(No Model.) 3 Sheets—Sheet 1.

J. G. DOWNIE.

PORTABLE DRILLING MACHINE.

No. 441,540. Patented Nov. 25, 1890.

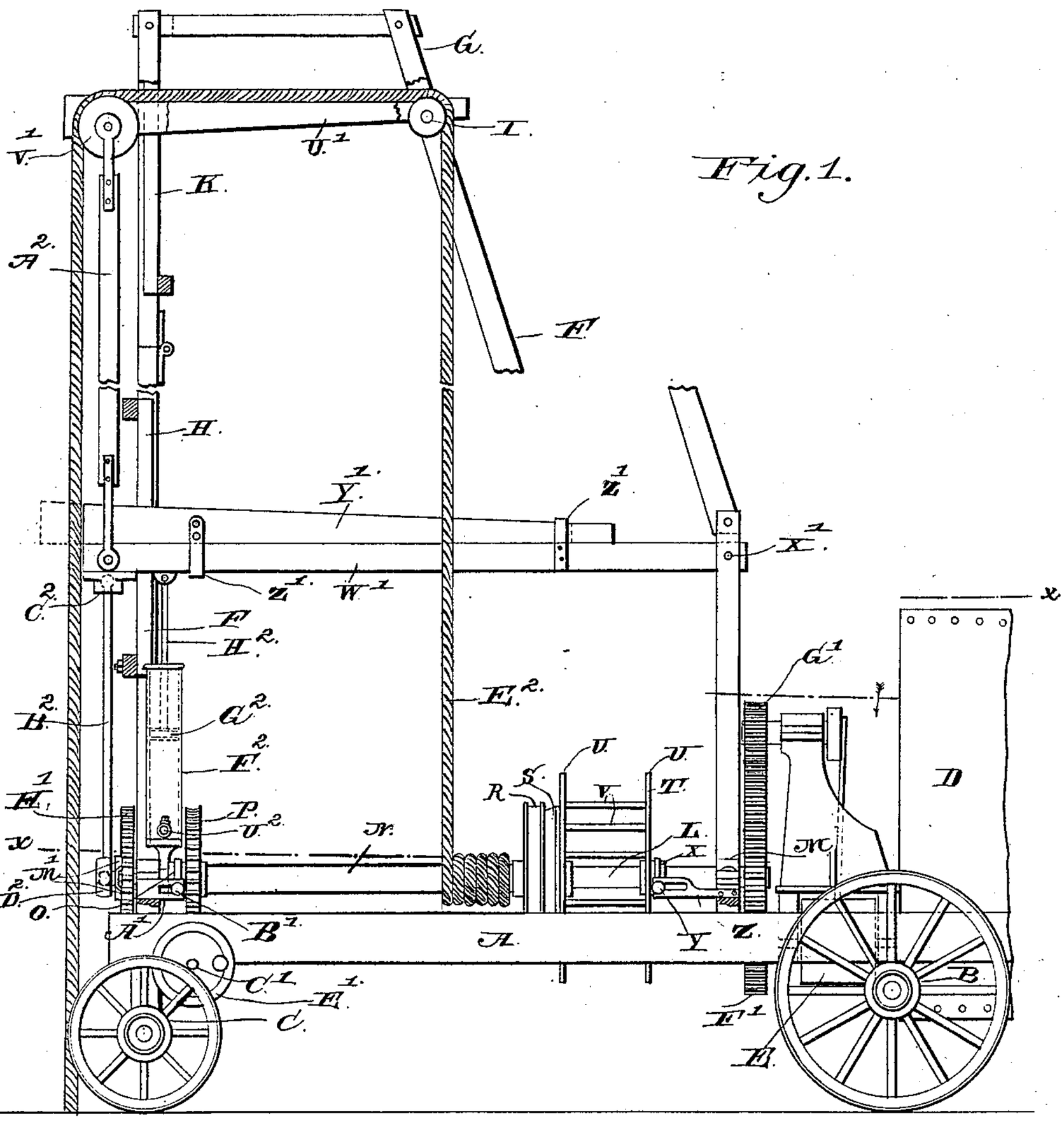

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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PORTABLE DRILLING MACHINE.

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Fig. 2.

