(No Model.)

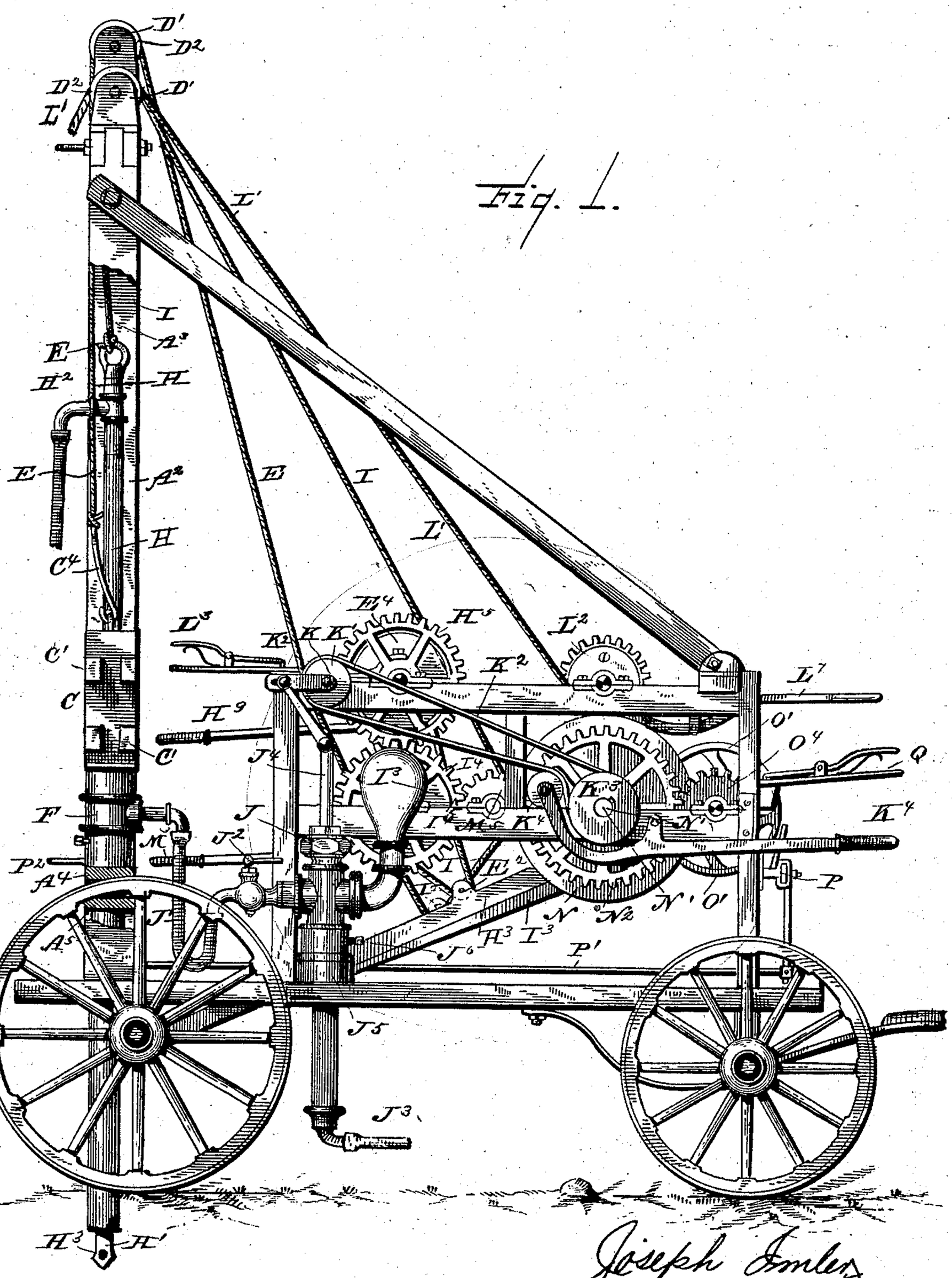
4 Sheets—Sheet 1.

J. IMLER.

WELL DRILLING MACHINE.

No. 369,339. Patented Sept. 6, 1887.

Fig. 1.



