No. 723,555. PATENTED MAR. 24, 1903.

G. H. SPAULDING.

APPARATUS FOR DRILLING WELLS OR LIKE PURPOSES.

APPLICATION FILED FEB. 24, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

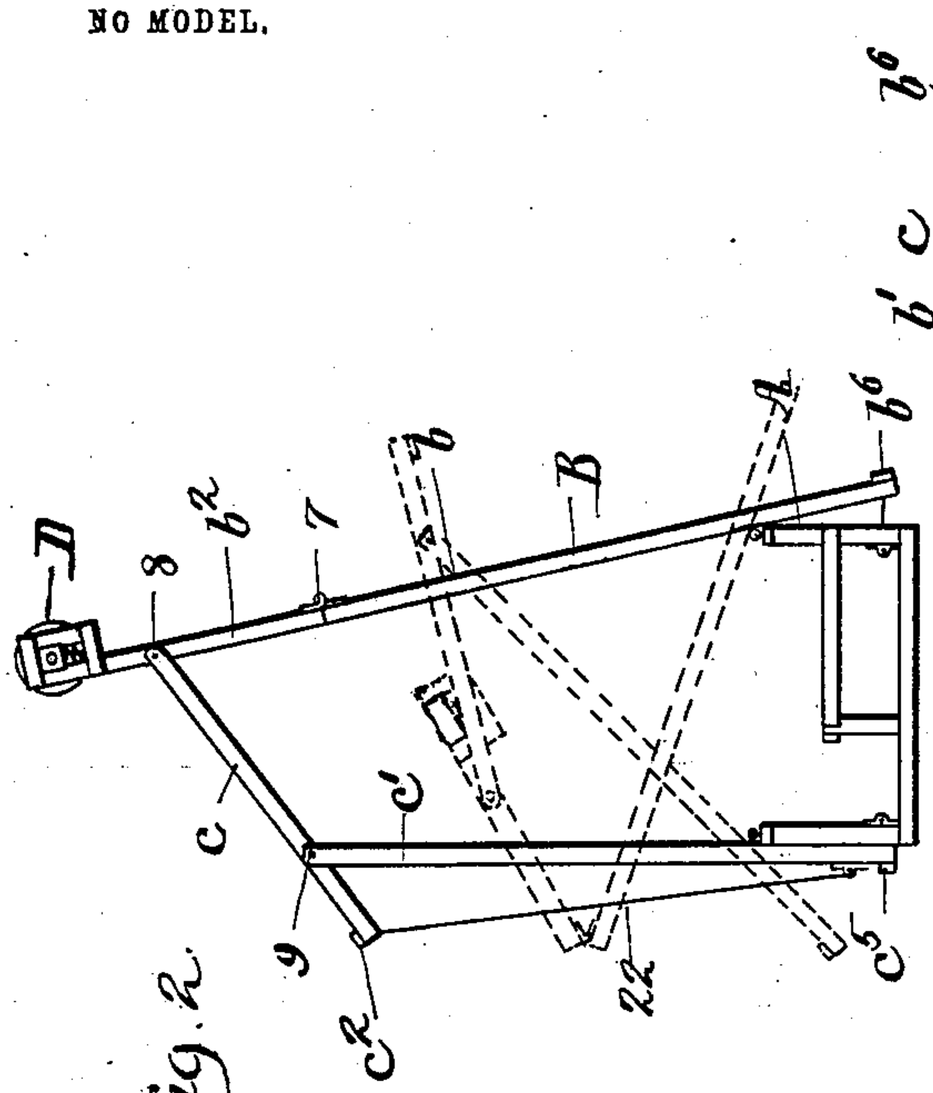

Fig. 2.