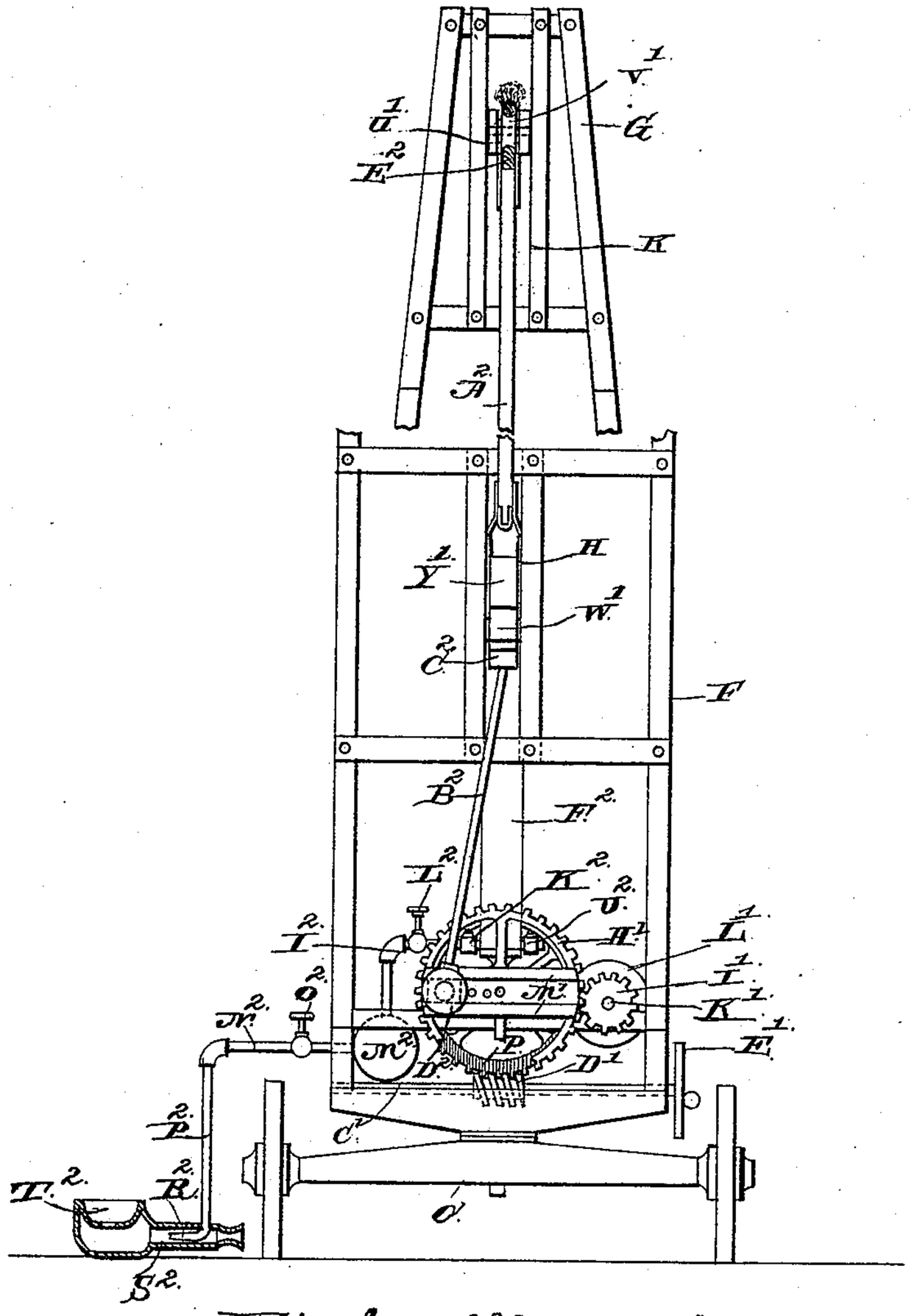
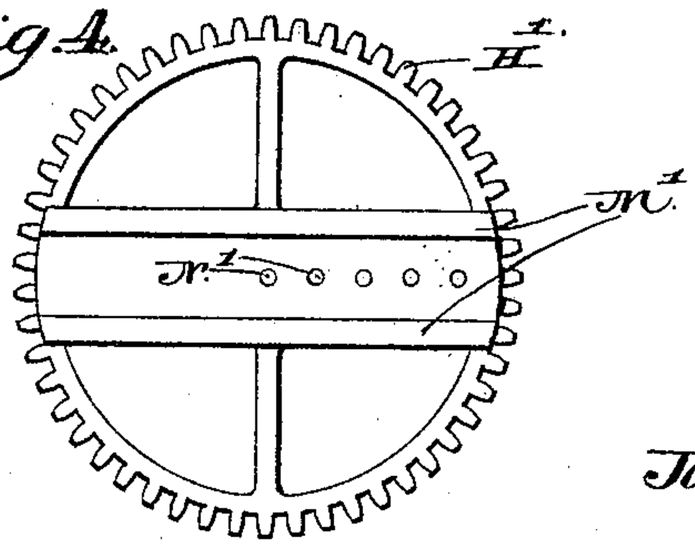


