C. D. KIRKPATRICK.

APPARATUS FOR CONSTRUCTING PIPE WELLS.

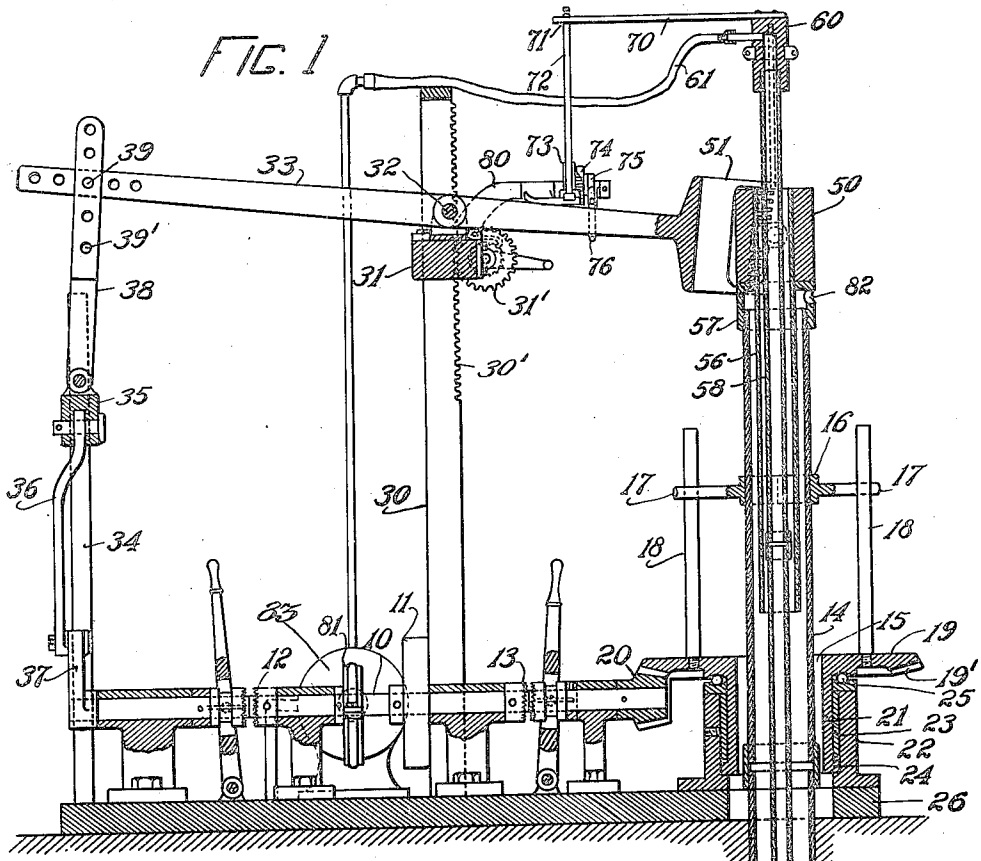
APPLICATION FILED JUNE 6, 1912.

1,123,129.

Patented Dec. 29, 1914.