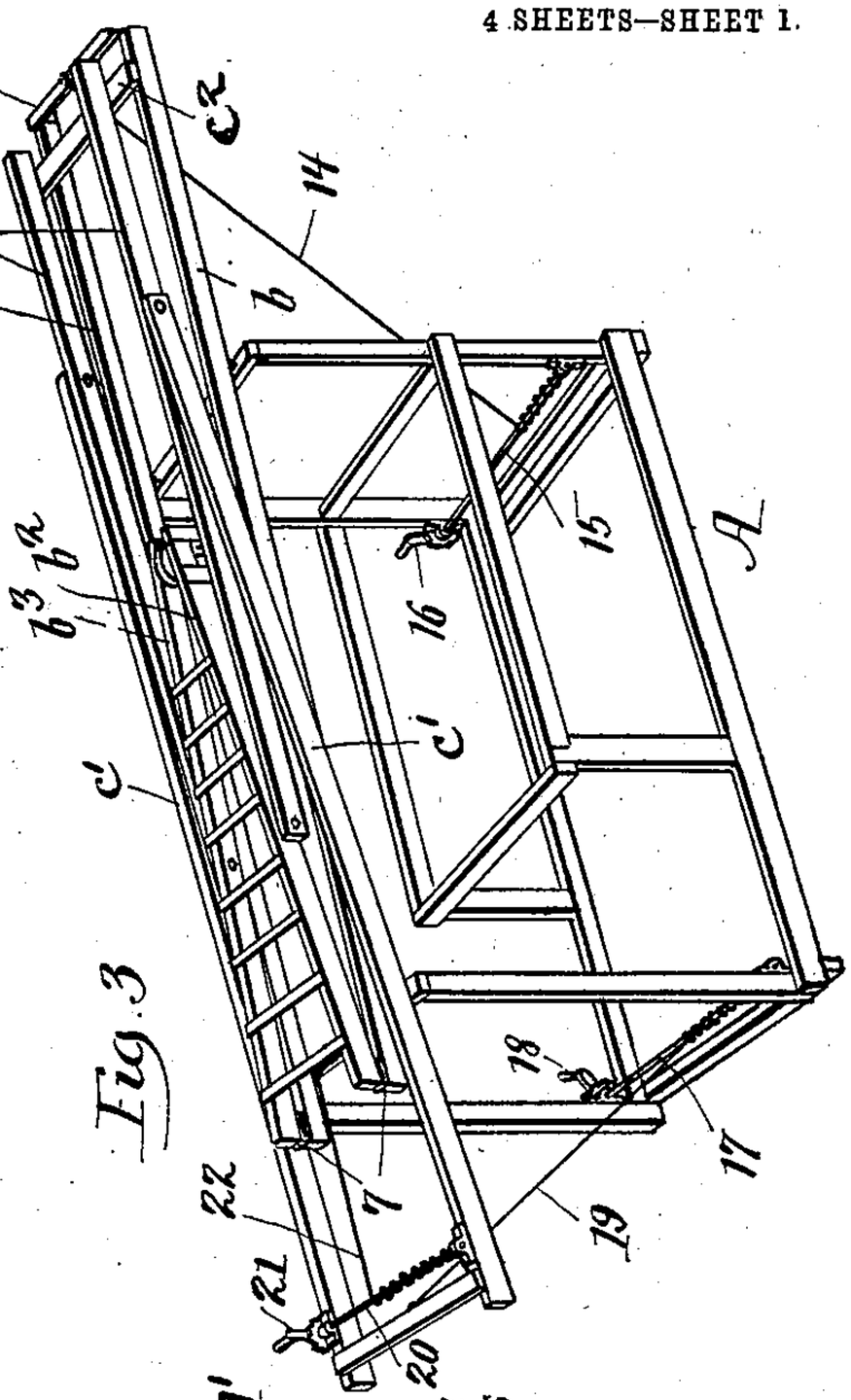

Fig. 3.

Fig. 1.

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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 4

