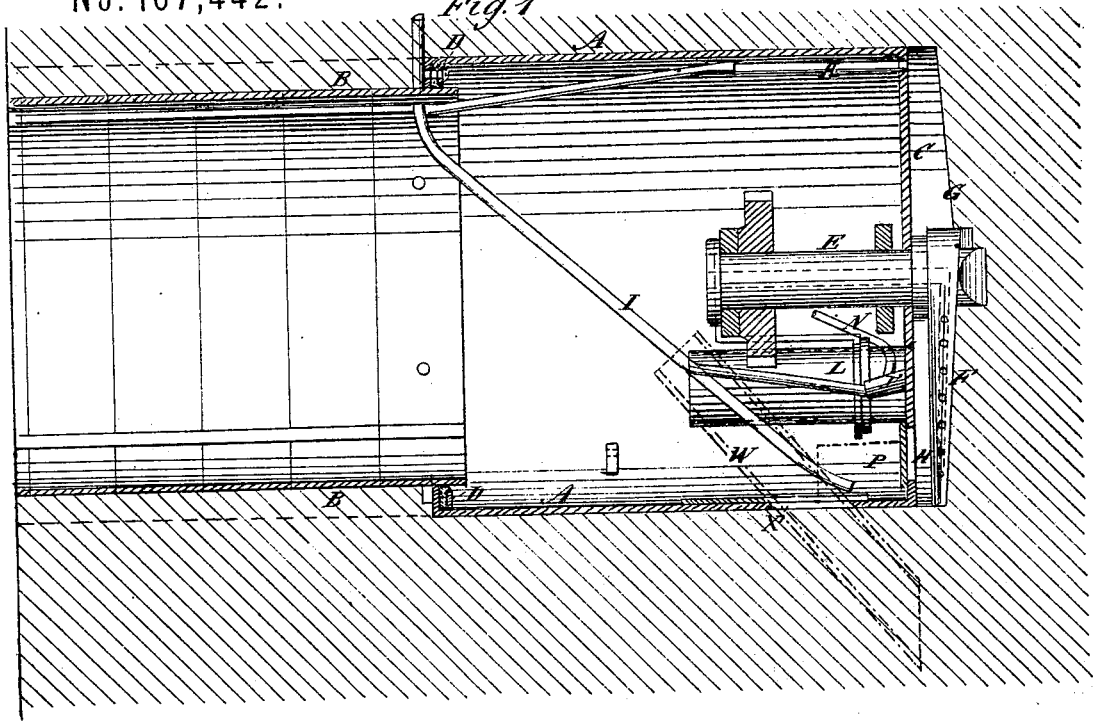


Fig. 2

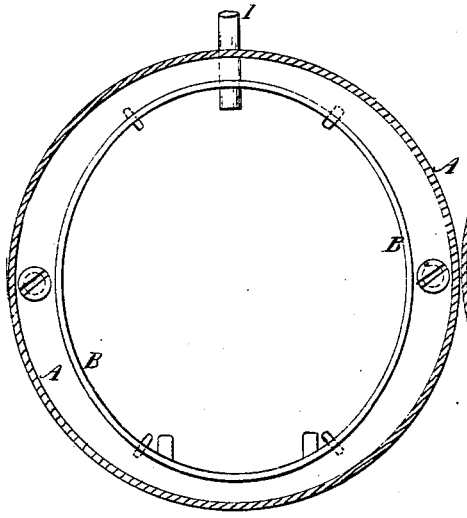


Fig. 3

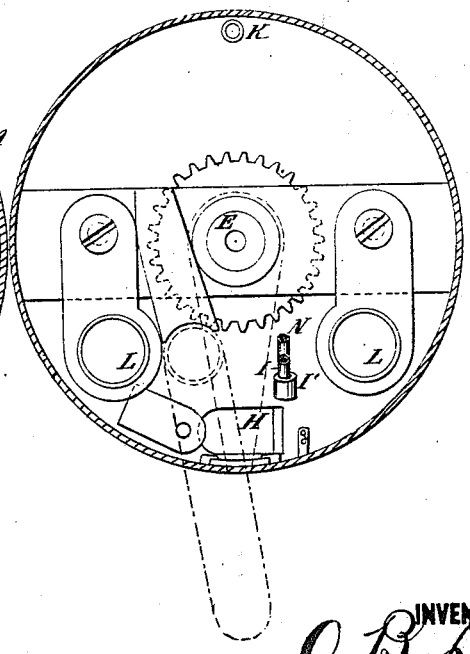
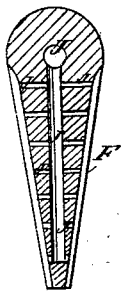


Fig. 4



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OLNEY B. DOWD, OF NEW YORK, N. Y.

IMPROVEMENT IN TUNNELING-MACHINES.

Specification forming part of Letters Patent No. **167,442**, dated September 7, 1875; application filed August 6, 1875.

CASE A.

To all whom it may concern:

Be it known that I, OLNEY B. DOWD, of the city, county, and State of New York, have invented a new and Improved Tunneling-Machine, of which the following is a specification:

This machine is designed mainly for tunneling under the beds of rivers and other water-courses where the material is soft and liable to cave and crush in; and the invention consists of a cylindrical case, with a head at the front end, out of which projects at the center a revolving shaft carrying a cutting and scraping arm, which breaks and cuts down earth, clay, sand, silt, and other similar substance, and forces them into the case through an opening at the bottom of the head.