2 SHEETS—SHEET 1.

FIG. 1



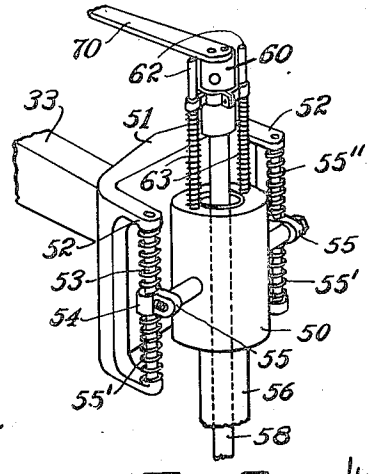


FIG. 2

WITNESSES

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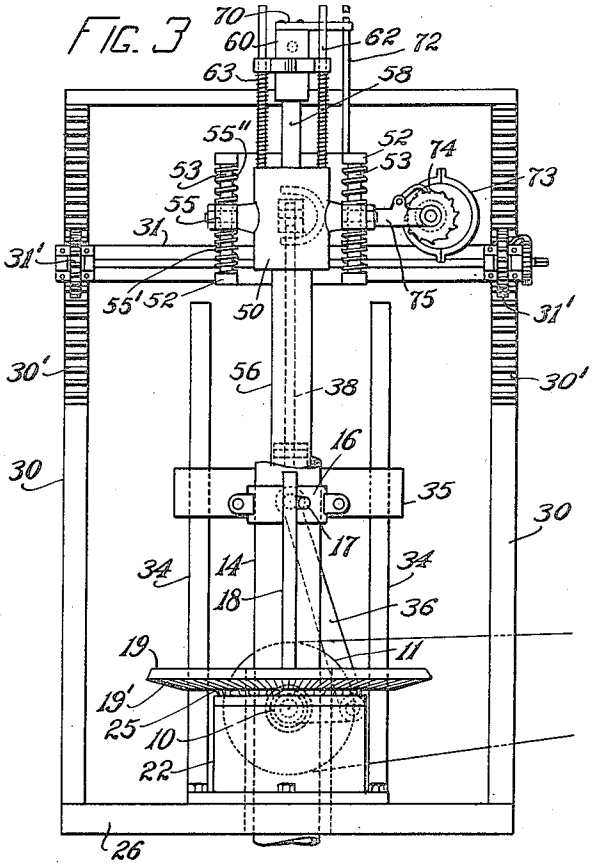
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2 SHEETS—SHEET 2.

FIG. 3



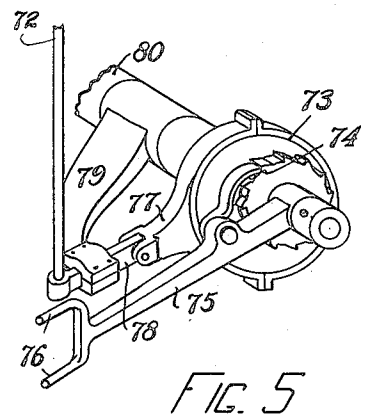


FIG. 5

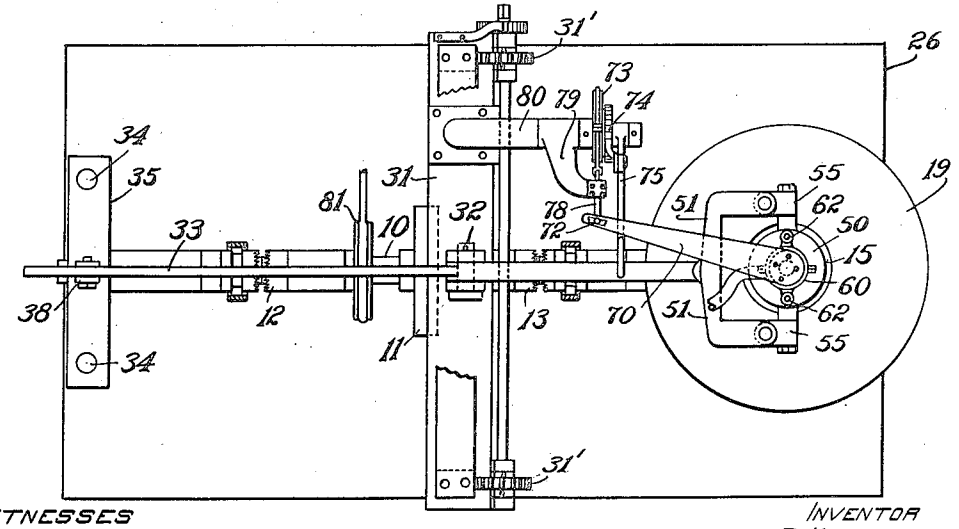


FIG. 4

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APPARATUS FOR CONSTRUCTING PIPE-WELLS.

1,123,129. Specification of Letters Patent. Patented Dec. 29, 1914.

Application filed June 6, 1912. Serial No. 701,948.

To all whom it may concern:

Be it known that I, CHARLES D. KIRKPATRICK, a citizen of the United States, residing at Melrose, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Apparatus for Constructing Pipe-Wells, of which the following is a specification.