Fig. 4.



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(No Model.) 3 Sheets—Sheet 3.

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PORTABLE DRILLING MACHINE.

No. 441,540. Patented Nov. 25, 1890.

Fig. 3.

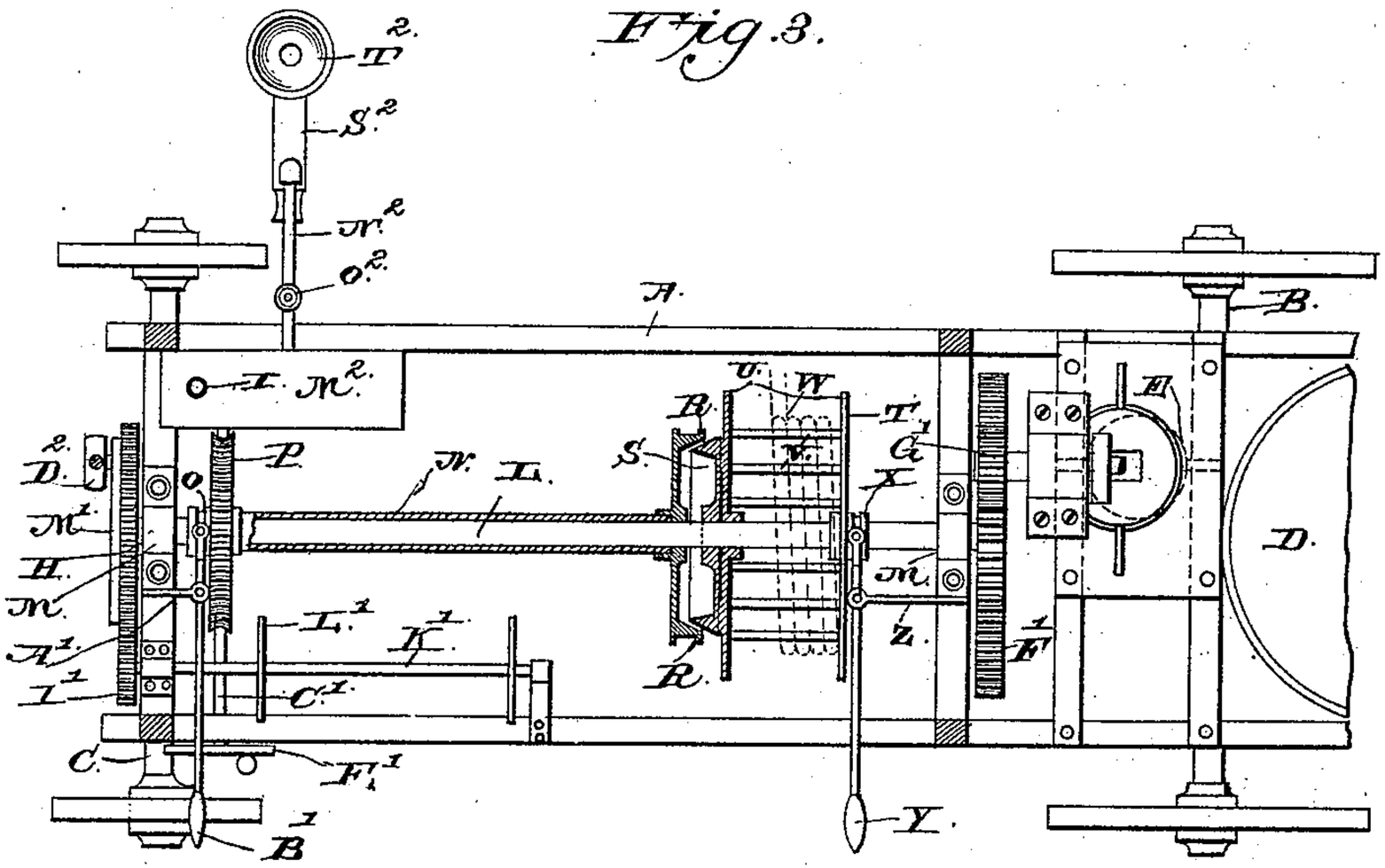


Fig. 5.

