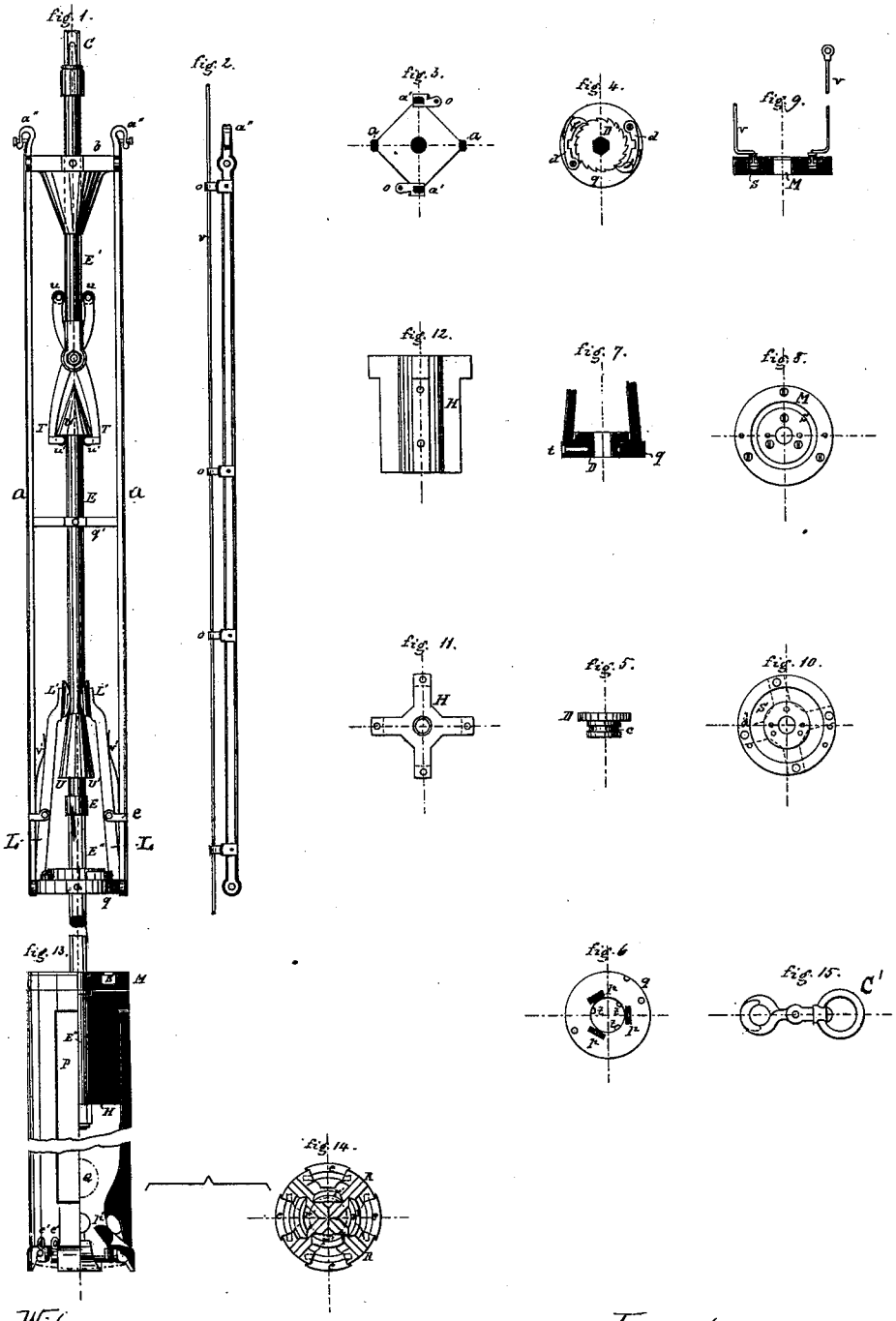
2 Sheets—Sheet 1.

A. V. y CASTROPOL.

Earth Drilling and Boring Machine for Artesian and other Wells.

No. 221,520. **Patented Nov. 11, 1879.**



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2 Sheets—Sheet 2.

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fig. 16.