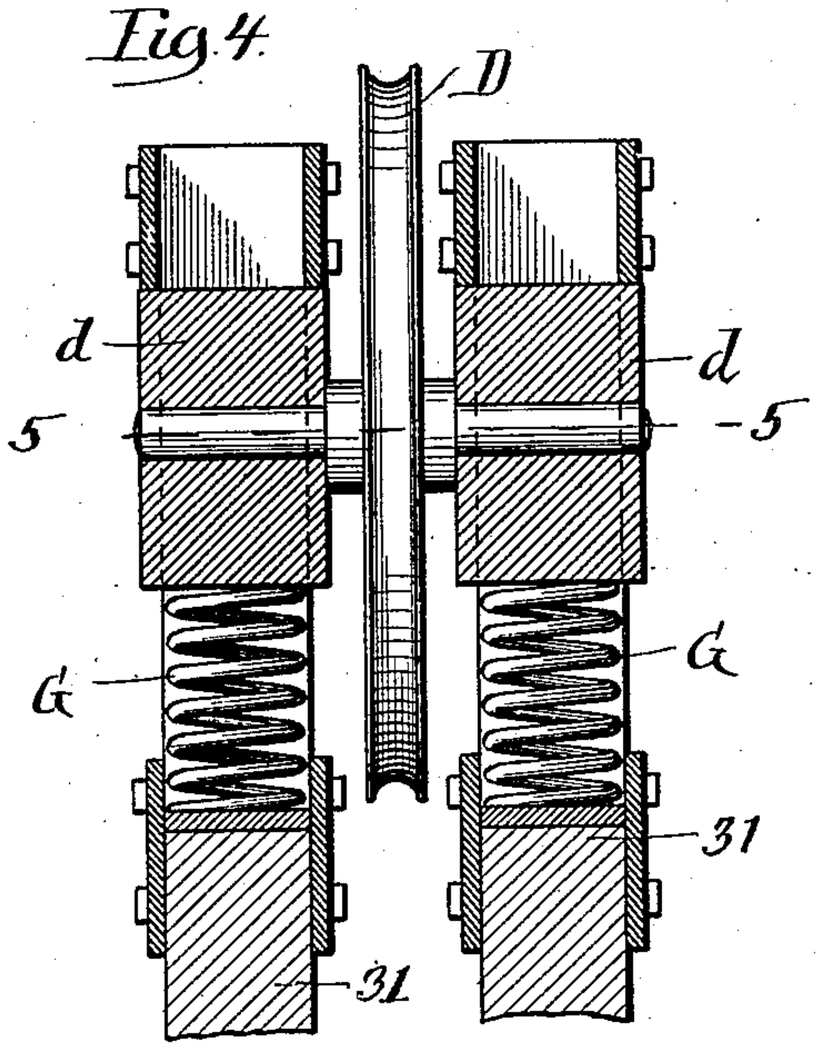

Fig. 5

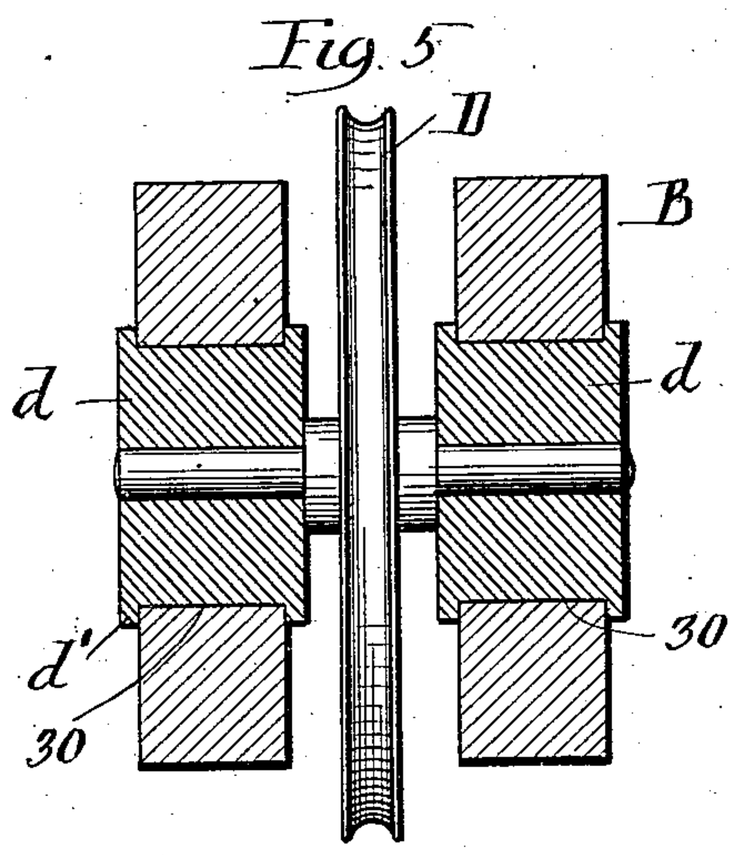

Fig. 6.

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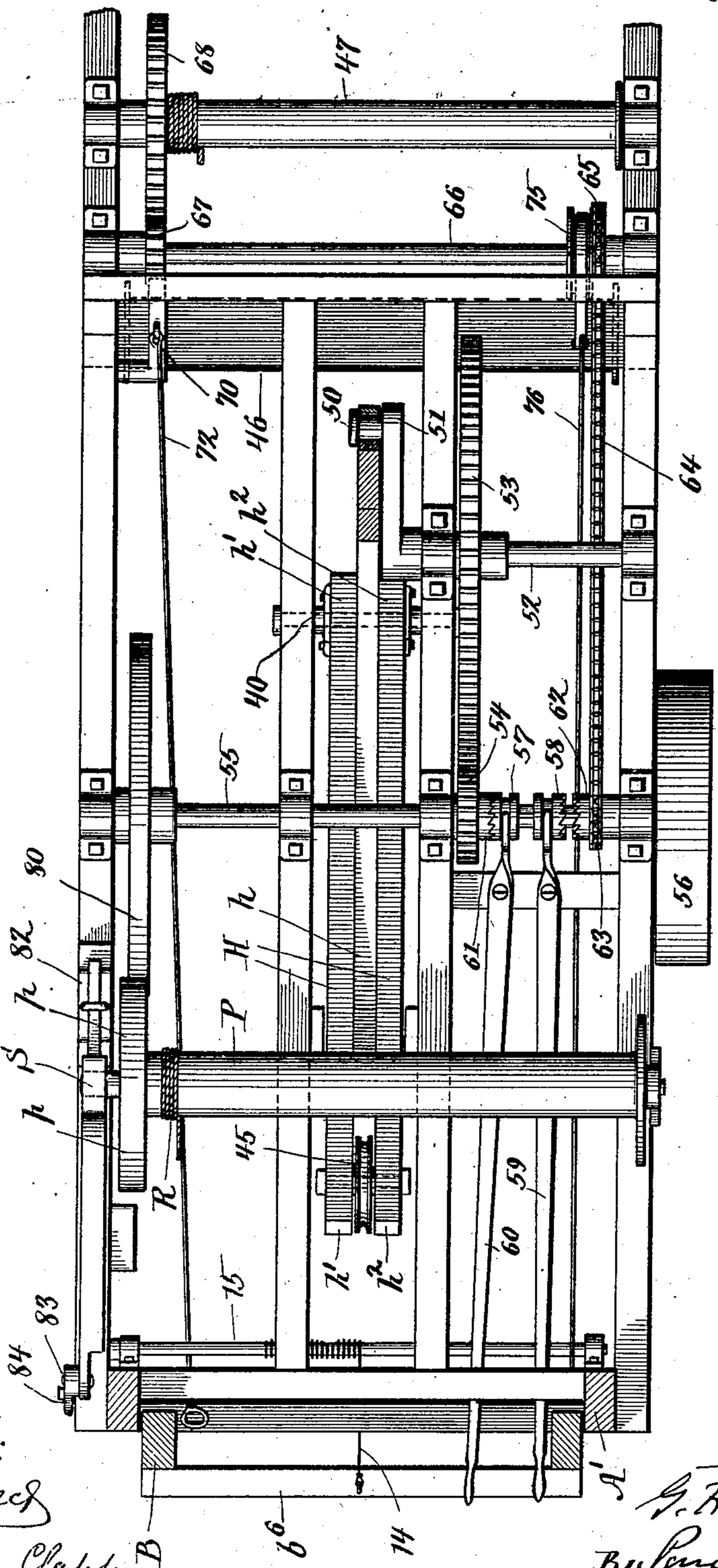
NO MODEL. 4 SHEETS—SHEET 3.