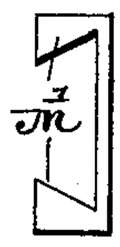


Fig. 7.

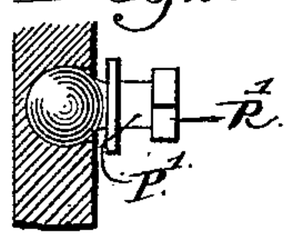


Fig. 6.

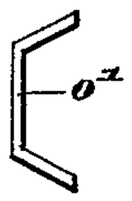
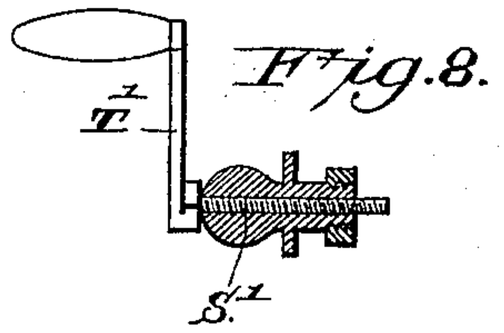


Fig. 8.



Witnesses
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UNITED STATES PATENT OFFICE.

JOHN G. DOWNIE, OF BEAVER FALLS, PENNSYLVANIA, ASSIGNOR TO THE KEYSTONE PORTABLE DRILLER COMPANY, LIMITED, OF SAME PLACE.

PORTABLE DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 441,540, dated November 25, 1890.

Application filed March 13, 1889. Serial No. 303,078. (No model.)

To all whom it may concern:

Be it known that I, JOHN G. DOWNIE, a citizen of the United States, residing at Beaver Falls, in the county of Beaver and State of Pennsylvania, have invented a new and useful Improvement in Portable Drilling-Machines, of which the following is a specification.

My invention relates to an improvement in portable drilling and pipe-driving machines for making water-wells, oil-wells, and prospecting for minerals; and it consists in the peculiar construction and combination of parts, that will be more fully set forth hereinafter, and particularly pointed out in the claims.

In portable drilling-machines as heretofore constructed the shaft carrying the rope-reel has usually been arranged in a plane at right angles to the walking-beam, which latter has usually been placed longitudinally with relation to the frame. The result has been that it has been impossible to use a reel of sufficient length for deep wells, since a reel about four feet long is as long as can be mounted to work well on a portable machine, placing it crosswise in the frame. By my present invention I have so arranged the parts of the mechanism as to place the reel lengthwise in the frame and in the same vertical plane as the walking-beam. By this arrangement I am enabled to use a reel about ten or fifteen feet long, if so desired, and at the same time, the rope, being distant from the axis of the reel equal to the radius of the latter, will not interfere with the operation of the beam, because it passes to one side of the latter in passing from the reel to the guide-sheaves. Another advantage gained by this arrangement of the reel is that in operation the strain, which is often equal to a weight of from five thousand to ten thousand pounds, is equalized upon the frame, while when the reel is placed crosswise the whole strain comes upon the side of the frame, except at the precise point where the rope is being unwound centrally from the reel. Furthermore, by placing the reel and the operating-shaft longitudinally in the center of the frame I am enabled to erect the center of the derrick directly over the center of the frame.

In the accompanying drawings, Figure 1 is a side elevation of a drilling and pipe-driving machine embodying my improvement. Fig. 2 is an end elevation of the same. Fig 3 is a top plan view, partly in section, on the line *x x* of Fig. 1. Fig. 4 is a detail view of the crank-wheel. Figs. 5, 6, 7, and 8 are detail views of parts thereof.

The main frame or platform A is mounted on a rear truck B and on a pivoted truck C, whereby it may be readily drawn from place to place. On the rear end of the frame or platform is mounted a suitable steam-boiler D, and immediately in front of the boiler is a steam-engine E, which is preferably of the vertical oscillating variety.