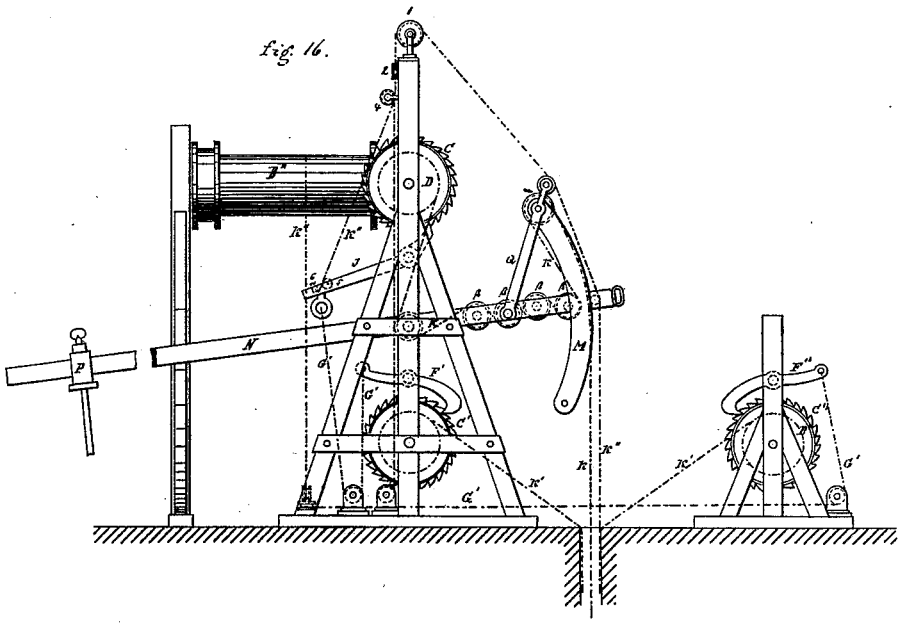
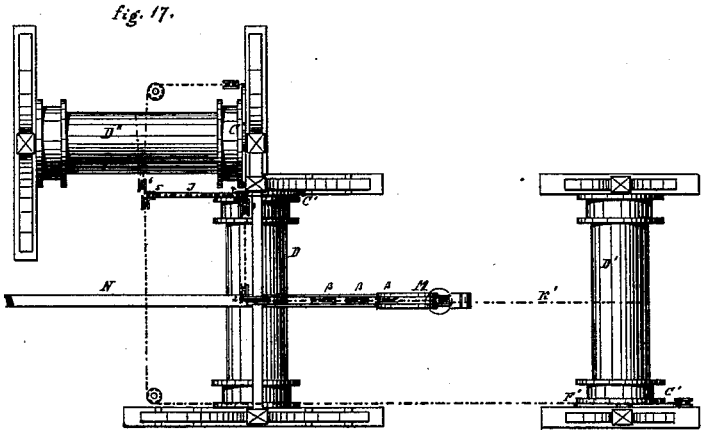


fig. 17.



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UNITED STATES PATENT OFFICE.

AMADOR VILLAR Y CASTROPOL, OF MADRID, SPAIN.

IMPROVEMENT IN EARTH DRILLING AND BORING MACHINES FOR ARTESIAN AND OTHER WELLS.

Specification forming part of Letters Patent No. **221,520**, dated November 11, 1879; application filed July 30, 1879.

To all whom it may concern:

Be it known that I, AMADOR VILLAR Y CASTROPOL, of Madrid, Kingdom of Spain, have invented an Improvement in Earth Boring and Drilling Machines for Artesian and other Wells, of which the following is a specification.

The present invention relates to a boring apparatus in which is employed a falling and rotating boring tool or cylinder, means for enlarging the bored hole and receiving and withdrawing the loosened material, and an automatic regulator.

The invention consists in the construction and combination of devices, which will be hereinafter more fully described, and then set forth in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 represents the frame of the boring-cylinder. Fig. 2 is a detail view of one of the frame-bars and regulator-rod. Fig. 3 is a cross-section of the aforesaid frame. Fig. 4 is a ratchet-and-pawl mechanism for rotating the boring-cylinder. Figs. 5, 6, and 7 are detail views of the ratchet-wheel and manner of fitting the same. Figs. 8, 9, and 10 indicate the manner of connecting the regulator devices with the boring-cylinder. Figs. 11 and 12 show the means for securing the boring-cylinder to the frame. Fig. 13 is a vertical view of the boring-cylinder, partly in section. Fig. 14 is a bottom view thereof. Fig. 15 represents the swivel or link for connecting the boring devices with the actuating mechanism. Fig. 16 is a side elevation of the frame-work of the apparatus, with the different actuating devices mounted thereon. Fig. 17 is a top or plan view of the same.