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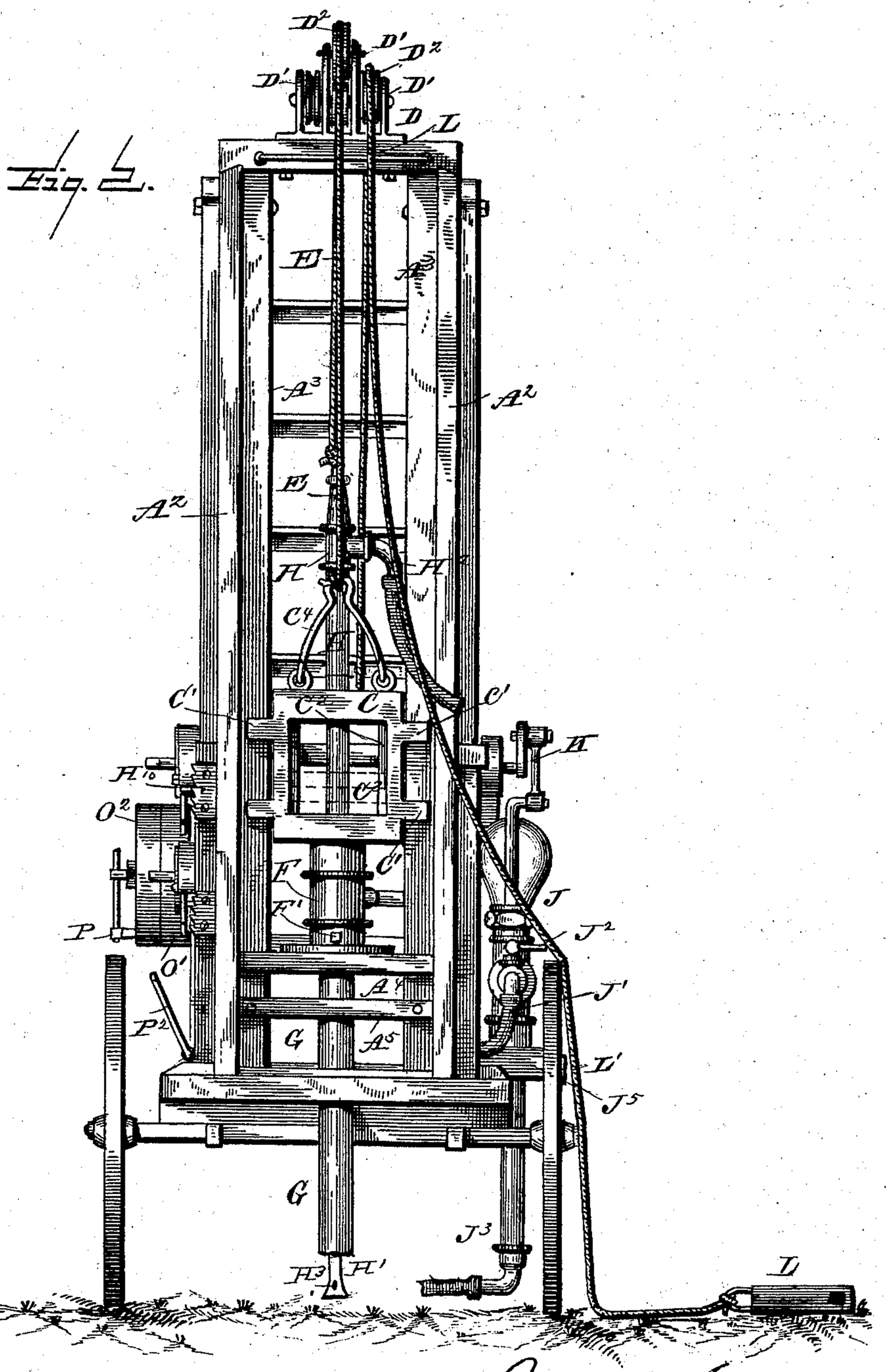
WELL DRILLING MACHINE.

No. 369,339. Patented Sept. 6, 1887.

Fig. 2.