A frame F rises from the main frame or platform, the upper portion of the said frame being extended to form a derrick G and being hinged to the lower portion of the frame in such manner that it may be folded downward thereon out of the way, as shown. In the front side of the frame F are a pair of vertical guides H, and journaled near the rear upper corner of the derrick is a sheave I. Said derrick-frame is provided on its front side with a pair of vertical guides K, which are in all essential respects similar to the guides H.

A shaft L is arranged longitudinally above the frame or platform A and is journaled in bearings M at the front and rear sides of the frame F. Loosely mounted on the said shaft is a hollow tubular drum N, which is adapted to slide longitudinally and to revolve independently on the shaft. At the front end of the said hollow drum is a collar having the annular peripheral groove O, and rigidly secured to the drum near the said collar is a worm-wheel P. Attached to the inner end of the hollow drum is a disk which is provided with an outwardly-extending lateral annular flange R, the inner side of which has an inclined frictional engaging-surface adapted to form frictional contact with a friction-disk S, which is rigidly keyed to the shaft.

A reel T is loosely mounted on the shaft L on the inner side of the friction-disk S, the said reel comprising a pair of circular heads U and a series of horizontal connecting-bars V, the latter being arranged in the form of a

circle. By this construction the inner side of the reel is open, and thereby the sand-pump rope W, which is coiled on the said reel, and which when in operation is ordinarily water-soaked, will become speedily dried by contact with the air, and thereby the said rope will be preserved from decay.

On the rear side of the reel T is formed a collar having an annular flange X, the said flange being engaged by the bifurcated inner end of a shifting-lever Y, which is fulcrumed to an arm Z, attached to one end of the frame F. The bearing for the outer end of the shaft L has an arm A′, to which is fulcrumed a shifting-lever B′, the inner end of which engages the grooved collar O. By operating the lever B′ the hollow drum may be moved longitudinally on the shaft L and the friction-disk R thereof caused to engage the friction-disk S, and thereby cause the hollow drum to rotate in unison with the shaft. The hand-lever Y is adapted to perform the same office for the reel T by moving the latter into engagement with the opposing plane side of the friction-disk S.

A shaft C′, which is arranged transversely on the frame or platform A and is journaled in suitable bearings, has a central portion provided with a worm D′, which is adapted to engage the worm-wheel P when the drum N is moved out of engagement with the friction-disk S, and thus enable the said drum to be revolved independently of the shaft L. The said shaft C′ has a hand wheel or crank E′ at one end by which it may be rotated.

On the inner end of the shaft L is keyed a spur-wheel F′, which is engaged by a pinion G′ on the crank-shaft of the engine, and thus the shaft L is geared to the engine and is adapted to be continuously rotated thereby when the machine is in operation.

To the outer end of the shaft L is keyed a crank cog-wheel H′, which engages a pinion I′ on a shaft K′, the latter being mounted in suitable bearings in the frame or platform A and being provided with a pair of disks L′, for the purpose to be hereinafter stated. The wheel H′ is provided with a pair of transverse guides or ways M′, and arranged between the said guides or ways in a radial line and in the face or web of the said wheel are a series of adjusting-recesses N′. The said ways or guides M′ have their inner sides dovetailed, and between the same is fitted a dovetailed block O′, which is adapted to be moved from the center to the periphery of the wheel. A crank-pin P′ has its inner end extended through an opening in block O′ and secured to the latter by a clamping-nut R′. The said crank-pin is provided with a longitudinal threaded opening, and in the latter operates a set-screw S′, the same having its outer end provided with a crank T′, whereby it may be rotated, and having its inner end adapted to engage either of the recesses N′, to the end that the block O′, and consequently the crank-pin, may be adjusted to any desired point between the periphery and the center of the wheel H′ and secured to the latter at any desired adjustment. A lever or beam U′ has its inner end pivoted on the spindle or bolt which forms the bearing for the sheave I, the outer end of the said beam extending through and being adapted to play vertically between the guides K. In the outer end of the said beam is mounted a sheave or pulley V′. A beam W′ has its inner end pivoted to the rear side of frame F by means of a bolt or shaft X′, and the front end of the said beam extends through and is adapted to operate vertically between the guides H. On the upper side of the said beam is a longitudinally-adjustable extension-beam Y′, which is secured thereto by means of U-shaped metallic straps Z′. A connecting-rod A^2 has its upper end pivoted on the shaft or spindle of the sheave V′ and has its lower end pivotally connected to the outer end of the beam W′. Hence the beams W′ and U′ are adapted to oscillate in unison. A pitman B^2 has its upper end connected to the outer end of the beam W′ by means of a ball-and-socket joint C^2, and has its lower end connected to the crank-pin P′ by means of a ball-and-socket joint D^2, and consequently the rotary motion of the shaft L, when the pitman is adjusted out of the center of the wheel H′, will cause oscillating motion to be imparted to the beams W′ and U′, and the stroke or limit of the movement of said beams will be proportioned to the distance between the centers of the wheel H′ and of the crank-pin, as is obvious, and thereby a stroke of greater or less extent may be communicated to the beam.