Fig. 7



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NO MODEL. 4 SHEETS—SHEET 4.

Fig. 8.

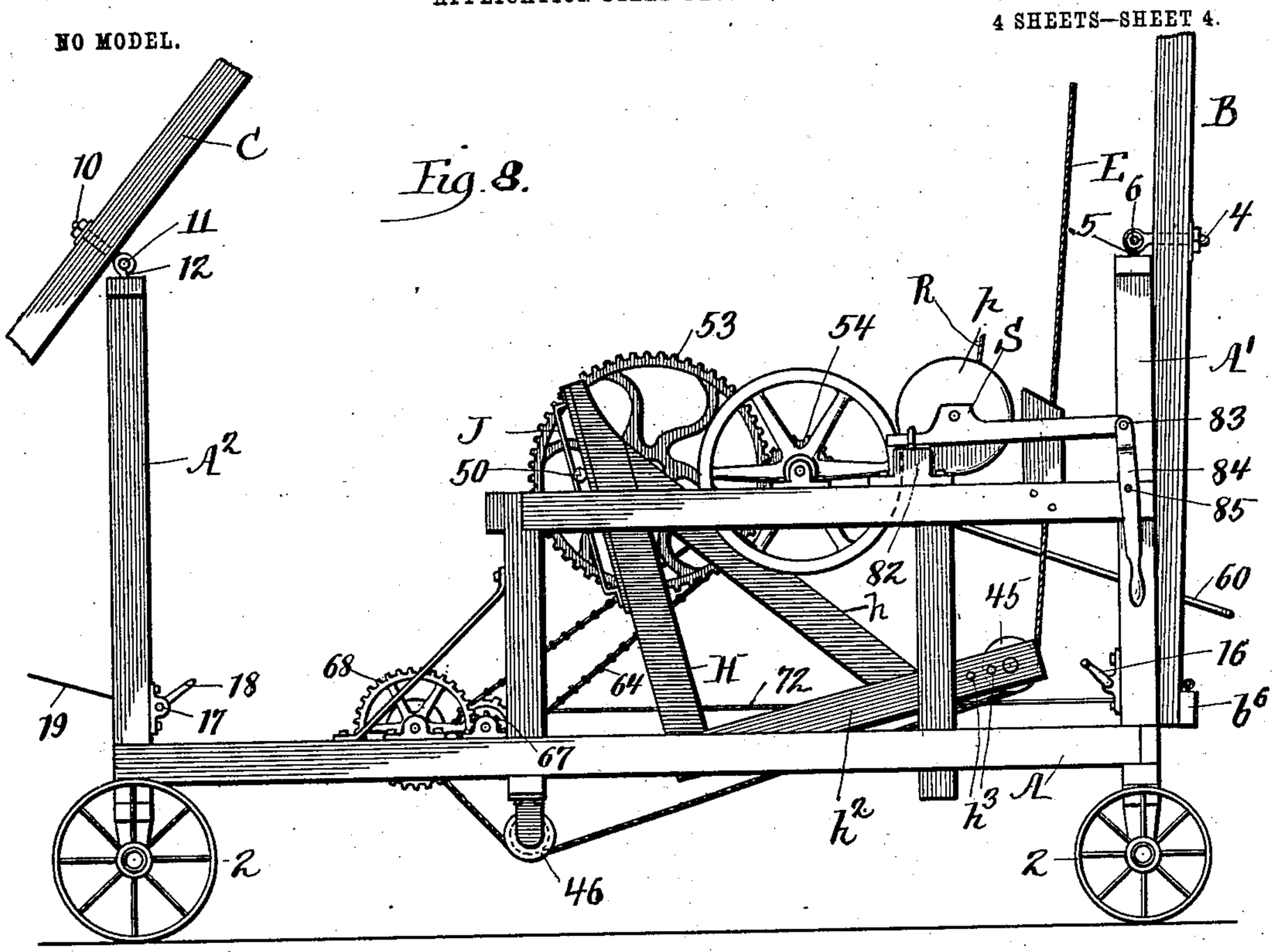
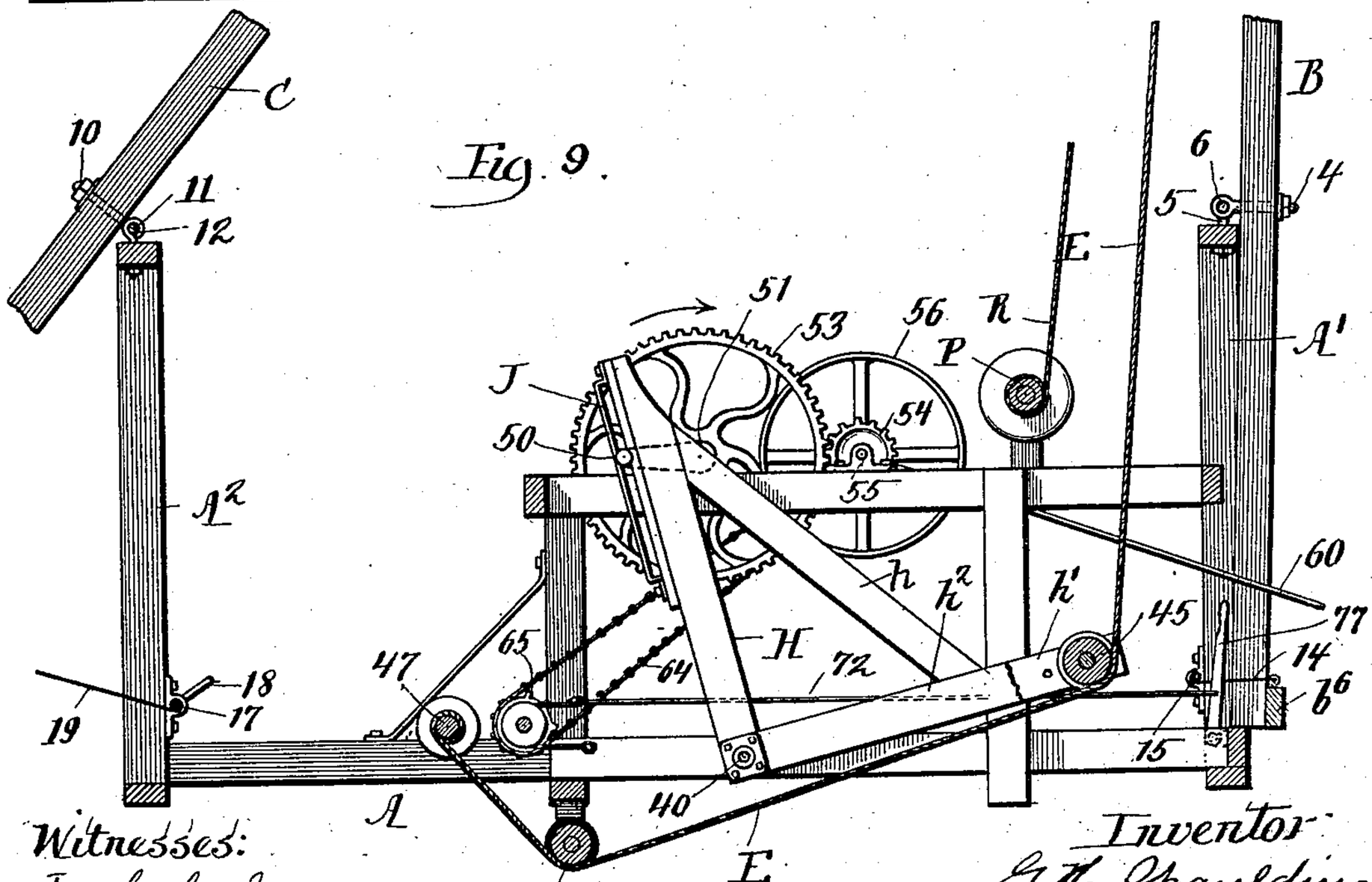