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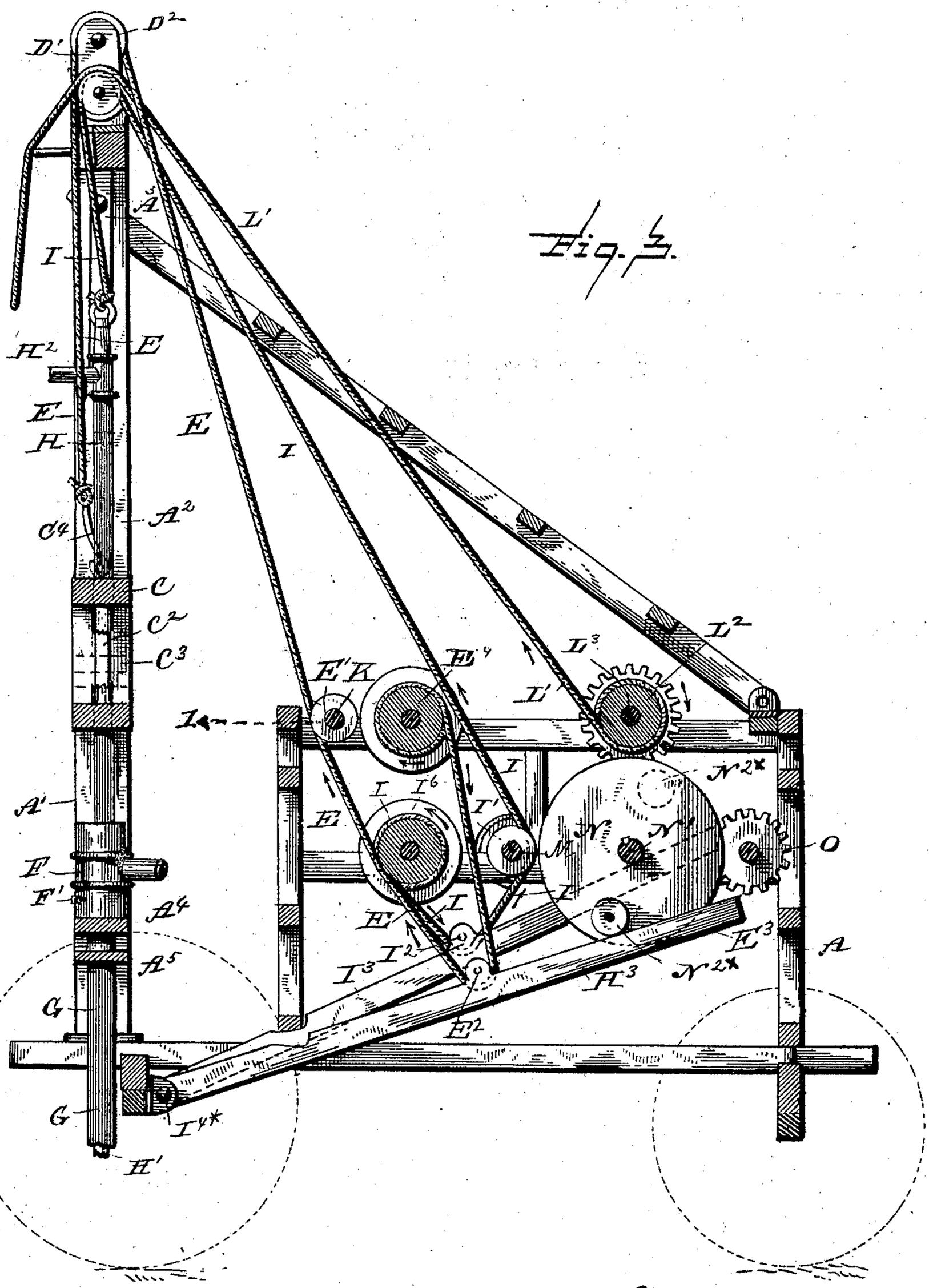
WELL DRILLING MACHINE.

No. 369,339. Patented Sept. 6, 1887.

Fig. 3.



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4 Sheets—Sheet 4.

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WELL DRILLING MACHINE.

No. 369,339. Patented Sept. 6, 1887.

Fig. 4.