A cable E^2 is attached to the hollow drum N and is adapted to be reeled theron and unwound therefrom and passes over the sheaves I and V′, the pendent end of the said cable being in the well and provided with the usual weight employed for driving the pipe-lining downward in the well or the usual drilling-tools employed in drilling wells. The oscillating motion of the beam U′ causes the said weight or drilling-tools, as the case may be, to be alternately raised and dropped, and the cable may be played out from time to time as the process of sinking the pipe or drilling proceeds by revolving the worm-shaft C′. The said shaft by being geared to the hollow drum N may be also rotated so as to raise the weight attached to the cable. Owing to the fact that the length of the stroke of the beams W′ and U′ may be regulated, the stroke of the weight or drilling-tools attached to the cable may be regulated.

Inasmuch as the drum N, to which the cable rope is attached, remains ordinarily stationary while the drilling or pipe-driving process is being carried out, and the pulley V′, over which the cable passes, is mounted in and caused to play with the beam U′, which operates the driving or drilling tool attached to the cable, it follows that only a minimum de-

gree of friction will be exerted on the cable, and hence the durability of the latter will be very considerably enhanced.

When the well becomes clogged with débris, it is necessary to withdraw the drill attached to the cable, and this is accomplished by operating the handle-lever B′ in such manner as to simultaneously ship the drum N, disconnect its worm-wheel P from the worm D′, and cause its friction-disk R to engage the friction-disk S, revolving with the shaft L continuously, and thereby the rotary motion of the shaft will be imparted to the drum and the cable-rope will be reeled thereon and the drilling-tool elevated. When the drilling-tool has been raised to a suitable height, the operator immediately returns the drum to its former normal position, with its friction-disk out of contact with the friction-disk S and its worm-wheel P in engagement with the worm D′. The latter serves to hold the drum stationary and prevents it from unreeling the cable unless its shaft C′ is turned by hand-power.

It will be apparent from the foregoing description that the drum may be connected to and disconnected from a constantly-revolving shaft L while the engine is at full operation and without the danger of breaking any part of the machine. In the event that any great obstruction should encounter the drilling-tool when the same is being hoisted from the well, the drum N will slip idly on the shaft L, inasmuch as the frictional contact between the disks R and S is not rigid, and thereby injury to the cable will be avoided. The said disks may also be employed as a brake to control the speed with which the drilling-tool is lowered into the well when the drum N is loose on the shaft and the cable is being unreeled therefrom.

The reel T is designed to operate a sand-pump when the drilling-tools have been withdrawn from the well, and when said reel may be caused to rotate with the shaft L to raise the sand-pump by operating the lever Y and causing the reel to engage the friction-disk S, and when said reel is moved from said disk and thus rendered loose on the shaft it will unreel the sand-pump rope and the latter by its own gravity will descend in the well. The friction-disk S, the reel, and the hand-lever Y also form a friction-brake, which may be employed to regulate the speed of the descent.

When it is necessary to use a temper-screw, the extension Y′ is moved outward on the beam W′ until its outer end is directly over the center of the well, and the temper-screw is then attached to the outer end of the said extension. When lowering pipes into the well, the extension Y′ is moved inward, so that it will be out of the way of the pipe when the latter is in a vertical position.