This invention relates to improvements in apparatus for constructing pipe-wells. More particularly it relates to mechanism for driving the pipe into the ground; and it is among the objects of the invention to provide means by which the mechanism shall deliver a rapid succession of blows upon the pipe; permit the hammer to be fed downward as the pipe is driven; rotate the pipe while it is being driven; and provide, as auxiliary to the pipe driving and turning mechanism, mechanically actuated means for removing earth within the driven pipe. To accomplish all of these objects by a single mechanism, a hammer head is suspended by springs, which may be differential springs, on the end of a lever that is continuously oscillated by any convenient source of power, such as a gasolene engine. A circular feed motion for the pipe is arranged, driven from the same source of power, each of these being separable from the rest of the mechanism; and a cross-head with water pipe and drill working within the driven pipe is arranged to be engaged by the hammer on its upward swing, to be thus loosened and raised.

It is also the object of the invention to provide the other useful features which are incidental to the apparatus herein set forth, the intent of the patent being to cover whatever is novel in the ideas disclosed.

In the accompanying drawings: Figure 1 is a side elevation in central section of apparatus embodying the invention, showing the hammer down; Fig. 2 is a perspective view of the hammer head, on a larger scale; Fig. 3 is an end elevation of the apparatus shown in Fig. 1, with the hammer in mid-position; Fig. 4 is a plan of the same; and Fig. 5 is an isometric view of a detail.

Referring to the drawings, 10 represents a main driving shaft which may be operated continuously in one direction from a source of power such as a gasolene motor, not shown, a pulley 11 being indicated for the connection to the power, although any other suitable connection might be made. A clutch 12 connects one end of this shaft to the hammer operating mechanism, and a clutch 13 connects its other end to the pipe rotating mechanism, so that both may proceed simultaneously. The speed of rotation will be directly proportionate to the rapidity of hammer blows, because both are driven from the same shaft. The pipe 14 that is to be driven extends down and up through the hollow center 15 of a heavy disk 19 that forms part of the machine and is arranged to rotate about a vertical axis. It carries means by which it may be engaged and rotated by the head, such as a clamp 16 with bars 17 extending radially which can be engaged by uprights 18 carried on the rotating disk. This disk 19 has, on its under side, gear teeth 19′ adapted to engage in a bevel gear 20 which is driven by the clutch 13, the ratio of gearing being such that the disk 19 has considerably fewer rotations per minute than the clutch 13. From the disk 19 a hollow shaft 21 extends downward with a rather long vertical bearing 23 in a stationary block 22, and having a flange 24 engaging the under side of the bearing 23. Ball bearings 25 or other suitable thrust bearings may be provided for the disk 19 where it rests downward on the top of the block 22. The disk consequently turns easily on its thrust bearing and is maintained vertical and central by the long bearing 23 and by the under flange 24, notwithstanding the several stresses to which it may be subjected, and the unbalanced thrust of the driving bevel gear 20. The block 22 is rigidly and stationarily supported on a frame or sill-work 26, which also supports the main shaft and other parts of the mechanism. Rising from the sill frame, astride of the main shaft, are two uprights 30, 30, adapted to hold a bar 31 that may rise or fall thereon carrying the fulcrum 32 of a lever 33 which actuates the hammer. Each of these vertical guides has a rack 30′, in which pinions 31′ mounted on the bar are adapted to mesh. Other uprights 34, 34 afford a vertical slide bearing for the block 35 which connects the rod 36, driven by the crank 37, with a link 38 on the tail end of hammer lever 33. This link may, as illustrated, be connected to the hammer lever at

one of several alternative points, 39, 39′. The hammer head 50 is mounted at the other end of the lever 33 with the fulcrum 32 intervening. Consequently, the fixing of the link with its connection at various positions 39 on the lever alters the throw of the hammer, enabling the operator to adjust it to a longer or shorter stroke; while the various positions 39′ on the link adjust it so that it travels through a somewhat higher or somewhat lower zone with respect to the level of the fulcrum 32. The latter effect can, to a degree, be obtained by connecting a link 38 of fixed length in various oblique positions. The construction illustrated gives a range of fine adjustments, and also enables the hammer to reach up to drive the top of a pipe standing high out of the ground or to reach down to drive a pipe very low.