Fig. 9.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DRILLING WELLS OR LIKE PURPOSES.

SPECIFICATION forming part of Letters Patent No. 723,555, dated March 24, 1903.

Application filed February 24, 1902. Serial No. 95,159. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. SPAULDING, a citizen of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Apparatus for Drilling Wells or Like Purposes, of which I do declare the following to be a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

This invention has for its object to provide an improved construction of folding derrick-frame whereby the derrick may be more easily and quickly raised and lowered. This object of the invention I have accomplished by the improvements hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the claims at the end of this specification.

Figure 1 is a perspective view showing the main frame and derrick of a well-drilling machine embodying my invention. Fig. 2 is a view in side elevation of the main frame and derrick, showing the manner of raising and lowering the derrick mast and brace. Fig. 3 is a perspective view of the main frame and derrick with the derrick mast and brace in folded position. Fig. 4 is an enlarged detail view, in vertical section, through the bearings for the spring-supported sheave at the top of the derrick-mast. Fig. 5 is a view in cross-section on line 5 5 of Fig. 4. Fig. 6 is a view in side elevation of the upper portion of the derrick-mast, showing the spring-supported sheave in position. Fig. 7 is a plan view of the machine with the derrick-mast shown in section. Fig. 8 is a view of the machine in side elevation with part of the derrick and with its brace removed. Fig. 9 is a view in longitudinal section through Fig. 8.