During the process of drilling a well it is necessary to be almost continually sharpening the drilling-tools, as the latter become rapidly worn when operating in rock, and it is desirable to provide a portable forge adapted to travel with the drilling-machine. To this end I mount a cylinder F^2 on the frame or platform A at one end of the frame F, the same being arranged directly under and in vertical alignment with the beam W′. In the cylinder is a piston or plunger G^2, which is connected to and operated by the said beam by means of a pitman H^2. A pipe I^2 extends from the lower end of the cylinder and is provided with a check-valve K^2 and a stop-cock L^2, and said pipe terminates in a tank or reservoir M^2. From the latter projects a pipe N^2, having a stop-cock O^2, and to the said pipe is attached one end of a flexible pipe P^2, and to the opposite end of said flexible pipe is attached a nozzle R^2, which is arranged in a tuyere S^2, the latter having a fire-pot T^2 at its outer end, as shown. An inlet-valve U^2 is also arranged at the lower end of the cylinder. When the beam W′ is in motion, the piston is reciprocated in the cylinder; and at each downstroke of the piston air is forced into the tank M′ and becomes compressed in the latter. By opening the stop-cock O^2 the compressed air from the tank is forced through the nozzle R^2 into the tuyere, and air is sucked in through the latter and forced through the burning fuel in the fire-pot. Thus an efficient forge is constructed, which is an indespensable part of a complete portable machine for the class of work to which the machine is adapted; but the piston-plunger G^2, cylinder F^2, pitman H^2, and inlet-check valve U^2 perform an additional office, as follows: When the beam W′ is in use and at its highest point, it is then relieved of the weight pendent from the cable E^2, and, as no engine-governor can be used on this class of machines, the engine when relieved of its load tends to accelerate the beam W′ on its downward stroke, and, if not resisted, would carry the beam W′ to its lowest point and start it on its upward stroke before the drilling-tools attached to the cable E^2 had expended their force on the rock. Hence when performing the operation of drilling the stop-cock L is closed wholly or in part as the workmen may see proper. On the upstroke of the beam W′ the plunger-piston G^2 draws the cylinder F^2 full of air. The check-valve U^2 then closes, and the yielding resistance of the air in the cylinder F^2 retards the motion of the engine and regulates it to that extent that the beam W′ may not return on the upstroke until the drilling-tool has expended its force on the rock. At this point the resistance of the compressed air in the cylinder F^2, acting on the plunger-piston G^2, assists the engine in raising whatever weight may be attached to the cable E^2. The united force of the engine and the resilience of the compressed air thus produces a differentiated motion of the beam W′ and results in the effect of raising the drill-

ing-tool in less time than it takes it to fall with a constant pressure of steam on the engine.

Since the drilling-tools are attached to a cable and are carried downward by gravitation only, and the motion downward cannot therefore be accelerated, it is obvious that to increase the number of strokes per minute the speed of the upward stroke must be increased beyond that of the downward stroke. This I accomplish in the above described manner, and am able thereby to make from one-third to one-fourth more strokes per minute by reason of the regulating influence of the compressed air in the cylinder, and by allowing a part of the air to escape through the stop-cocks L^2 and O^2 the differentiated movement of the beam W′, and consequently the tool attached to the cable, can be carried on to any desired extent, and thus the same weight of tools and power of machinery made to perform one-third to one-forth more work than without the regulating cylinder and plunger.

Having thus described my invention, I claim—

1. In a portable drilling-machine, the continuously-revolving shaft arranged longitudinally in the frame and having the crank-wheel, the beam U′, arranged longitudinally in the same vertical plane as the shaft pivoted at its inner end and having the sheaves at its inner and outer end, the reel or drum loose on the shaft, means, substantially as set forth, to rotate the drum independently of the shaft, the cable attached to the drum and passed over the sheaves, and connections between the crank-wheel and the beam to oscillate the latter, substantially as described.

2. In a portable drilling-machine, the combination of the continuously-revolving shaft arranged longitudinally in the frame between the sides of the latter, the crank-wheel at the front end of said shaft, the drum loose on the shaft and having the worm-wheel, the worm-shaft engaging the said worm-wheel, the lever to move the drum longitudinally on the shaft, friction devices to lock the drum to the shaft, the longitudinally-arranged beam U′, having the guiding-sheaves, the cable attached to the drum and passing over said sheaves, and connections, as set forth, between the crank-wheel and the beam U′, all arranged and operating substantially as set forth.

