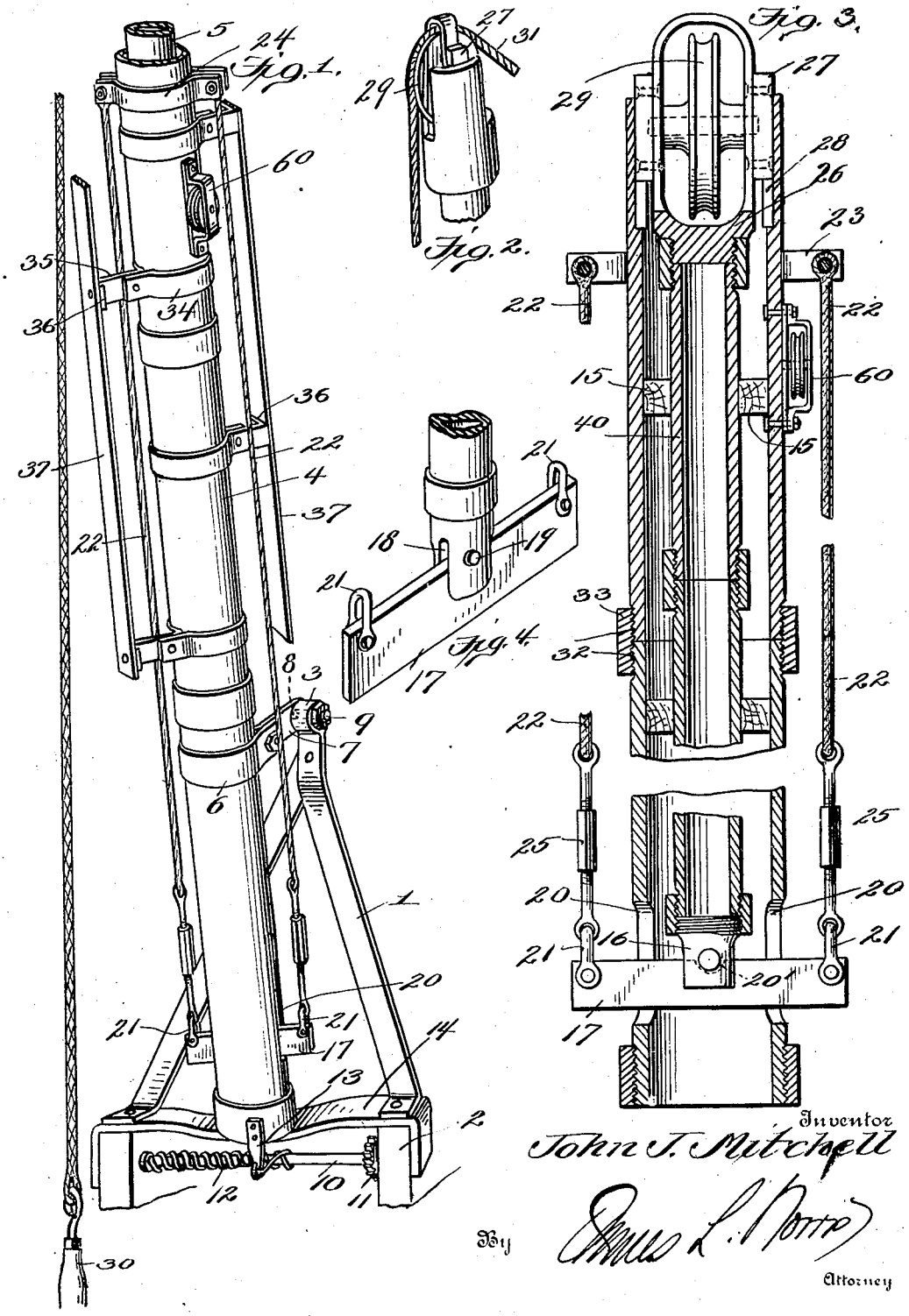
March 18, 1930. J. J. MITCHELL 1,751,348

TUBULAR DERRICK

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TUBULAR DERRICK

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Fig. 5.