A designates the main frame of the machine, that may be mounted in the usual manner upon suitable carrying-wheels 2. At the front of the main frame A rises the rectangular frame A′, whereby is supported the derrick-mast B, and at the rear of the main frame rises a similar rectangular frame or upright A^2, whereby is supported the derrick-brace C. As shown, the derrick-mast B comprises side bars b, b', b^2, and b^3, forming a frame that will be suitably braced throughout its length, and this frame may be provided with the usual ladder-rungs b^4. The derrick-mast B is pivotally mounted at the top of the upright frame A′. The pivoting of the derrick-mast B to the frame A′ may be effected by providing the bars of the derrick with eyebolts 4 and by providing the cross-bar of the frame A′ with eyebolts 5, suitable pivots 6 extending through these several eyebolts. The derrick-mast B is formed of upper and lower sections that are hinged together, as at 7. To the upper section of the derrick-mast B are pivotally connected, as at 8, the upper ends of the bars c, that comprise the upper section of the derrick-brace C, these bars c being hinged or pivoted, as at 9, to the side bars c', that comprise the lower section of the brace. The lower ends of the bars c of the upper brace-section extend some distance beyond the pivoted points 8, and, as shown, these ends are connected by a cross-bar c^2, that projects laterally and is adapted to contact with the lower bars c' of the brace when the brace is in position for use. The derrick-brace C is pivotally mounted upon the top of the vertical frame A^2, and, as shown, this pivotally mounting of the brace is effected by providing the side bars of the brace with eyebolts 10, through which passes a pivot-rod 11, that also passes through eyebolts 12, rising from the top of the frame A^2. To the lower end of the derrick-mast B is connected a cross-bar b^6, to which is fixed one end of a cord or cable 14, which passes around the winding-shaft 15, that is journaled upon the main frame A and is provided at one end with a crank 16, whereby the shaft may be turned. This winding-shaft will be furnished with a ratchet-wheel that will be engaged by a check-pawl to hold the shaft in position. A similar shaft 17, having a crank 18 at one end, is journaled upon the rear portion of the frame A, and from this shaft 17 passes a cord or cable 19, that is connected to a cross-bar c^5 at the lower end of the brace C. The shaft 17 will be provided with a ratchet-wheel and check-pawl similarly to the shaft 15. Across the lower end of the brace C extends a winding-shaft 20, provided with a crank-handle 21, and from the shaft 20 extends upwardly a cord or

cable 22, that is connected to the cross-bar c^2 at the lower end of the upper section of the brace. The winding-shaft 20 will be furnished with a ratchet-wheel and check-pawl to limit its movement.

From the construction of parts as thus far defined it will be seen that when the machine is to be used for drilling wells or like purposes the derrick and brace will occupy the relative positions shown by full lines in Fig. 1 of the drawings. If now it is desired to fold the derrick and brace, one of the attendants will turn the shaft 17 so as to wind the cord or cable 19 thereon, thus drawing backwardly the upper portion of the brace C, and at the same time the other attendant will turn the shaft 15 so as to allow the cord 14 sufficient slack to permit the derrick-mast B to swing rearwardly. The shaft 20 will be allowed to turn freely to pay out the cord 22, so as to permit the upper section of the brace to turn freely. Having wound the cord 19 upon the shaft 17 until the lower end of the brace C is brought against the upright frame A^2, as shown in Fig. 2, the attendant will then slacken the cord 14, so as to permit the lower hinge-section of the derrick-mast B to pass between the side bars of the lower section of the brace C. As the derrick-mast B thus swings downwardly its upper portion will turn about the hinge or pivot point and will fold rearwardly and downwardly, drawing with it the upper end of the top section of the brace C. After the derrick-sections B have been turned to the position shown by dotted lines in Fig. 2 the attendant will slacken the cord or cable 19, so as to permit the lower section of the brace C to turn about the pivot-rod 11 and swing forwardly and downwardly onto the top of the machine, as shown in Fig. 3. When it is desired to raise the derrick mast and brace to operative position from the position last described, one attendant will turn the shaft 17 to wind thereon the cord or cable 19, thereby first bringing the lower section of the brace C to vertical position, after which the shafts 15 and 20 will be turned so as to wind thereon, respectively, the cords or cables 14 and 22 until the derrick-mast B and the section of the brace are brought to the position shown by full lines in Fig. 1 of the drawings, it being understood, however, that as the cords or cables 14 and 22 are thus wound the cord or cable 19 will be slackened, so as to permit the brace C to pass from the vertical to the incline position.

I am aware that various kinds of folding derricks have been heretofore proposed; but none of these prior structures afforded so simple and effective a means whereby the derrick could be raised and lowered by the attendants without the necessity of their leaving the ground, either in raising the derrick or in securing the parts together in operative position.

At the top of the derrick-mast B is placed a drill-rope sheave D, over which passes a drill-rope E, to the free end of which the drill-tools will be connected. The drill-rope sheave has its axle mounted in vertically-movable blocks or bearings d, that are held in manner free to move in vertical direction within guideways 30 at the top of the derrick. Preferably the blocks d are formed with guide-flanges d', that straddle the rails comprising the guideways 30. At the base of the guideways 30 are fixed the blocks 31, upon which are supported the coiled springs G, the upper ends of these springs bearing against and serving to support the journal-blocks d. The springs G are of such power as to normally hold the sheave D in the raised position seen in the drawings when the weight of the drill-tools is upon the sheave.