I propose, for the sake of clearness, to divide the apparatus into different heads, and describe each separately, viz:

Frame of the boring devices.—The same consists, as is seen in Figs. 1, 2, and 3, of four vertical bars, *a a a' a'*, which are connected with each other by means of the top cone, *b*, the central disk, *q'*, and the bottom disk, *q*. These two disks also serve for the guidance of the vertical boring-rod E, the construction whereof will be hereinafter described. The two bars *a* terminate at their upper ends in hooks *a''*, which serve for the attachment of the safety ropes or cables. At the lower end of the frame are arranged two vertical levers, L, which are pivoted to clips *e*, on the inner sides of the bars *a*, as is shown in Fig. 1. These levers are constantly pressed against the boring-rod E through the medium of the springs *v' v'*, the shoes L' on the upper ends of the levers insuring the proper frictional contact between the respective parts. The other bars, *a' a'*, are provided with loops or eyes *o*, through which pass two rods, *v*, that serve to actuate the regulator hereinafter described. A ratchet-wheel, D, mounted or fitted in the lower disk, *q*, has a hub, which is provided with a circumferential groove, into which fit screws *t*, having rounded ends. The wheel D does not rest directly on the disk, but is supported on the rollers *p* of said disk, so as to lessen friction. Pawl-levers *d*, pivoted to the disk *q* and connected with the lower ends of the vertical levers L, serve to turn the ratchet-wheel, this being effected as the shoes of said levers L glide on the boring-rod E, which is itself turned by the movement of the ratchet-wheel.

Description of the boring-rod.—The same is composed of two separate or independent parts, E and E'. The upper part, E', passes through the cone *b* and carries the pivoted grapple-bars or tongs T. It is also provided with an apertured-top head, C, for receiving the swivel-link C', Fig. 15, to which is attached the main cable carrying the boring devices. The lower part, E, of the boring-rod is provided at its upper end with a cone-head, U, which remains always above the central disk, *q'*. The portion of the boring-rod immediately below the cone-head U is cylindrical and terminates in the cone U', into which is screwed the upper cylindrical end of a square or hexagonal portion, E'', of the boring-rod. The boring-cylinder proper is secured to this angular portion by means of the piece H. (Shown in Figs. 1, 11, and 12.)

Description of the boring-cylinder.—The same is preferably constructed of cast-iron, and the diameter thereof is determined by the width of the bore-hole. The upper end of the cylinder is formed by the disk or head M, which belongs to the regulator, to be hereinafter explained. The cylinder is firmly connected with the angular portion of the boring-rod by means of the winged part H inserted into said

cylinder and secured thereto, as seen in Fig. 13. A door, P, formed in the shell of the cylinder serves for the removal of the excavated material or débris. The inside of the cylinder gradually becomes narrower toward the lower end, or, in other words, the chamber is of a hyperbolical form, which is closed at its narrowest part by a valve, Q. The boring devices proper consist of the two diametrical cutting-knives R and the four concentric cutting-knives *r'*, which are connected with each other, and are let into the bottom of the cylinder, as is shown more fully in Fig. 14 of drawings. The cutters *e*—generally four in number for enlarging the bore-hole—are provided with gudgeons, and are fitted in openings formed in the cylinder, so as to be capable of turning therein, the cutters being held in their proper positions by disks *e'* fastened by means of screws. As shown in Fig. 13, the expanding or enlarging cutters are provided with hemispherical balance-weights *p'* at their upper ends, which weights can enter internal depressions in the bottom of the boring-cylinder, so as to properly present the cutters when the cylinder is lowered in the ground. As shown by dotted line in Fig. 13, the lower edges of the cutting-knives R and *r* are arranged in a curved or convex plane, while the cutting-edges of the cutters *e* project below the cutting-surfaces of the other knives.

Description of the regulator and the devices for actuating the boring mechanism.—The connection of the regulator with the boring cylinder or mechanism is effected by the disk M, Figs. 8 and 9, which is connected with the winged piece H by four screws. This disk is provided with a circular surface groove, S, in which run rollers applied to the bent lower ends of the rods *r*. These rods, as heretofore stated, pass through the guide-loops on the bars *a'*, and are provided with top eyes for the attachment of a cable or rope leading to the surface of the ground. It will be apparent that the rods *v* will partake of the vertical movement of the cylinder and do not interfere with the proper passage of the latter.

The vertical movement of the cylinder is transmitted by means of the cable K″ to the regulator. As shown in Fig. 16, this cable is first carried through the head of the lever N, which serves for raising the boring devices, and then, after passing over the sheaves or rollers 1 to 6, inclusive, it is secured to the drum D″.

The sheaves 1, 2, 3, and 4, are mounted in the stationary frame-work, and the sheaves 5 and 6 are fitted in the rear end of the pawl-lever J. The cable K, connected with the boring-rod, passes over the arc-shaped bar M carried by the lever N, thence around a series of sheaves also fitted in said lever, and, finally, it is wound on the drum D. The two safety-cables which carry the frame of the boring-cylinder are wound directly on the two drums D′.

The different drums are of the same diameter, and are each provided with an equally-sized ratchet-wheel, C C′ C″. The pawl-levers F F′ F″ operating on these ratchet-wheels are connected with each other by means of ropes, which lead to the pawl-lever J, and are connected therewith, so as to operate all the pawl-levers simultaneously.

