(No Model.) 3 Sheets—Sheet 1.

W. M. BOWERS & W. HAMILTON.

WELL DRILLING MACHINE.

No. 420,004. Patented Jan. 21, 1890.

Fig. 2.

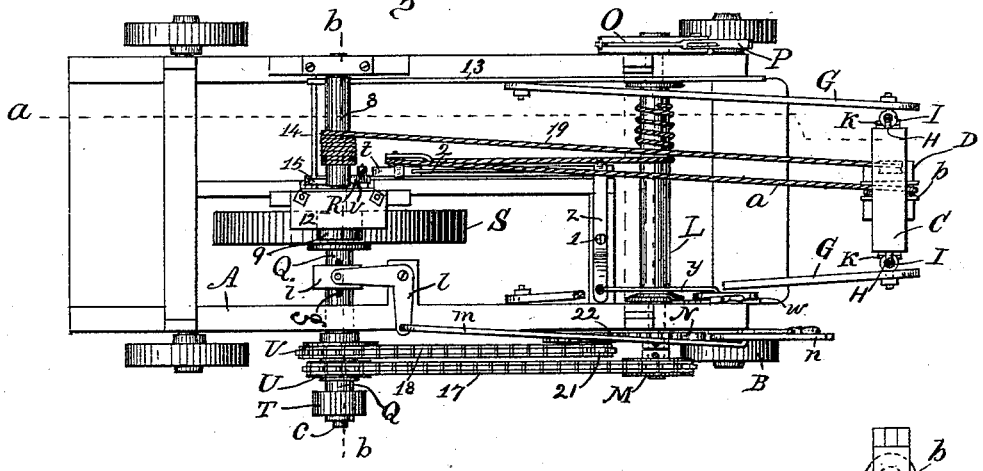
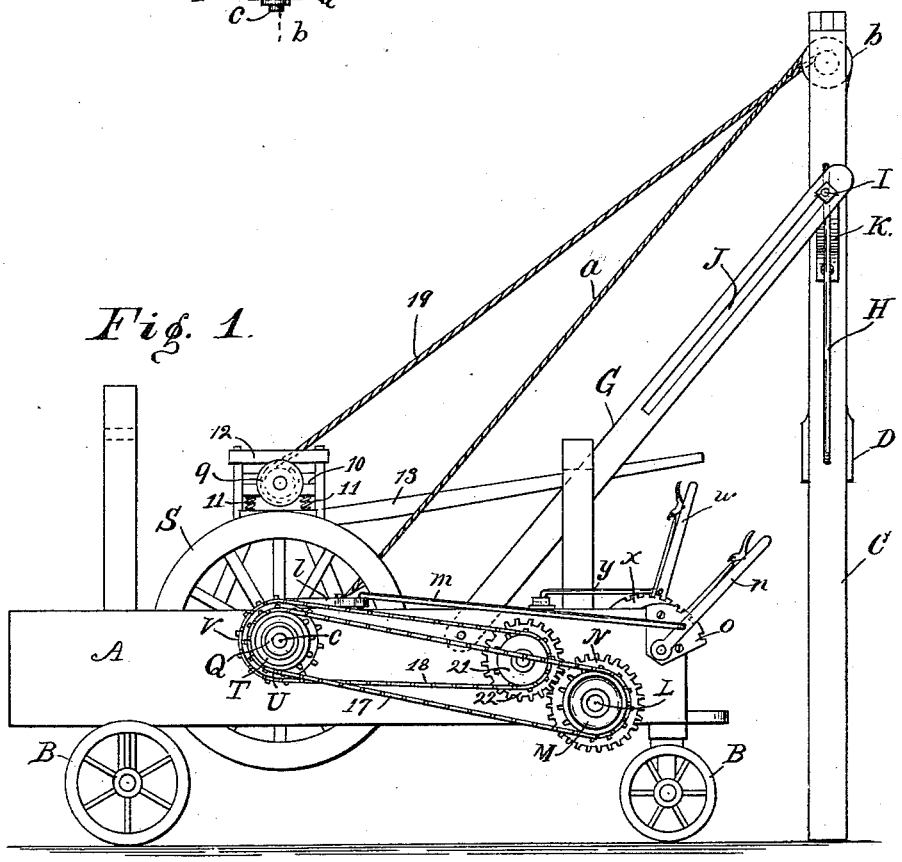


Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

W. M. BOWERS & W. HAMILTON.

WELL DRILLING MACHINE.

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Fig. 4.