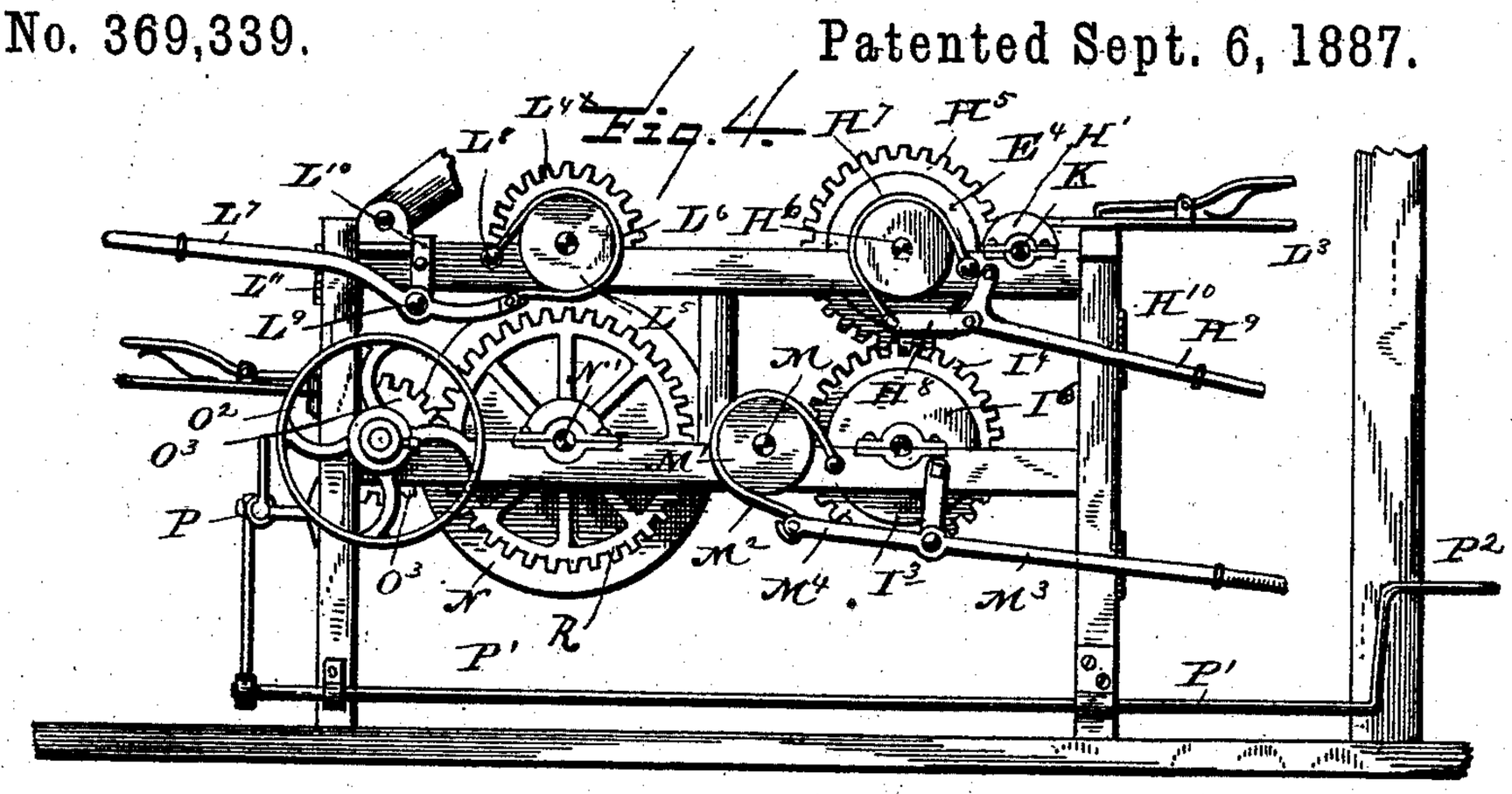


Fig. 5.