The hammer head 50 is suspended from the lever 33 by springs which permit it to yield somewhat up and down from the median line of the lever. While these springs may be of any suitable sort, those which restrain the upward motion of the hammer head may preferably be somewhat stiffer than the others. As illustrated, the suspension consists of a fork having two arms, 51, 51 on the end of the lever 33, each of which is forked vertically into prongs 52, 52. Between each pair of prongs 52 is a vertical rod 53 on which slides a sleeve 54 connected by a swivel 55 to the head 50. Thus the head intervenes horizontally between the prongs 51 of lever 33 and is supported on the sleeves 54 that travel up and down between the prongs 52, the travel being restrained if desired by suitable springs 55″ arranged above and 55′ arranged below the sleeves on rods 53. The upper of the springs, 55″, may be stiffer than the lower, 55′. The hammer head 50 is a tubular block of suitable weight, and carries beneath it a tubular extension 56 which reaches down through the cap 57 of the pipe that is to be driven and constitutes a guide so that the hammer always strikes the cap centrally. Within these is a pipe 58, which also serves as a drill rod, that reaches down through the hammer head 50, its extension guide 56, and the driven pipe 14 to the bottom thereof where it carries a drill head 59 of suitable shape. One shape for this is illustrated in Fig. 1, where the end of the passage through the pipe 58 is marked 58′ and is seen to discharge on each side of the drill head. The upper end of this pipe or drill rod 58 carries a cross head 60 into which a hose 61 discharges water for the pipe 58. The cross head itself is guided by two vertical rods 62 that rise from the hammer head 50. Spiral springs 63 may be carried on these to soften the upward impact of the hammer head on the cross head. Means may also be provided to move the rod 58 and drill 59 more or less during the operation of the machine by rotating the cross head. As illustrated, this consists of an arm 70 extending horizontally from the head for turning it. At 71 it is engaged loosely by a vertical arm 72, on which it is free to rise and fall. The arm 72 remains stationary in elevation except as it is adjusted to higher or lower position by movement of the bar 31 that carries the fulcrum block, this arm 72, and the mechanism now to be described for giving to the upright arm 72 its horizontal motion. Said mechanism consists of an eccentric 73 which is rotated step by step by a pawl and ratchet 74 operated by a lever 75 having a fork 76 adapted to engage the hammer lever 33. As the hammer lever rises and falls, the lever 75 and pawl and ratchet rotate the eccentric, giving to the eccentric rod 77 a reciprocating motion which is communicated to the upright 72 through a cross head 78 mounted in a bracket 79 on the main bracket 80 which supports all of this portion of the mechanism on the bar 31. When the machine is in operation the bar 72, moving to and fro horizontally, turns the drill head 59 a little for each fresh stroke. This turning begins on the upward motion of the hammer head, because of the way the pawl and ratchet are arranged, and consequently has the initial effect of loosening the drill head 59 so that it can be raised more readily in case it is embedded in earth.

The earth in the interior of the driven pipe is removed by a pump 83, indicated diagrammatically in Fig. 1 driven from the main shaft 10 by an eccentric 81 and discharging through the hose pipe 61. This pump, forcing water to the drill head through the passage 58, maintains a current upward through the driven pipe, by which the water and the loose earth borne by the water are discharged through the opening 82 in the driving cap 57. The driven pipe, and the drill pipe must each be lengthened, from time to time by addition of sections. Their relative length may be such that the hammer 50 plays between the cap 57 and the cross head 60.

The operator will, according to circumstances, prefer to have the drill head 59 working below or above the bottom of pipe 14. This can be adjusted by regulating the throw or travel of the hammer, so that it bears the more downward upon the cap 57, or upward on the drill cross head 60, the blows upon the drill being delivered by the falling weight of its head and rod, after being lifted by the hammer, while the blows upon the pipe 14 are delivered directly by the hammer.