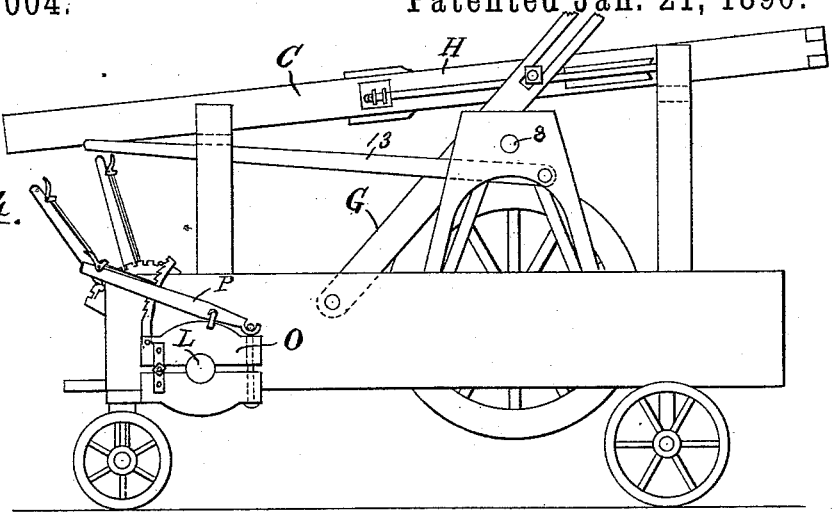
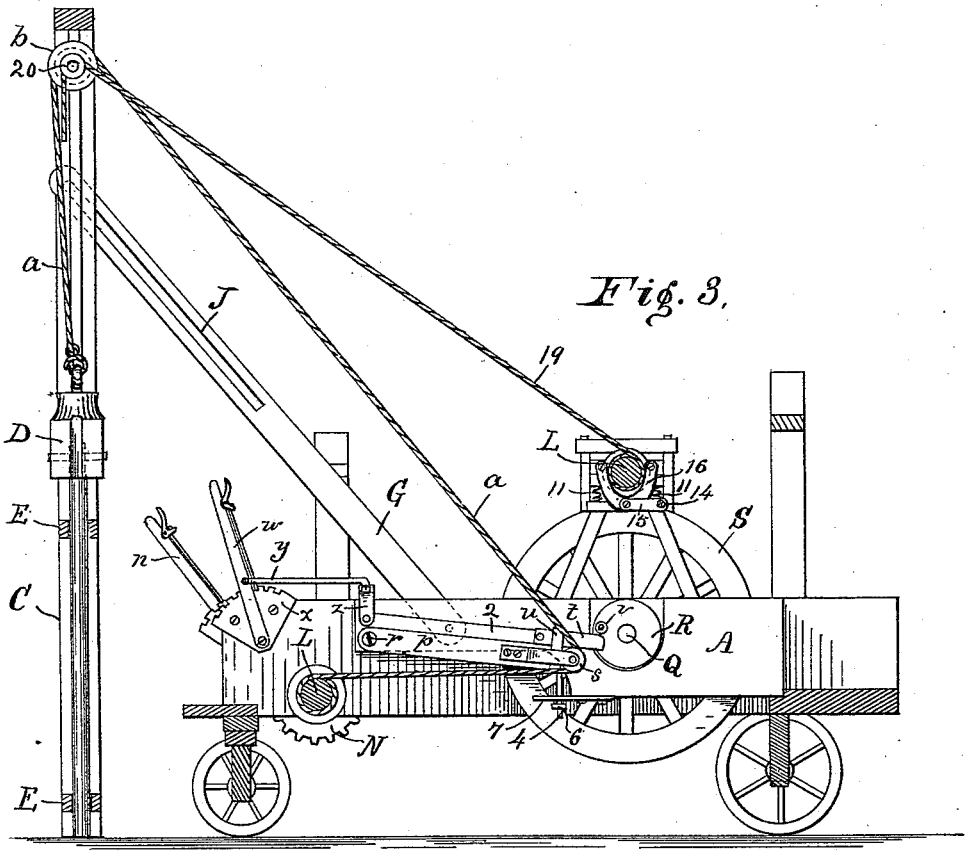


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

W. M. BOWERS & W. HAMILTON.

WELL DRILLING MACHINE.

No. 420,004. Patented Jan. 21, 1890.

Fig. 7.

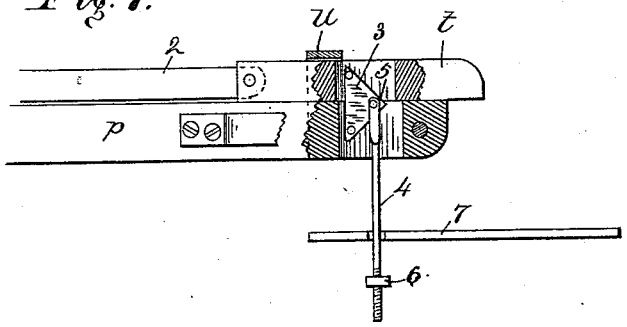


Fig. 5.