In drilling wells it is highly important that the drill-tools shall be maintained in a vertical line at the time the stroke is made, since otherwise there is a tendency of the drill-point to be deflected, thereby causing the drill to be broken or the hole to proceed out of true line. In most if not all of the drilling-machines now upon the market the drill-rope is a Manila or like fibrous rope, in which there is more or less elasticity, and the length of the rope between the winding-drum and the drill is such that the rope will become taut slightly before the drill completes its drop. Hence the drill in completing its drop stretches or strains the rope, and consequently keeps the drill in true vertical line. There are, however, serious objections to the use of a Manila or like fibrous rope, particularly for the reason that under the severe strain to which it is subjected it speedily wears out. Various attempts have heretofore been made to use a wire drill-rope; but so far as I am aware these attempts have been unsuccessful, because the wire rope has substantially no elasticity, and consequently if the length of the rope were such as to cause it to become taut before the drill-point made its impact, inasmuch as the wire rope would not stretch, the weight of the drill-tools at the end of the drop would come upon the rope instead of on the rock or earth to be drilled. On the other hand, if the wire rope were sufficiently long to permit the point of the drill to strike the rock or earth there would be a certain amount of slack in the rope and the drill would not be held in true vertical line at the instant that the drill made its stroke. With a spring-supported sheave for the drill-rope this rope may be made of wire, because if the amount of rope between the winding-drum and the drill-tools be such that the rope will become taut just before the drill makes its impact upon the rock or earth then the momentum of the dropping drill-tools will cause the sheave to descend slightly, and thus produce sufficient strain upon the wire rope to hold the drill in true vertical line, while at the same time allowing it to complete its descent. Various attempts

have heretofore been made to provide a spring-supported sheave for the drill-rope; but in every instance such sheave and its spring-support have been mounted so as to move bodily for the purpose of exerting the power upon the drill-rope necessary to lift the drilling-tools. In other words, the spring-support for the drill-rope sheave has been interposed between the drill-operating power and the sheave. The result of such construction has been that in lifting the sheave in order to cause the drill-tools to be raised the sheave-supporting spring has been necessarily compressed, and on the downstroke of the lifting mechanism the expansion of the spring has served to seriously retard the drop of the tools. With my present construction, on the contrary, the sheave-supporting spring is not materially compressed in the operation of drawing the drill-rope to lift the drill, and consequently the spring only comes into action when the rope has been released to drop the drill and when the weight of the drill-tools at the end of the drop comes severely upon the sheave.

For the operation of the drill the mechanism next to be described is preferably employed. Upon the main frame A is pivotally mounted, as at 40, a walking-beam H. This walking-beam is formed of two sections arranged at an angle to each other and connected together, the free ends of the walking-beam sections being united by a brace-bar *h*. Preferably the lower section of the walking-beam consists of two bars *h'* and *h*², and in the free ends of these bars is journaled a pulley 45, around which passes the drill-rope E. This drill-rope E is also shown as passing around a roller 46 and thence onto a winding-drum 47, that is journaled upon a shaft extending transversely of the main frame. The pulley 45 is adjustably mounted upon the lower section of the walking-beam in order that it may be moved toward and from the fulcrum or pivotal point of the beam. Preferably this adjustment of the pulley 45 is effected by forming the bars *h'* and *h*² with a plurality of holes *h*³, adapted to receive the journal of the pulley 45. The upper section of the walking-beam is provided upon its outer edge with a guideway J for the crank-pin 50, that projects from the end of a crank 51 on a shaft 52, that is journaled at the top of the main frame A. As shown, the shaft 52 has fixed thereto a gear-wheel 53, that meshes with a pinion 54, loosely mounted upon a main drive-shaft 55, extending transversely of the main frame and carrying at its outer end a pulley 56, that will be driven by the engine of the machine. As shown, the shaft 55 has keyed thereto the clutch members 57 and 58, these clutch members being movable lengthwise of the shaft and being controlled by clutch-levers 59 and 60 in manner well understood by those familiar with this class of apparatus. The clutch member 57 is adapted to engage with the corresponding clutch member 61 on the hub of the pinion 54, while the clutch member 58 is adapted to engage with a corresponding clutch member 62 on the hub of a sprocket-wheel 63, that is loosely mounted on a shaft 55. The sprocket-wheel 63 is connected by a chain 64 to the sprocket-wheel 65, that is keyed to a shaft 66, extending transversely of the main frame at its base, and at its opposite end the shaft 66 is provided with a pinion 67, that meshes with a gear-wheel 68, fixed to the drill-rope-winding drum 47, extending transversely of the main frame. A check dog or pawl 70, pivoted to the main frame, as at 71, is adapted to engage with the teeth of the pinion 67, and from this dog 70 leads a cord or wire 72 to the front of the machine, where it is within convenient reach of the attendant. The shaft 66 is shown as provided with a friction-pulley 75, over which passes a brake band or wire 76, one end of this wire being fixed at a point below the shaft, while its opposite end extends to the front of the machine, where it is connected to a pivoted brake-lever 77.

