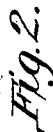


No. 826,329.

PATENTED JULY 17, 1906.

V. L. GRABIEL.
DITCHING MACHINE.
APPLICATION FILED DEC. 26, 1905.

2 SHEETS—SHEET 1.



Witnesses:
Vernon G. Lamb
Charles W. Leebnick

Inventor,
Virgil L. Grabel.

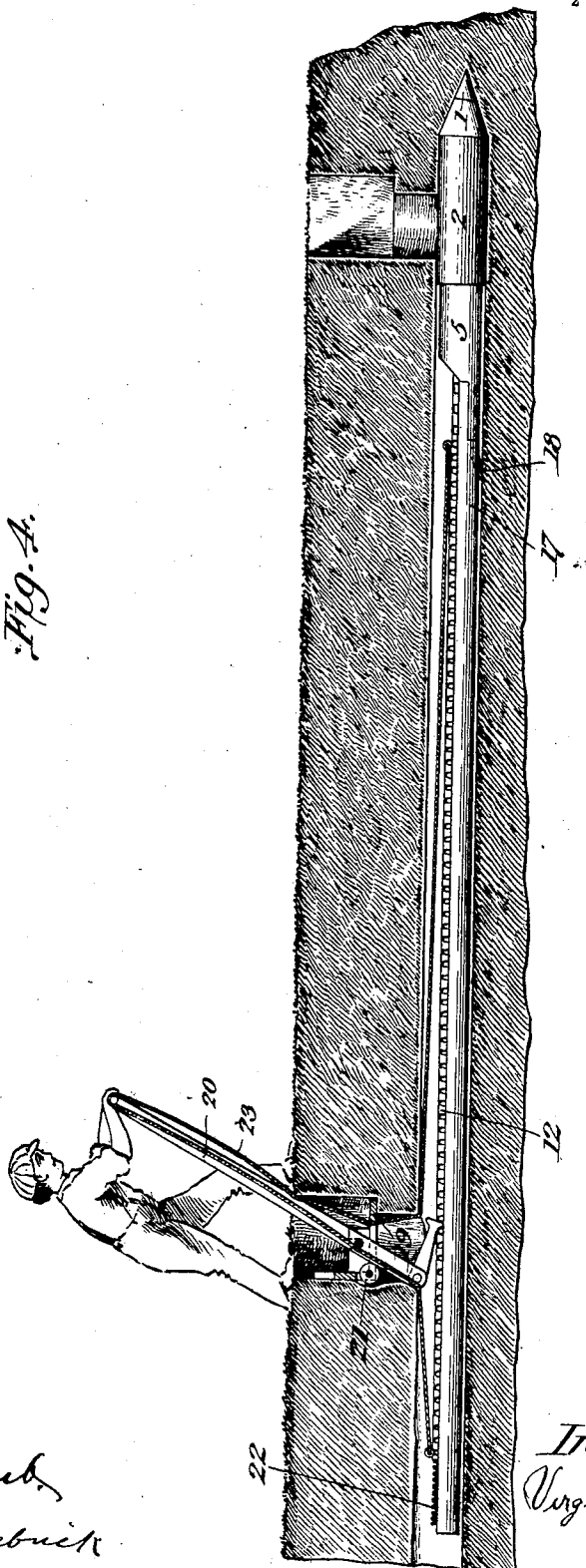
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Fig. 4.



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Inventor,
Virgil L. Grabiel.

UNITED STATES PATENT OFFICE.

VIRGIL LEON GRABIEL, OF WEST LAFAYETTE, OHIO.

DITCHING-MACHINE.

No. 826,329.

Specification of Letters Patent.

Patented July 17, 1906.

Application filed December 26, 1905. Serial No. 293,416.

To all whom it may concern:

Be it known that I, VIRGIL LEON GRABIEL, a citizen of the United States, residing at West Lafayette, in the county of Coshocton and State of Ohio, have invented a new and useful Ditching-Machine, of which the following is a specification.

My invention relates to improvements in ditching-machines in which a cone-pointed cylinder is driven forward through the soil ahead of a heavy bar by means of explosions inside the cylinder; and the object of my invention is to drive a hole through the soil at any desired depth along the line of a proposed ditch, which hole is suitable for tile, without the necessity of excavating all the soil directly above. I attain this object by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of the cone-pointed cylinder with its attachments and piston and also the head end of the bar resting in its place inside the cylinder. Fig. 2 is a detailed view in perspective of the tail end of the bar, together with its attachments, consisting of the piston-pipe, lever, and fulcrum, Fig. 3, showing the top end of the lever; and Fig. 4 shows the machine in operation.

Similar numerals refer to similar parts throughout the several views.

The forward end of any part is the end nearest the cone.

N numeral 1 is a hollow steel cone the point of which screws off to admit of a dry battery being placed inside. To the base end of this cone is fastened the cylinder, numeral 2, inside of which operates piston-head 4 and the bar-head 5 5.