A swinging movement is imparted to the lever N by means of a steam-engine or other suitable motor, and, as already stated, this lever is provided with an arc-shaped arm at its shorter end, and is fulcrumed in the frame-work and provided with a diagonal brace, Q, which gives additional strength to the arc-shaped arm. The frame-work, together with the various cables and operating parts, are properly balanced according to the amount of resistance offered in boring by the adjustable weight P on the lever N.

The operation of the apparatus is as follows, viz: The swinging movement of the lever is transmitted to the boring-rod or the upper part, E′, thereof by means of the cable K, the twisting of the latter being prevented by the swivel-link. (Shown in Fig. 15.) When the cable K, together with the rod-section E′, is elevated, the rod-sections E and E″, together with the boring-cylinder, are also raised until the rollers *u u* of the grapple T come in contact with the cone *b*, when the said grapple opens so as to liberate the cone U, whereupon the boring-cylinder falls down by its own weight. Simultaneously with this operation the cone U′, at the lower end of the cylindrical part E′, will force apart the levers L, whereby the ratchet-wheel D and the boring rod or spindle will be rotated to a certain extent. As the cable is again moved in a downward direction the grapple will seize the cone U and raise the same, together with the boring-cylinder, when the next upward stroke takes place. The loosened or excavated material can freely enter the cylinder, the valve preventing the escape therefrom.

As already explained, the rods *v*, belonging to the regulator, partake of the movement of the boring-cylinder; but this movement will have no effect upon the pawl-lever J until a certain limit has been reached. When the fall of the cylinder is in excess of this limit then the following result takes place, viz: The cable K″, the unwinding of which from the drum D″ has been prevented by the pawl-lever F″, will raise the end of the pawl-lever J, thus causing the various pawl-levers F F′ F″ to become disengaged from their respective drums D D′ D″, whereby the cables will be unwound to a certain extent. By this means the main cable and the auxiliary cables connected with the frame of the boring-cylinder will be increased in length. As all the drums are of an equal size, the cables are unwound a uniform distance, so as to obtain a regulated descent of the boring devices. This descent is effected in an automatic manner, and hence a safe operation of the apparatus is insured.

It will be obvious that when the boring devices have reached a great depth the balance-

weight must be moved toward the outer end of the lever, or away from the fulcrum.

When the boring-cylinder has been sufficiently lowered and is filled with loose material, then the motive power is arrested and the cylinder is brought to the surface of the ground by winding up the cables on their respective drums. The contents of the cylinder are discharged by opening the door, and then the movable parts are lubricated and the cylinder again lowered into the ground.

The lowering operation is considerably facilitated because the bore-hole has been made larger than the cylinder by the cutters *e*. The size of these cutters and their arrangement may be so varied that the descent of the cylinder is not retarded, even if the bore-hole is designed to receive a lining.

By means of my apparatus I am enabled to obtain a bore-hole which is so much larger than the lining that the boring-cylinder can readily work through said lining.

Further points of advantage are the free descent and the automatic rotation effected by simple mechanism; likewise the free taking up of the loosened material, which, for this reason, does not retard the further boring operation. The breakage of the main cable employed in my system does not produce the evil effects of a connecting bar or chain in ordinary earth-boring machines, because the auxiliary cables always suffice to bring the boring-cylinder to the surface of the ground. The presence of the lever and the regulator will enable the apparatus to be worked with a great saving of power. The use of the regulator will enable the boring operation to be performed by comparatively unintelligent workmen.

I may observe that by reason of the easy manipulation and simple construction of my apparatus, the same is capable of being used for performing all earth-boring operations, such as boring wells, mining purposes, geological researches, and excavating building-foundations.

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

1. In an earth-boring apparatus, the cutting devices, consisting of the diametrical knives R, concentric knives *r'*, and pivoted enlarging cutters *e*, as and for the purpose set forth.

2. The combination of the plate M, having groove S, the rods *v*, cable K″, lever J, and drum D with the boring-cylinder, as and for the purpose set forth.

3. In an earth-boring apparatus, the frame for the boring-cylinder, consisting of the bars *a a'*, cone *b*, and disks *q q'*, as herein set forth.

4. In an earth-boring apparatus, the combination, with a boring-cylinder, of mechanism for rotating the same, consisting of the rod E, cone-shaped enlargement U′, levers L, springs *v'*, pawls *d*, and ratchet-wheel D, as herein set forth.

5. The combination of the cables K K′ K″, drums D D′ D″, ratchet-wheels C C′ C″, pawl-levers F F′ F″, and connecting-ropes with the lever J, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

AMADOR VILLAR Y CASTROPOL.

Witnesses:
C. SCHOMBURG,
JOAQUIM FRIGUEROS PEREZ.