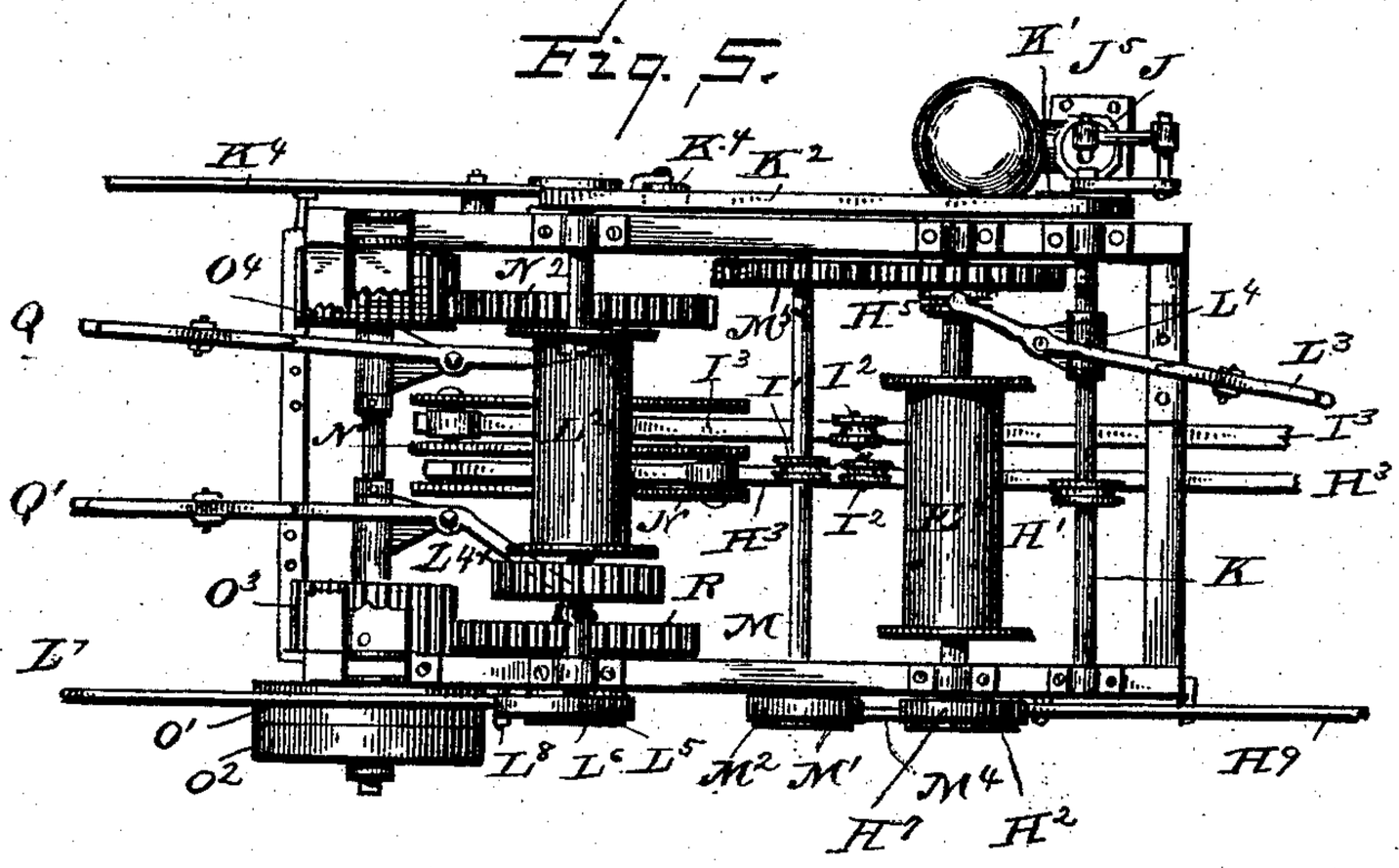


Fig. 7.

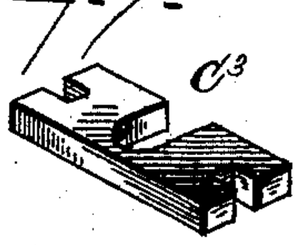


Fig. 6.

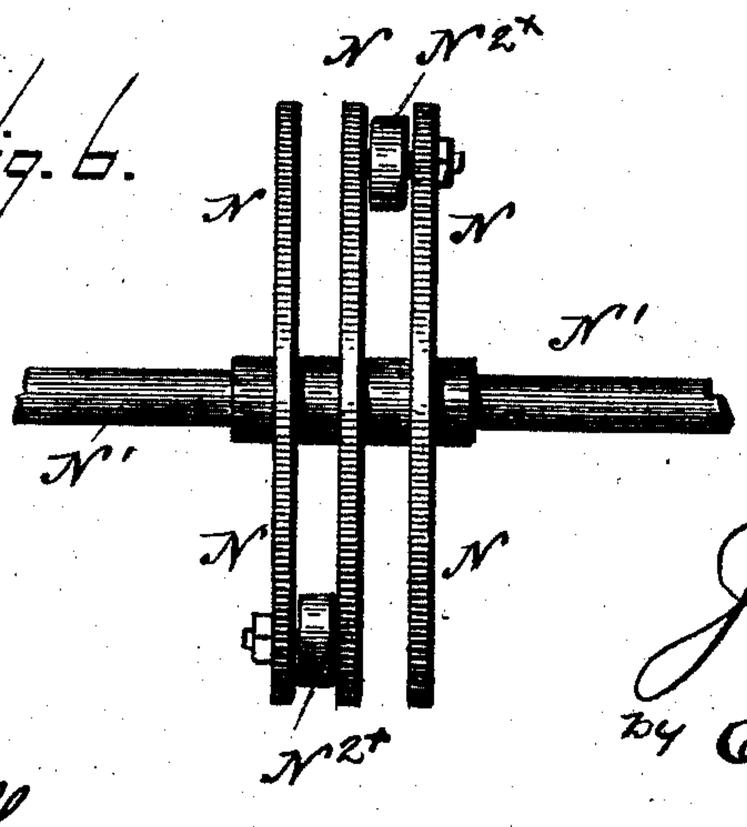
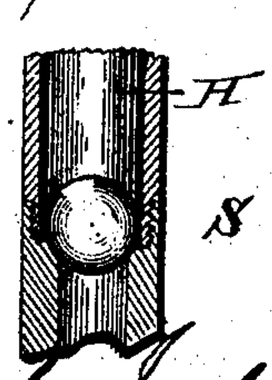


Fig. 8.