The shaft carrying the arm is hollow, and the arm is also hollow and suitably perforated to allow of softening the earth with water in case of need by forcing the water out through the shaft, and there is a pipe discharging through the head at the top for watering the earth in that way in case of need, to render it sufficiently fluid to be forced out through pipes. In the bottom of the case, near the front end, is an oblique opening, through which a large tube may be projected to sink a hole below the line of the tunnel by working through the tube to sink a bowlder or other solid object out of the case. The case is to be forced along as fast as the earth is removed in advance of it, and it is to be followed up by the wall of the tunnel, which is to be built along at the same time as the work progresses, keeping the rear open end packed with the wall of the tunnel, and so as to exclude water and mud or silt from settling into the case. There is a pipe for discharging the silt, &c., by hydraulic pressure as it is received into the case through the head, the pipe being extended up through the tunnel-wall to the river-bed or a scow on the water.

Figure 1 is a longitudinal sectional elevation of my improved tunneling-machine. Figs. 2 and 3 are transverse sections. Fig. 4 is a section of the arm for cutting the earth and scooping it around to the passage into the case.

Similar letters of reference indicate corresponding parts.

A is a hollow cylindrical case of metal, a little larger than the tunnel wall or casing B to be made. It is closed by a head, C, at the front end, and is open at the rear end, which has a packing, D, to form a water-tight joint with the tunnel, which is to be built in the case, and the case is to be shifted along the tunnel as the work progresses by pressure applied to the head. E is a rotary shaft projecting out through the center of the head, and carrying the arm F, which is to cut or scrape down the bank G to the opening H, through which the earth is to be received inside of the case for being conveyed away out through the tunnel, or forced through a discharge-pipe, I, which may extend up through the tunnel to river-bed or to a scow, and through which the earth may be forced by pneumatic or other pressure, either by being received directly into a branch, I′, of the discharge-pipe, having a water-pipe, N, through which water is forced to carry out the silt, or it may be received in the case and be shoveled into a box, P, to be closed, and have water forced through it. Generally the silt will press against the outside of the head, so that the water will force out through tube I. J represents water-passages through the shaft and arm, for introducing water when required to soften the earth, and K is a tube for introducing the water at the top of the case-head. The shaft will be revolved by any suitable power arranged within the case, and geared to it in any approved way. The arm has a groove in each edge to form cutting-lips, and in the lower part of the head of the case are a couple of short tubes, L, contrived to slide forward into the earth in case it should pack hard between the arm and the head of the case to fill the open ends, and remove the earth thus taken into the case through them after the tubes are drawn back, and so make space that will receive some of the earth, and thus lessen the pressure, said tubes to be forced out into the earth and drawn back with the earth received in them as often as may be needed to prevent the arm from running hard

by the resistance which would otherwise exist in consequence of the packing of earth behind it. These have been found necessary only in working in sand. The arm will be revolved sometimes one way and sometimes the other way, and a tube will pass through the center of the shaft to its junction with the arm, where by a part revolution of the tube in the shaft the connection can be changed so as to discharge the water through the side of the arm that is moving forward. The openings in head B will be provided with suitable gates to stop the water instantly when required.

It sometimes occurs that a sunken anchor or a bowlder too great to be pressed out of its place by arm F is met, and stops the arm. In such a case a tube, W, is forced down through a suitable opening in the bottom of case A to a point considerably lower than the head of the case, and the earth is excavated through this tube, thus allowing obstructing substance, with other material, to settle below the case. One or more of these tubes can be used.

The power may be a movable engine connected with the case, and provided with ventilating apparatus, or compressed air may be used, but, preferably, in large work water should be used, pressed through strong pipes by hydraulic pump at mouth of tunnel. In using water it is desirable to have pressure of one thousand or fifteen hundred pounds per inch. When water is so used it should, after working the hydraulic engine, exhaust through the tubes leading under tanks or tubes in which the mud or earth of the excavation is placed, so as to carry the mud by its pressure and its momentum with the water through a tube in finished tunnel to the surface of the ground above the tunnel, or to the surface of the bed of river above the tunnel.

For the above purpose the water should exhaust with a power of from fifty to one hundred and fifty pounds to the inch, (in excess of the atmospheric pressure,) according to the depth of the tunnel and material being carried out by it, sand being the most difficult to carry. All parts of the case should be very strong, and head C should be securely braced. The machine being in place, and a portion of the walls of the tunnel being constructed, and the power, if of water, being supplied, a portion of it will work the hydraulic engine which rotates shaft E, arm F; another small portion may pass through tube in shaft E, and holes out through arm F or through pipe K, to dissolve the material as described, and a third tube may connect the water with several strong hydrostatic presses located in case A, and working by their pistons back upon the completed wall of the tunnel, thus pressing the case forward as the silt or earth is cut away. The hydrostatic presses, and the mode of moving case forward, are not shown, both being old devices.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination of case A C, shaft E, and arm F, substantially as described.

2. The combination, with case A C and revolving arm F, of passages J K, by which to conduct water or air to the arm, substantially as specified.

3. The shaft E and arm F, having water-passages J, as described.

4. The combination of one or more tubes W with the case A C, substantially as specified.

5. The combination of receiving-pipe I′, water-pipe N, and discharge-pipe I with the case A C, substantially as specified.

OLNEY B. DOWD.

Witnesses:
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ALEX. F. ROBERTS.