In operation the shaft 10 rotates continuously at a uniform speed, thus causing a continuous and uniform oscillation of the

hammer lever 33. A speed relation between the various moving parts, which ought to be taken account of in designing or in adjusting any particular machine, and which makes the mechanism capable of very rapid and smooth work, depends upon the relation of the natural period of oscillation of the hammer head on its springs to the power driven oscillation of the lever which supports it. The speed of the main shaft and the adjustment of the connections to the hammer lever should be such as to work in harmony with the period of oscillation of the springs. When moving downward, the hammer head is both pulled by gravity and thrown by the lever. When moving upward the momentum is checked, when the lever 33 reverses its direction, by gravity and by the lifting of the drill cross head 60. These cooperate with the stiffness of the springs 63 to stop the hammer head's upward motion quickly and to throw it back down again, so that the hammer can operate at a considerable speed, the time required in checking the upward momentum being short. The drill starts down when the hammer does, but usually delivers its blow a trifle later, owing to the hammer being thrown down, while the drill merely falls. The solid earth at the foot of the pipe therefore is not subjected to opposing blows, but each has time to produce its effect undisturbed by the other, while the two, acting in quick succession, are more effective than if separated by a long interval. The result is to drive the pipe by a large number of quickly delivered yet powerful blows, churning and scouring of the interior, and the rotation of the pipe itself being effected simultaneously therewith. This is an improvement as compared with previously known methods, in which the blows have been relatively slow, and increased speed of driving has been attainable only by striking heavier blows. The apparatus is also an improvement over previous apparatus in which it has been necessary to lift and let fall the churning head and drill by hand, and to turn the driven pipe by hand, the driving blows on the main pipe being ordinarily suspended while one of these operations is in progress.

Although the mechanism has been here described as it may be used for driving a pipe, it will be obvious that it might be used for a drill; and perhaps for other similar purposes, and that parts of the mechanism disclosed may be used without applying the whole of it. When the mechanism has been suitably adjusted as to speed, that speed may be used continuously during the operation, and the force of the blow delivered may be varied by changing the elevation of the carriage 31 that holds the fulcrum block 32 of the hammer. This is done by means of the rack and pinion. This changes the zone through which the normal travel of the hammer head occurs, so that the point at which it encounters the cap on the drilling pipe to deliver its blow is more or less distant from the point to which its travel would otherwise extend; and this makes it unnecessary to change the speed in order to get a heavier blow when needed. At the same time the rack and pinion enables the hammer to follow the pipe as it is driven down, and is in this respect an improvement over the method used in rope and drum machines where this is accomplished by letting out some slack from the drum that holds the rope. In fact, by the present invention all rope is eliminated, and materials that are quicker in action and more durable in life are substituted. It will also be observed that by applying the rack and pinion to the fulcrum the movement of the pinion to effect a certain movement of the hammer action is considerably less than the distance moved by the pipe, because the travel of the fulcrum is multiplied by the leverage of the beam.

I claim:—

1. Apparatus for driving pipe or the like, comprising automatically oscillating percussion mechanism combined with means for rotating the driven pipe on its axis while said percussion mechanism is operating, and means acting within the pipe to disintegrate the material therein.

2. Apparatus for driving pipe or the like, comprising the combination of an oscillating lever, a hammer head thereon adapted to drive the pipe by percussion, and means to rotate the driven pipe on its axis while said hammer is operating, and means acting within the pipe to disintegrate the material therein.

3. Apparatus for driving pipe, comprising, in combination, an oscillating hammer; a water pipe and drill adapted to operate within the driven pipe; said hammer on its oscillation in one direction striking the driven pipe to drive it and on its oscillation in the other direction lifting the drill to let it fall.

4. Apparatus for driving pipe, comprising, in combination, simultaneously operating means, each connected continuously to the source of power, producing rapid percussion on the pipe, slow rotation of the pipe about its axis, and scouring of material within the pipe.

5. Apparatus for driving pipe, comprising the combination of a hammer and means for producing rapid percussion thereby on the top of the driven pipe; a drill lifted by the hammer and acting within the pipe by percussion; and means to rotate both driven pipe and drill while the hammer mechanism is operating.

6. Apparatus for driving pipe, comprising the combination of a hammer and means

for producing rapid percussion thereby on the top of the driven pipe, a drill acting within the driven pipe and lifted by the upward swinging of the hammer; and means to vary the zone of action of the hammer relative to the pipe and to the drill, to act upon either alone or upon them both alternately.

7. In apparatus for driving pipe or the like, the combination with a continuously acting source of power, of a lever continuously oscillated thereby; a hammer head, spring-mounted thereon in position to drive the pipe by percussion; means to rotate the pipe simultaneously about its own axis; and means acting within the pipe to disintegrate the material therein.