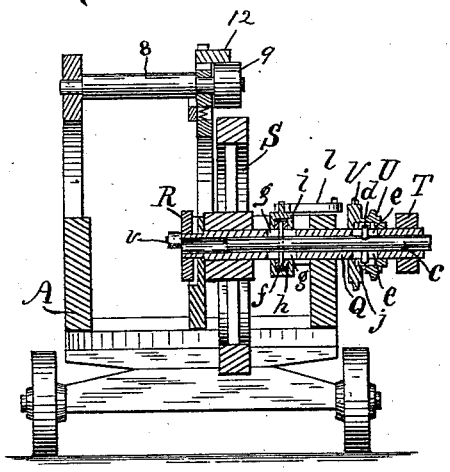
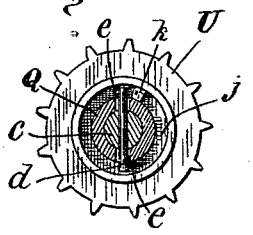


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM M. BOWERS AND WOOD HAMILTON, OF THORNTOWN, INDIANA; SAID HAMILTON ASSIGNOR TO JAMES A. BALL, OF SAME PLACE.

WELL-DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 420,004, dated January 21, 1890.

Application filed May 31, 1889. Serial No. 312,734. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM M. BOWERS and WOOD HAMILTON, citizens of the United States, residing at Thorntown, in the county of Boone and State of Indiana, have invented a new and useful Improvement in Well-Drilling Machines, of which the following is a specification.

Our invention relates to an improved machine for drilling deep tubular wells, as those for natural gas or oil, said machine comprising a derrick carrying a sliding weight or drill-head and guides for the well-tube, windlasses for raising and lowering the drill-head and the drilling-tools, and means for raising and dropping the drill-head, the whole mounted on carrying-wheels and arranged for convenient manipulation.

The objects of our improvement are, first, to provide means whereby the force of the blow given by the drill may be conveniently and nicely controlled and adjusted by the operator without changing the speed or movement of the driving-shaft of the machine; second, to provide means for reversing the direction of rotation in the windlass for raising the weight or drilling-tools without reversing the motor or driving-shaft, and, third, to provide for folding the derrick and its supports back upon the body of the machine when not in use, all as hereinafter fully shown and described.

The accompanying drawings illustrate our invention.

Figure 1 is a side elevation showing the derrick in working position. Fig. 2 is a plan of the same. Fig. 3 is a vertical longitudinal section at *a*, Fig. 2. Fig. 4 is an elevation of the side opposite that shown in Fig. 1, showing the derrick packed for removal. Fig. 5 is a vertical transverse section at *b*, Fig. 2. Fig. 6 is a transverse section of the main shaft on a larger scale. Fig. 7 is a side elevation, on a larger scale and partly in section, of the driving-lever.

The mechanism is mounted on a rectangular frame A, which is provided with carrying-wheels B. The derrick C is provided with a sliding drill-head D and cross-bars E E, for guiding the well-tube F. The derrick is supported in a vertical position by means of braces G G. Braces G G are pivoted at one end to the sides of the main frame, and are connected at the other end by eyebolts I I to rods H H, mounted on opposite sides of the derrick, the eye of the bolt being arranged to slide along the rod and the shank projecting through a longitudinal slot J in the brace, the arrangement being such that the brace may be clamped against the rod by the nut on the bolt.

K K are light flat springs, which are secured, respectively, at one end to the side of the derrick, the other end resting against the rod H below the eyebolt I, their purpose being to prevent the eyebolt from sliding down on the rod. By this construction the derrick and its braces are adapted to be folded down upon the main frame when not in use, as hereinafter explained.

L is a windlass extending across frame A, near the front end, turning in bearings formed in the main frame, and projecting therefrom at each end. To one end of windlass L a sprocket-wheel M and a spur gear-wheel N are rigidly secured, so as to turn therewith, and the other projecting end of the windlass is embraced by a clamp O, which is secured to the side of the main frame, and operates by means of a lever P as a brake on the windlass. The sliding drill-head D is suspended by a rope *a*, passing over a pulley *b* at the top of the derrick to windlass L.