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UNITED STATES PATENT OFFICE.

JOSEPH IMLER, OF GARRETT, INDIANA.

WELL-DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 369,339, dated September 6, 1887.

Application filed August 6, 1886. Serial No. 210,206. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH IMLER, a citizen of the United States, residing at Garrett, in the county of De Kalb, State of Indiana, have invented certain new and useful Improvements in Well-Drilling Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention has relation to well-drilling machines of that class in which a tube is driven into the ground simultaneously with the operation of drilling, which latter operation is performed by operating the drill within the tube.

In a patent recently granted me the mechanism operated to drive the drill and the pipe simultaneously at each blow of the hammer, and water was forced downwardly through the hollow drill-rod to discharge the sand and loosened earth upwardly through the tubing.

I have learned by experience that discharging the sand and loosened earth in the manner above specified is objectionable, in that it often packs about the drill at the bottom of the tubing in such manner as to render it exceedingly difficult to extricate the drill. I have also learned that there is a great advantage in being able to drive the pipe and drill independently of each other, and, furthermore, to be able to determine the distance below the end of the pipe at which the drill shall be performing the operation of excavating.

Among the principal objects of my invention are to secure the advantages resulting from these differences in operation; and my invention consists in the means provided for securing said mode of operation and the advantages accruing therefrom.

Referring to the drawings, Figure 1 is a side elevation; Fig. 2, a front elevation; Fig. 3, a vertical section; Fig. 4, a partial side elevation opposite that shown in Fig. 1; and Fig. 5, a plan of the windlass portion of a machine constructed in accordance with my invention, with parts of the frame-work broken away. Fig. 6 is a detail in front elevation, hereinafter described. Fig. 7 is a perspective of a hammer-plate; and Fig. 8 is also a detail, hereinafter referred to.

Like letters of reference indicate like parts in all the figures of the drawings.

Mounted upon any suitable truck is a windlass frame-work, A, and a hammer frame-work, A′, the latter consisting of two uprights, A^2, having guiding-strips A^3 for the hammer C. Upon the upper beam of said frame-work is mounted a casting, D, comprising four standards, D′, with four pulleys, D^2, arranged therein, the two central pulleys being arranged one above the other.

The hammer C consists of a single casting having lugs C′, adapted to embrace the guiding-strip, and having a rectangular opening provided with ribs C^2 at opposite sides, whereby removable plates C^3, (see dotted lines Figs. 2, 3, and 7,) adapted to fit the opening and the ribs, may be inserted and removed for increasing or diminishing the weight of the hammer, as may be desired. A bail, C^4, connected with the hammer, serves the purpose of attaching the hammer-rope E to the hammer. A coupling, F, is removably connected with the upper end of the well-tubing G, and is provided with a set-screw or bolt, F′, for retaining the same in connection with the well-tube. A cross-head, A^4, is fitted upon the guides A^3 of the frame-work, and encircles the well-tube, while the cross-bar A^5 also encircles said tube, so that when at the commencement of the operation of driving the coupling and tube extend to the upper part of the frame-work these cross-heads will retain the tube in a vertical position.

H represents the drill-rod, which is in tubular form and is provided at the lower end with the drill H′ and near the upper end with a branch pipe, H^2, for the discharge of sand and earth looosened by the drill, in a manner hereinafter described.

I is the drill-rope.

J represents a pump, and a pipe, J′, connects it with the coupling F on the well-tube. A cock, J^2, is provided in the connecting-pipe to control the discharge of water from the pump into the tube.

J^3 is a pipe connecting the pump with a suitable supply of water.

J^4 is a piston-rod to the pump, suitably connected with a crank-shaft, K, whereby the rotation of said shaft, as hereinafter described, will operate the pump.

The pipe connecting the pump with the coupling on the tube is flexible, and the pump-barrel itself is supported in a collar, J^5, mount-

ed on the truck, so that by means of a set-screw or bolt, J^6, the pump may be elevated or depressed with relation to the crank-shaft J, and therefore the effective length of stroke of the piston may be adjusted, whereby the supply is rendered greater or less, as desired.

L, Fig. 2, is an ordinary sand-pump, which by means of the rope L′, passing over one of the pulleys D^2 and suitably connected with a windlass, L^2, (see Fig. 1,) may be raised and lowered independently of the remaining elements of the machine, as hereinafter described.