8. In apparatus for driving pipe or the like, the combination with a continuously acting source of power, of a lever continuously oscillated thereby; a hammer head, spring-mounted thereon in position to drive the pipe by percussion; and a weight engaged by the hammer head on its upward travel, whereby the said upward travel is retarded and the return stroke instituted more rapidly, said weight comprising a drill depending within the driven pipe.

9. In apparatus for driving pipe or the like, the combination of an oscillating hammer and a support therefor, a drill depending within the driven pipe and adapted to be engaged by the hammer head on its upward travel, whereby the drill is lifted and the upward travel of the hammer retarded; the support for said hammer being a power driven lever, whereby the hammer is thrown downward and delivers its blow before the drill, not so impelled, delivers its blow.

10. In apparatus for driving pipe or the like, the combination of a lever with a hammer head at one end adapted to strike the pipe; means to engage and rotate the pipe; a pump and connections for scouring contents from the pipe; a driving shaft; connections from the shaft to the pump, the pipe engaging means and the other end of the lever; an upright support; and a fulcrum sustained thereby at variable elevation, said fulcrum supporting the lever, and said connections being adapted to suit varying elevations of the lever and pipe.

11. Apparatus for driving pipe or the like comprising the combination of a drill acting at the bottom of the pipe and having a rod extending up through the pipe, percussion mechanism acting on both pipe and drill, and means to turn both while said percussion mechanism is operating.

12. In apparatus for driving pipe or the like, the combination of a driving shaft; a hammer; linkage connecting said shaft and hammer, oscillating the hammer to and from the driven pipe; means to engage the driven pipe; and gearing connecting said shaft and means, rotating the driven pipe.

13. In apparatus for driving pipe, the combination of an oscillating hammer acting downward upon the pipe; a drill acting within the pipe and having a member above the top of the pipe; and means actuated by the oscillations of the hammer to rotate the drill step by step.

14. In apparatus for driving pipe, the combination of a hammer; means oscillating the hammer to strike down upon the driven pipe; a drill operating within the driven pipe; a rod running out from the drill through the hammer; and a device connecting said oscillating means to the rod and converting the oscillation movement into a turning of the drill.

15. In apparatus for driving pipe, the combination of a hammer; means oscillating the hammer to strike down upon the driven pipe; a drill operating within the driven pipe; a rod running out from the drill through the hammer; an arm extending laterally from said rod; an eccentric adapted to shift the arm horizontally; and a connection from said oscillating means actuating the eccentric step by step.

16. In apparatus for driving pipe, the combination of a hammer; means oscillating the hammer to strike down upon the driven pipe; a drill operating within the driven pipe; a rod running out from the drill through the hammer; an arm extending laterally from said rod; an eccentric adapted to shift the arm horizontally; and a connection from said oscillating means actuating the eccentric step by step; the engagement for turning the eccentric occurring on the upward stroke of the hammer, whereby the drill is turned and thus loosened before being raised.

17. In apparatus for driving pipe, the combination of a drill adapted to operate within the pipe and having a cross-head above the top of the pipe; a hammer; and guides extending both downward and upward from the hammer head, engaging respectively the pipe top and the cross head, whereby the one hammer drives both pipe and drill.

18. In apparatus for driving pipe, the combination of a hammer head; a tube extending down therefrom and entering the pipe top for guiding the hammer; a drill adapted to operate within the pipe; a drill rod therefor; passing up through the pipe, said tube and said hammer, and having a cross head above the hammer; and a lever adapted to oscillate the hammer head between said pipe top and said cross head.

19. Apparatus for driving pipe or the like comprising the combination of an arm oscillating vertically and having a driving head thrown up and down by the arm and movable in and out thereon; a rotating

member adapted to turn a driven pipe; and means to churn and wash out the earth within the driven pipe.

20. Apparatus for driving pipe or the like comprising the combination of a vertical oscillating lever, means for feeding the fulcrum of said lever vertically; a driving head, spring-attached to the lever; means for rotating the driven pipe; a tubular churning drill within the pipe; means to wash out the earth therein; and means to support said drill loosely on said head.

Signed by me at Boston, Mass., this third day of June, 1912.

CHARLES D. KIRKPATRICK

Witnesses:

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