Q is the driving-shaft, which is mounted in suitable bearings near the rear end of the main frame A. Said driving-shaft is hollow, and is provided with a crank-wheel R, a balance-wheel S, and a driving-pulley T, which are secured rigidly to the shaft, so as to revolve therewith, and with a pair of sprocket-wheels U and V, which are arranged to turn loosely thereon, except when temporarily engaged, as hereinafter described.

Within the hollow shaft Q a rod *c* is arranged to slide longitudinally. The rod is provided with a pin *d*, which projects through longitudinal slots *e e* in opposite sides of the shaft, and with a pin *f*, which projects through longitudinal slots *g g* and engages a sleeve *h*, which is arranged to slide longitudinally on the exterior of the shaft and to rotate therewith. Sleeve *h* is embraced by a second

sleeve *i*, which slides upon the shaft, but does not rotate therewith. The opposed faces of the hubs of the sprocket-wheels U and V are recessed, as at *j*, to allow the projecting ends of pin *d* to rotate within them. A stop, as at *k*, is arranged in the recess of each of said wheels, so as to project into the path of the pin *d* when it is at the bottom of the recess in either wheel. Said stop does not, however, extend the whole depth of the recess; but there is sufficient space between the ends of the stops in the two wheels, when their hubs are in contact, to allow the pin to rotate with the shaft without engaging either wheel. Rod *c* is moved longitudinally to throw pin *d* into engagement with either of the sprocket-wheels U and V, or out of engagement with both, by means of a bell-crank lever *l*, which is pivoted at its angle to the main frame and at one end to sleeve *i*, the other end of the lever being connected by a rod *m* to a reversing-lever *n*, which is pivoted to the main frame near the front end, and engages the notched sector *o*.

The driving-lever *p* is pivoted to the main frame at *r*, and is provided at its free end with a grooved friction-pulley *s* and an extensible tip *t*. Said extensible tip *t* consists of a short arm held to the upper side of the lever by a clip *u*, and arranged to slide longitudinally along and project beyond the end of the lever into the path of the crank-pin *v*, which projects from the crank-wheel R. Tip *t* is adjusted along lever *p* by means of the reversing-lever *w*, pivoted to the main frame near its front end and engaging the notched sector *x*, a connecting-rod *y*, an intermediate lever *z*, pivoted to the main frame at 1, and a connecting-rod 2, the arrangement of the whole being such that, the bight of rope *a* being passed over pulley *s*, the operator may, by means of the reversing-lever *w*, project tip *t* to a greater or less extent into the path of the crank *v* as it revolves, thereby causing a greater or less depression of the driving-lever and consequent length of movement of the drill-head D and the drilling-tools connected therewith.

For the purpose of forming an adjustable stop for the upward movement of the driving-lever, which shall be automatically lengthened or shortened by the sliding movement of the tip *t* along the driving-lever, we connect the tip and the driving-lever by a bell-crank lever 3, Fig. 7, the opposite ends of said lever being pivoted, respectively, to the driving-lever and the sliding tip, and a stop-rod 4 being suspended from the free angle 5. Rod 4 passes downward and is provided with a head 6, which engages the under side of a plate 7, secured to the main frame. The effective length of rod 4 is increased when tip *t* is slid outward and decreased when the tip is moved in the opposite direction. A windlass 8, having at one end a driving-pulley 9, is mounted above the driving-shaft Q in such a position that its pulley 9 may be brought in contact with the periphery of the balance-wheel S, so as to be rotated by friction therewith. That end of the windlass 8 to which the pulley 9 is secured is mounted in a bearing 10, which is yieldingly supported by springs 11 11 in such a manner as to hold the pulley 9 normally out of contact with wheel S and in contact with a flange 12, projecting from the standard in which the bearing is mounted. Bearing 10 is drawn downward, so as to bring pulley 9 in contact with wheel S, by means of a lever 13, which is connected with the bearing by a shaft 14, having an arm 15, and a yoke 16, attached to the bearing and to the arm 15.

Windlass 8 is for the purpose of raising and lowering tools for cleaning out the débris from the well tube or casing after the drill has been removed, a rope 19 passing therefrom over a pulley 20 at the top of the derrick. Windlass L is turned in one direction by means of a chain belt 17, passing over sprocket-wheel M on the windlass and sprocket-wheel U on the driving-shaft, and is turned in the opposite direction by means of a chain belt 18, passing over sprocket-wheel V on the driving-shaft and a sprocket-wheel 21, which is mounted on a stud projecting from the side of the main frame. Said sprocket-wheel 21 has attached thereto so as to revolve therewith a spur gear-wheel 22, which intermeshes with gear-wheel N on the windlass.