I will now trace from the drill and hammer the ropes employed for operating the same and describe the elements of the machine which operate the drill and hammer through the medium of ropes. The drill-rope I passes over one of the pulleys D^2, and from thence over an idle-pulley, I′, loosely mounted upon a brake-shaft, M, and from thence through a pulley, I^2, mounted on a walking-beam, I^3, pivoted in a casting, I^{4*}, secured to a cross-bar of the truck and at a point as near as possible under the center of the hammer—that is, near the well-tube. From the pulley I^2 the drill-rope I passes to and around a windlass, I^6, having rigidly secured to the shaft thereof a gear, I^4. (See Fig. 1.) The hammer-rope E passes over another of the pulleys D^2 and from thence against an idle pulley, E′, mounted on the crank-shaft K; or said idle pulley may be mounted on a bracket extending from the frame A, so as to deflect the rope to about the point 1, (see Fig. 3,) whereby said rope will not rub against the windlass I^6, and from thence to and around a pulley, E^2, mounted on the walking-beam E^3, also pivoted at I^{4*}, and from thence said rope passes to a windlass, E^4, arranged directly above the windlass I^6 and provided with a gear, E^5, (see Figs. 1 and 5,) which may or may not mesh with the gear I^4, it being mounted upon the shaft of the windlass L^2, so as to be moved longitudinally thereon by means of a lever, L^3, pivoted to a casting, L^4, mounted on the crank-shaft K.

The free ends of the walking-beams E^3 I^3 are arranged to operate between disks N, mounted upon the shaft N′ and having at diametrically-opposite points anti-friction rollers $N^{2\times}$. In this instance two of such rollers are represented, whereby during each revolution of the shaft N′ each of the walking-beams is depressed at its free end. It is apparent that if the anti-friction rollers are increased in number the number of depressions at each revolution of the shaft will be proportionately increased. The anti-friction rollers being arranged diametrically opposite each other, produce alternate depressions of the walking-beams, so that by means of the rope-connections, above described, the strokes of the hammer and drill alternate. A great advantage is secured in providing the walking-beams with pulleys or sheaves as connections for the ropes and the beams, because the friction is reduced to a minimum, as well as the wear upon the rope, which is excessive when the latter is arranged to come into direct contact with the anti-friction rollers of the disks or their equivalent. Furthermore, in the operation of the machine, the point of resistance being nearly beneath the hammer, as at I^{4*}, the tendency to lift the machine—as, for instance, when a drill becomes fixed and while the disks are operating to lift the same—is overcome by reason of the location of the pivoted ends of the walking-beams and the elasticity of the rope itself upon which the strain comes.

The crank-shaft K is operated by a pulley, K′, fixed thereon and connected by a belt, K^2, with the pulley K^3, mounted on the shaft N′. (See Fig. 5.) A belt-tightener, K^4, serves to throw the pump into and out of operation.

Parallel with the shaft N′ is the power-shaft O. This is provided with a fast and loose pulley, O′ O^2, respectively, and a pair of long-faced pinions, O^3 O^4, arranged near opposite ends of the shaft. A belt-shifter, P, is arranged in front of the pulleys, and is connected to a crank-shaft, P′, extending along the side of the machine, and terminating in a belt-shifter-operating lever, P^2, near the front end of the machine—that is, the end at which the drill and well-tube are arranged.

The sand-pump rope L′, as before stated, passes around the windlass L^2, and on the shaft of said windlass is mounted a pinion, $L^{4\times}$, and at the end of said shaft is a brake-disk, L^5, around which a strap, L^6, passes and is connected to a lever, L^7, at one end, and fixed to the frame-work at L^8 at its opposite end. The said lever is pivoted at L^9 to a bracket, L^{10}, fixed to the frame-work. A ratchet-plate, L^{11}, is arranged on the frame-work to receive the lever and retain it in an adjusted position. The object of this mechanism is to regulate the fall of the sand-pump when lowering the same.

Each of the windlasses employed to control the operation of the drill and of the hammer is also provided with a friction device differing in construction from that just described. On the shaft of the windlass E^4 is a friction-disk, H^6, (see Fig. 4,) and strap H^7, one end of which is secured to the frame and the other to a link, H^8, which is pivotally connected to a bell-crank lever, H^9, pivoted to the frame-work and passing so as to be retained by a rack-plate, H^{10}, in an adjusted position. The operation of this friction device is as follows: Lifting the free end of the lever tightens the strap upon the disk. On the shaft M is the friction-disk M′, employed to control the windlass I^6, the strap M^2 of which is connected to a lever, M^3, similar to the lever H^9, by means of a link, M^4.