On the top of the main frame A is mounted a winding-shaft P, adapted to have wound thereon a bucket-rope R, to the free end of which a suitable bucket will be connected. The bucket-rope R passes over a pulley journaled in the upper part of the derrick-mast B. One end of the bucket-rope shaft P is provided with a friction-wheel adapted to be thrown into frictional contact with a fly-wheel 80 on the drive-shaft 55. The journal of the bucket-rope shaft P, adjacent the friction-wheel *p*, is mounted upon a sliding bearing S, one end of this bearing resting upon a block 82 at the top of the main frame, while the opposite end of the bearing S is pivotally connected, as at 83, to the upper end of a hand-lever 84, that is pivoted, as at 85, to the main frame. The opposite journal of the bucket-rope shaft P is yieldingly supported in any convenient manner to permit the bodily movement of the friction-pulley *p*. By shifting the shaft P by means of the hand-lever 84 the friction-pulley can be brought to bear against the rim of the fly-wheel 80, and the bucket-rope R can be wound so as to lift the bucket from the well after it has been lowered therein.

From the foregoing description the operation of the parts will be seen to be as follows: The attendant at the front of the machine will shift the clutch-lever 60 so as to throw the clutch member 57 into engagement with the clutch member 61, thereby causing the pinion 54 and gear-wheel 53 to be driven from the main drive-shaft 55. Revolution being thus imparted to the crank-shaft 52, the walking-beam H will be rocked about its pivot-point or fulcrum in the direction of the arrow in Fig. 9, and the power of the walking-beam will be exerted upon the drill-rope by the pulley 45, thereby drawing downward the drill-rope and lifting the drilling-tools. By reference to Fig. 9 of the drawings it will be

seen that as the drill-rope is thus drawn downward the wrist-pin 50 is exerting its power mainly through the brace *h* of the walking-beam. During a revolution of the crank-shaft around the lower part of its stroke the wrist-pin 50, by engaging with the back portion of the guideway J, will reversely rock the walking-beam H, so as to permit the drilling-tools to drop, and the lower section of the walking-beam completes its upper movement as the wrist-pin moves upward in the guideway J. The rearward bodily movement of the guideway J incident to the swinging of the walking-beam allows the wrist-pin to move upward at such time with a freedom of movement that permits practically of a free drop to the drilling-tools. It will be observed that wrist-pin 50 exerts its force upon the upper portion of the walking-beam in the act of lifting the drill-tools and while so doing traverses considerably more than one-half the circle described by it. Hence the greatest power will be applied at comparatively slow speed during the lifting of the drill-tools, while a quick drop of the tools is effected during the time that the wrist-pin is traversing the lower part of the circle that it describes. A further advantage incident to forming a walking-beam of sections arranged at substantially right angles to each other is that it enables a much more compact arrangement of the apparatus than would otherwise be possible. By shifting the pulley 45 to different positions in the lower end of the walking-beam the stroke of the drilling-tools may be varied as desired and the power can be correspondingly increased or diminished.

It is manifest that the details of structure above set forth may be varied by the skilled mechanic without departing from the spirit of invention and that features of the invention may be employed without its adoption as an entirety.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In apparatus of the character described, a folding derrick comprising a main frame, a derrick-mast formed of upper and lower sections hinged together above the main frame, the lower section of said derrick-mast being pivotally connected to the main frame, a brace formed of hinged sections also pivoted to the main frame and to the derrick-mast, and suitable lifting cords or cables.

2. In apparatus of the character described, a folding derrick comprising a derrick-mast formed of upper and lower sections pivoted together above the main frame, the lower section being pivoted a distance from the lower end to the main frame, a brace formed of upper and lower sections pivoted together, the lower section of said brace being pivoted at a distance from its lower end to the main frame and the upper section of said brace being pivoted to the derrick-mast, and suitable lifting cords or cables connected to the lower ends of the derrick mast and brace.

3. In apparatus of the character described, a folding derrick comprising a derrick-mast formed of upper and lower sections hinged together above the main frame, the lower section being pivoted to the main frame, a brace pivoted to said derrick-mast and formed of upper and lower sections hinged together, the upper section of said brace being pivoted to the lower section intermediate the ends of said upper section and suitable lifting cords or cables connected to the lower end of the upper section of the brace and to said derrick-mast.

4. In apparatus of the character described, a folding derrick comprising a derrick-mast formed of upper and lower sections hinged together, the lower section being pivoted at a distance from its lower end to the main frame, a brace pivoted to said derrick-mast and formed of upper and lower sections, the upper section of said brace being pivoted to the lower section at a distance from the end of said upper section, and the lower section of said brace being pivoted at a distance from its lower end to the main frame, and lifting cords or cables connected to the lower ends of the derrick-mast and of the upper and lower sections of said brace.

5. In apparatus of the character described, a folding derrick comprising a derrick-mast formed of upper and lower hinged sections, said lower section of the derrick-mast being pivoted to the main frame at a distance from the lower end of said lower section, a brace formed of upper and lower sections pivoted together, the upper section of the brace being pivoted to the derrick-mast and the lower section of said brace being pivoted to the main frame, the lower section of said brace extending downwardly a distance below its point of connection to the main frame, a winding-shaft mounted upon the main frame and connected by a cord or cable with the lower section of the brace and a winding-shaft mounted upon the main frame and connected with the derrick-mast.

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