6 is a tank for gasoline, the gasoline being poured in through the orifice 13, through which also air is pumped, as into a bicycle-tire, in order to furnish constant pressure for forcing the gasoline out at valve 10 whenever valve 10 is raised.

16 is an orifice admitting air through valve 10 whenever valve 10 is raised.

9 is a pin secured at its back end in bar 5 5 as a hinge and having a spring which forces the front end out whenever it reaches a groove in the upper inside surface of the cylinder. Within said groove is embedded a rod which operates on the sparker at 14, causing the electrified points of the sparker to come together at 15, producing a spark.

12 is a piston-pipe extending through the center of bar-head 5 5, the front end of which

is closed with a cap 7. Near cap 7 are elongated holes 8, through which burned gas may pass into piston-pipe 12 and out at the back end whenever the piston-pipe is shoved forward sufficiently to force the piston-head forward. Sufficient play is given piston-pipe 12 in piston-head 4 that when it is pulled back the holes 8 are closed, so that this burned gas cannot pass back again through them. Thus when piston-pipe 12 is shoved forward as far as possible all the burned gas contained in the chamber in front of piston-head 4 passes out through holes 8. At the same time valve 10 is raised by the pressure of air and gasoline against it in their rush to fill the chamber behind piston-head 4, and air and gasoline in proper proportion for explosion fill the chamber. As piston-pipe 12 is then pulled back until piston-head 4 strikes bar-head 5 5 valve 10 closes, as well as holes 8, valve 11 in the piston-head opens, and all the fresh air mixed with gasoline passes through it into the chamber ahead. By operating lever 20, Figs. 2 and 3, bar-head 5 5 is driven forward until pin 9 strikes the end of the embedded rod, which operates on the sparker at 14, thus producing a spark at 15 and an explosion within the chamber, which drives the cone and cylinder forward.

17 is a tail-bar half-round and having a groove lengthwise along the middle of the flat surface, in which rests piston-pipe 12. On each side of this groove is a line of cogs. Tail-bar 17 may be in sections of any desired length, and it may be made partly of wood or entirely of iron.

18 is a pin or spur embedded in the bottom of the tail-bar, having its front end secured as a hinge, so that when the explosion drives the bar backward it runs into the ground, assuming a perpendicular position. This affords resistance. There may be as many of these spurs along the bottom of tail-bar 17 as desirable.

22 is a coil-spring one end of which is fastened to the back end of tail-bar 17 and the other end fastened to the back end of piston-pipe 12. It is sufficiently strong to draw the pipe and piston-head back until the piston-head strikes bar 5 5. It will stretch out to about twice its length, which ordinarily is about one foot.

23 is a rope one end of which is fastened to piston-pipe 12 near the front end of the tail-bar. It passes through fulcrum 19 in front of lever 20, over the handle of lever 20, and

down through fulcrum 19 in front of roller 21. Its back end is fastened to the back end of piston-pipe 12.

5 A heavy bolt may be screwed into either side of cylinder 2 near its back end and extending into a horizontal groove in head-bar 5 5, which will prevent the cylinder from turning on the bar and also prevent the bar from going too far either into or out of the
10 cylinder.

The manner of starting and using this ditching-machine is as follows: After excavating at one end of the proposed ditch to the depth desired and long enough to admit
15 the machine with one or more sections of the tail-bar lying on the bottom at the desired angle and slant place fulcrum 19 securely above the tail-bar near its front end in such a way that when lever 20 is set into it the dogs
20 on the lower end of the lever will work properly in the cogs, as shown in Fig. 2. Fasten rope 23 as described above except the back end. Let there be sufficient space in the
25 cylinder to admit of the necessary amount of air and gasoline when the piston is operated as described above. Operate lever 20, driving the bar ahead until the explosion occurs, which is described above, driving the pointed cylinder forward. Operate the piston as
30 described above to clear out the burned gas and recharge. Then operate lever as before. Continue this operation until the desired

length of the tail-bar can be added, when the back end of rope 23 can be secured as described above. By digging holes at intervals
35 along the line of the proposed ditch for the fulcrum and the operation of the lever the machine may be driven any length desired, and thus the ditch constructed ready for the tile. (See Fig. 4.)
40

In manufacturing this ditcher the cone may be a pyramid with any number of sides, the battery and the gasoline may be located in other places than those indicated in the drawings, and the above descriptions, or a different explosive may be used, such as dynamite or powder, in which case the piston and sparker are unnecessary and the explosive is in cartridges and is fed from a magazine in head-bar 5 5 and fired by caps after the manner of a repeating-rifle, in all of which cases
45 the principle which I desire protected by patent is the same.
50

I claim—

The combination, in a ditching-machine, of
55 a pointed cylinder fitting over one end of a heavy bar ahead of which it is driven by means of explosions inside, substantially as set forth.

VIRGIL LEON GRABIEL.

Witnesses:

ELMER E. PATTERSON,
J. F. LIGGETT,
H. C. GRABIEL.