The operation of our machine is as follows: It is drawn to the place of operation with the derrick and its braces folded back and resting on suitable supports projecting above the main frame, as shown in Fig. 4. As the derrick is raised braces G G are swung forward and are then raised, the eyebolts I sliding along the rods H H until they pass the springs K K, where they are secured by tightening the nut *s* on bolts I. A bight is now formed in rope *a*, so that the rope passes from windlass L over pulley S, and from thence upward over pulley *b* and down to the sliding drill-head D, windlass L being firmly held by the brake-clamp O. The well tubing or casing and the drill having been put in position, the drill is connected to the sliding head D. Shaft Q is now put in motion by means of a portable engine or other suitable motor, the shaft turning in the direction indicated by the arrow in Figs. 1 and 3. When the reversing-lever *w* is thrown forward to the full extent of the notched sector *x*, the sliding tip *t* of the driving-lever *p* is retracted out of the path of the crank *v* and the drill-head is not moved. The lever *w* being thrown backward, tip *t* is projected a short distance into the path of the crank, which engages and depresses the driving-lever *p*, thus raising the drill until the crank passes out of engagement. The drill-head falls when the driving-lever *p* is released, and the driving-lever is thereby raised until checked by the stop-rod 4. The length of movement of the drill-head is thus seen to be wholly dependent on the

position of the tip *t*, and the consequent force of the blow of the drill may be perfectly controlled by the movement of lever *w*. During the process of drilling, lever *n* is set in the central notch of sector *o*, thus holding pin *d* in rod *c* out of engagement with both of the sprocket-wheels U and V. When it is desirable to raise the drill out of the casing, lever *n* is thrown forward, thus sliding rod *c* outward and engaging wheel U. By throwing lever *n* clear back wheel U is disengaged and wheel V is engaged, thus reversing the movement of the windlass. Windlass 8 is operated, as before described, by bringing the periphery of its pulley in contact with the balance-wheel by means of the lever 13.

It will be observed that all the required movements of the machine are controlled without changing or disturbing the steady movement of the driving-shaft.

We claim as our invention—

1. In a well-drilling machine, the combination of the derrick, the sliding head mounted on said derrick, the main frame, the driving-shaft mounted on said frame and carrying a crank-pin, the driving-lever pivoted to the main frame and having an extensible tip arranged to project into the path of said crank-pin, the rope arranged to connect said driving-lever and the sliding head, the reversing-lever, and intermediate mechanism connecting said reversing-lever and the extensible tip of the driving-lever, all arranged to co-operate substantially as specified, whereby the driving-lever may be extended while in motion more or less into the path of the crank-pin and the movement of the sliding head thereby controlled.

2. In a well-drilling machine, the combination of the main frame, the hollow driving-shaft, and the windlass mounted on said frame, the sprocket-wheel and the spur gear-wheel secured to the windlass so as to turn therewith, the pair of sprocket-wheels mounted on the driving-shaft so as to turn loosely thereon, the sprocket-wheel having a spur gear-wheel attached thereto and mounted on the main frame so as to intermesh with the spur gear-wheel on the windlass, the chain belt connecting the sprocket-wheel having said spur gear-wheel attached thereto and one of the loose sprocket-wheels on the driving-shaft, the chain belt connecting the other loose sprocket-wheel on the driving-shaft and the sprocket-wheel on the windlass, the rod arranged to slide within the hollow driving-shaft and having a pin projecting through the side of the driving-shaft and adapted to engage alternately either of the sprocket-wheels on said driving-shaft, and means, substantially as shown and described, for sliding said rod longitudinally within the driving-shaft, all arranged to co-operate substantially as specified, whereby the windlass is turned in opposite directions by the continuous movement of the driving-shaft in one direction.

3. In a well-drilling machine, the combination of the main frame, the driving-shaft mounted thereon, the balance-wheel secured to the driving-shaft, the windlass 8, arranged adjacent to the balance-wheel, so as to be driven by frictional contact therewith, the yielding bearing supporting one end of windlass and holding it normally out of contact with the balance-wheel and in contact with a fixed surface, the lever 13, and intermediate mechanism connecting the yielding bearing and said lever, whereby the bearing is depressed by the lever and the windlass rotated by frictional contact with the balance-wheel, substantially as specified.

4. In a well-driving machine, the combination of the main frame, driving-lever *p*, extensible tip *t*, bell-crank 3, and stop-rod 4, all arranged to co-operate in the manner and for the purpose specified.

5. In a well-driving machine, the combination of the main frame, the derrick having side rods H H, and braces G G, each pivoted at one end to the main frame and connected at the other end to one of the rods H by an eye-bolt, all substantially as and for the purpose specified.

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