3. In a drilling-machine, the combination of an upright frame, a guiding-sheave near the upper rear corner of the same, an oscillating beam U′, mounted upon the axis of said sheave and having a guiding-sheave at its outer end, an oscillating beam W′, arranged below the beam U′, a pivoted rod connecting the outer end of the beams U′ and W′, a main shaft arranged longitudinally in the frame and having a crank-wheel at its front end, a pitman connecting said crank-wheel with the beam W′, a drum mounted loosely upon the main shaft, a drill-rope attached to said drum and passing over the sheaves at the ends of the beam U′, and means for operating the main shaft and the drill-rope drum, substantially as set forth.

4. The combination, in a portable drilling-machine, of the frame mounted upon trucks, the derrick-frame, the oscillating beams U′ W′, arranged longitudinally one above the other in the same vertical plane, the rod connecting the vibratory ends of said beams, the sheaves at the ends of the upper beam U′, the drum or reel arranged longitudinally in the same vertical plane as the beams, the drill-rope passing from the drum direct over the sheaves at the inner and outer ends of the beam U′ and thence to the well, and operating mechanism, substantially as set forth.

5. The combination of the oscillating beam, the continuously-revolving shaft having the crank-wheel, and connections between the latter and the beam, the friction-disk fast on the shaft, the reel and drum loose on the shaft on opposite sides of and both adapted to engage the friction-disk and adapted for the attachment of the cable and sand-pump rope, means to revolve the cable-drum independently of the shaft, and the levers to throw the drum and reel into and out of engagement with the friction-disk, substantially as described.

6. The combination, in a drilling-machine, of the revolving shaft having the crank-wheel, the pivoted oscillating beam W′, the pitman connecting the latter to the crank-wheel, the extension Y′ on the beam W′, the pivoted oscillating beam U′, having the guiding-sheaves at its inner and outer end, and the connecting-rod between said beams, the cable passed over the guiding-sheaves, and the drum for said cable, substantially as described.

7. In a portable drilling-machine, the combination, with the drill-rope, the connecting-rod A^2, the pulley V′, and the oscillating beam W′, pivoted at its inner end extending to a point short of the drill-rope and connected at its outer end with an operating-pitman, of an extension-beam mounted to slide longitudinally upon the said oscillating beam, said extension-beam being normally inactive, but adapted, when necessary, to be moved in an outward direction over the center of the well for the attachment of a temper-screw, substantially as set forth.

8. The combination, with the oscillating beam, of the air-pump operated by the beam and the forge having the air-pipe connected to the air-pump, substantially as described.

9. In a drilling-machine, the bed-frame or platform mounted on wheels, the derrick-frame arranged longitudinally thereon, the longitudinal shaft, the engine and gearing to rotate the latter, the crank-wheel fast to the shaft, the friction-disk also fast on the shaft, the cable-drum and sand-pump rope-reel

loose on the shaft, the said drum having the worm-wheel, the worm-shaft to engage therewith, the levers to throw the drum and reel into and out of engagement with the friction-disk, for the purpose set forth, the oscillating beam W′, pivoted to the derrick-frame, the pitman connecting said beam to the crank-wheel, the extension Y′ on the oscillating beam, adapted to be moved longitudinally thereon, for the purpose set forth, the oscillating beam U′, having the guiding-sheaves at its inner and outer ends, the connecting-rod between said beams, and the cable attached to the cable-drum and passed over the guiding-sheaves, substantially as described.

10. In a portable drilling-machine, the combination, with the frame mounted upon trucks, of the shaft carrying the drill-rope reel and having a crank-wheel at its front end and the walking-beam, said shaft and beam being arranged longitudinally centrally between the sides of the frame and in the same vertical plane, connections between crank-wheel and the walking-beam, and suitable operating mechanism, substantially as and for the purpose set forth.

11. In a well-drilling machine, the combination, with the walking-beam, of an air-compressor having an inlet and outlet provided with check and regulating valves, the piston of said air-compressor being connected with said walking-beam, and a storage-tank for the compressed air, substantially as and for the purpose set forth.

12. The combination, with a well-drilling machine, of an air-compresser operated by the walking-beam, a storage-tank for the compressed air, a forge, and suitable connecting-pipes and check and regulating valves, substantially as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in presence of two witnesses.

JOHN G. DOWNIE.

Witnesses:
ROME REEVES,
ALDEN NEAL.