The system of gearing employed in this machine is as follows, (see Figs. 1 and 5:) Upon the shaft N′ is a master-gear, N^2, which meshes with the long pinion O^4. The hammer-windlass gear H^5 is driven by the drill-windlass gear I^4, and this gear is driven by the intermediate gear, M^5, mounted on the shaft M, so that when power is applied to the driving-shaft by the fast pulley, and while the gears

mentioned mesh as described, the hammer and drill-ropes may be wound up simultaneously to lift the hammer and the drill. Provision is made, however, for throwing any windlass-gear in the system out of mesh, or rather for rendering any windlass-gear in the system inoperative.

The lever L^3 serves to throw the gear H^5 of the hammer-rope windlass out of mesh with the companion gear I^4, mounted upon the shaft of the drill-rope windlass arranged beneath it.

A shifting-lever, Q, (see Fig. 5,) serves the purpose of throwing the gear N^2 out of mesh with the intermediate gear, M^5, while a similar shifting-lever, Q′, serves to throw the gear into and out of mesh with the gear R on the shaft of the sand-pump-rope windlass.

To recapitulate: The hammer-windlass is thrown out of the system of gearing by the lever L^3. Both windlasses, although operating together by their gears being in mesh with each other, may be thrown out of the general system by the lever Q, while the lever Q′ serves to throw into and out of the system of gearing the sand-pump windlass L^2.

The general operation of the machine is as follows: The power being applied as described, the disks rotate and the anti-friction rollers alternately come into contact with the walking-beams and depress their free ends, which produces a strain upon the ropes of the drill and of the hammer alternately, causing these elements to make alternate strokes. Friction is applied to the shafts of the hammer and drill windlasses by raising the free ends of the levers H^9 M^3 and retaining them in an elevated position, as described, so that the force of the blow of the hammer and of the drill shall unwind just a desired quantity of rope from the windlasses. In this manner an automatic paying out of the ropes as required is secured. Now, if it be desirable that the drill shall be a certain distance in advance of the lower end of the well-tube, then the friction on the drill-windlass is reduced, while that on the hammer-windlass is retained until the drill works to the desired point in advance of the tube. In this manner the distance of the drill-point from the end of the tube may be regulated at will. During the operation of the machine it will be noticed that the pump may also be operated to force water through the coupling F into the tube, which water passes down the same, being excluded from the drill until it reaches the bottom of the excavation, where it serves to loosen and take up the soil or sand removed by the drill and forces it into the tubular drill-rod, which it enters through ports H^3 (see Fig. 1,) near the drill-point, and said water, with the sand and dirt therein, is forced upwardly through the hollow drill-rod and is discharged therefrom through the discharge-pipe H^2. Now, it will be noticed that the power exerted to raise the dirt and sand exerts an upward pressure on the drill-rod, which materially assists in the operation of lifting the same, and this reduces the strain and wear upon the drill-rope and the lifting tendency of the machine whenever the drill is stuck. Whenever it is desired to increase the blow of the hammer, additional hammer-plates, C^3, may readily be inserted into the hammer, and thus a single hammer is adapted to operate in soils or rock of different hardness.

To facilitate raising and discharging refuse from the drill-rod check-valves S, which in this instance are balls, are arranged at suitable intervals in the hollow drill, as shown in Fig. 8, which is a vertical section of the tube, showing the ball-valve in elevation.

The tube H is larger than the ball-valve S, while the valve-seat is bored smaller than the tube H, so that water may pass upwardly when the ball is raised.

Having described my invention and its operation, what I claim is—

1. As a means for operating a drill-rod and hammer in a well-drilling machine, the combination of a shaft having mounted thereon a series of disks having friction-rollers, and walking-beams between the disks, whereby said disks act as guides for and to operate the walking-beams, substantially as specified.

2. In a well-drilling machine, a main shaft provided with a shiftable master-gear, a pair of windlasses provided with intermeshing gears, one of which is shiftable to engage and disengage the windlass-gear and the master-gear, whereby motion may or may not be imparted to one or both of the windlasses from the main shaft, substantially as specified.

3. In a well-drilling machine, an independently-operative hammer and drill-rod, a rope extending from each to independent windlasses, one of which has a shifting-gear and both of which have a friction-brake, whereby the penetration of the drill may be limited or adjusted or suspended, substantially as and for the purpose set forth.

4. In a well-drilling machine, a drill-rod, a rope for the same, a windlass for the rope, a walking-beam provided with a sheave or pulley through which said rope passes on its way from the windlass to the drill, and a main shaft carrying disks between which the walking-beam and a walking-beam-operating device is arranged, substantially as specified.

5. In a well-drilling machine, a hammer provided with an opening having opposite flanges, and with removable weights adapted to fit the openings and the flanges, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH IMLER.

Witnesses:

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W. S. DUVALL.