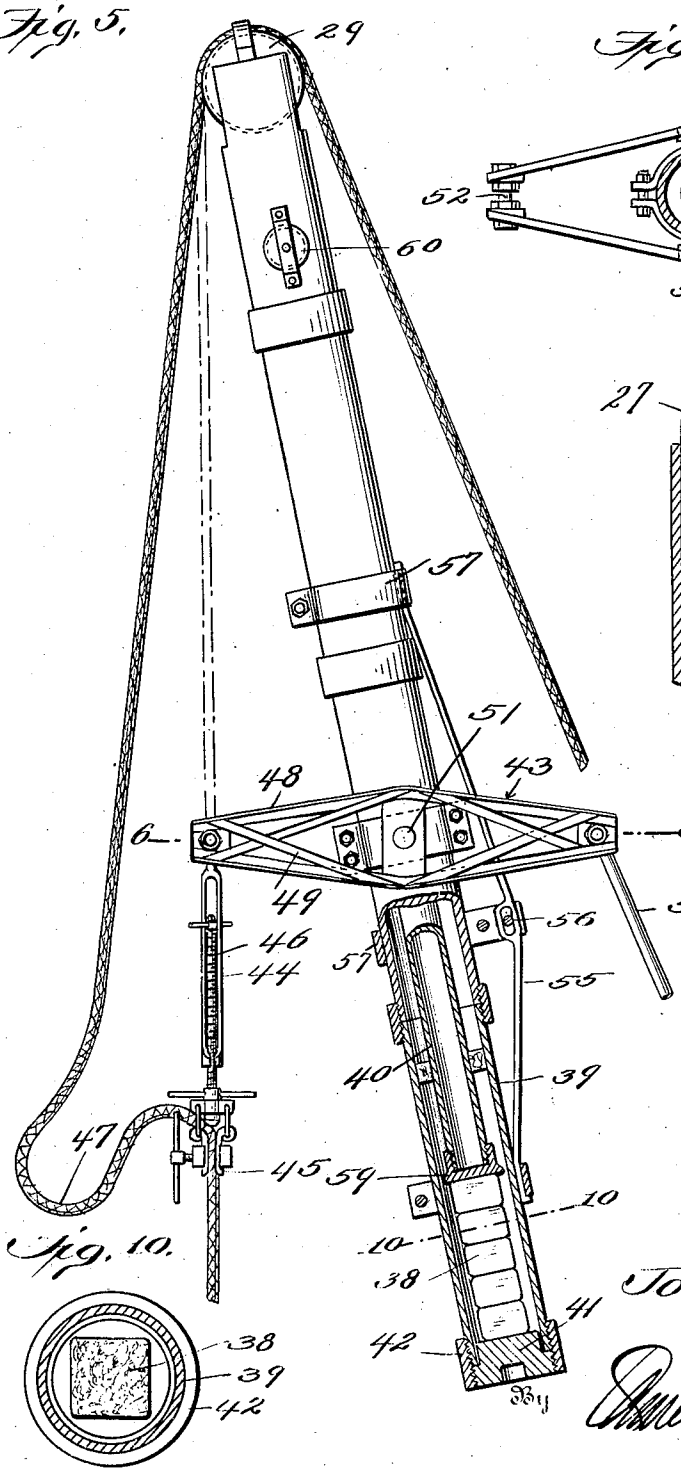


Fig. 6.

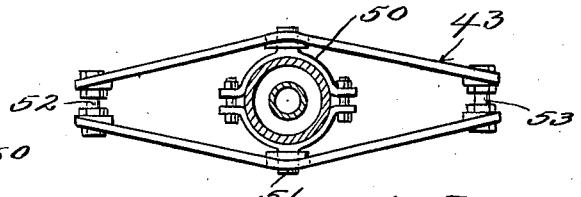


Fig. 7.

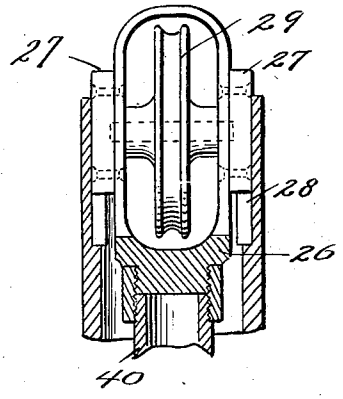


Fig. 8.

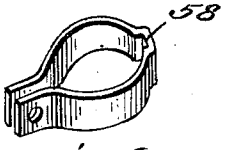


Fig. 9.

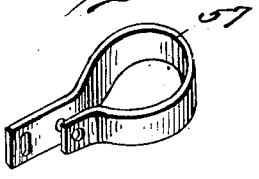


Fig. 10.

Inventor
John J. Mitchell
By
James L. Norris
Attorney

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UNITED STATES PATENT OFFICE

JOHN J. MITCHELL, OF PETERSBURG, VIRGINIA

TUBULAR DERRICK

Application filed February 9, 1924. Serial No. 691,860.

This invention relates to tubular derricks for well drilling machines and has for its object the provision of a knock-down construction of the type designated, which can be reduced to units of suitable size for shipment, and readily reconstructed or set up at the place of destination without especially skilled labor and with minimum expenditure of time.

The invention may be practiced, in its broadest application, with jerk-lines of any character whatsoever, both fiber and wire cables, but in its more specific adaptation the use of a wire cable jerk-line is contemplated.

Wire cables have the advantage of longevity and cheapness, but, notwithstanding, the fiber cable is considered superior to the wire cable in that it stretches, permitting the tool to fall with comparatively unimpeded momentum, and then by contracting, it deadens the rebound of the tool. Wire cable on the other hand, being unyielding, acts as a drag to the free descent of the tool and also communicates the shock of the impact of the tool to the mechanism of the derrick.

In order to get the benefit of the advantages of both wire and fiber cables, I have incorporated a resilient section into the jerk-line in both embodiments of my invention herein illustrated, between the fixed part of the derrick and the tool, using said section preferably in combination with a wire cable jerk-line, although it is to be understood that the invention is in no wise invalidated if fiber rope jerk-lines are used.

In the drawings:—

Figure 1 is a perspective view of my improved derrick, the top being broken away.

Figure 2 is a perspective view of the top of the derrick.

Figure 3 is a longitudinal section through the derrick.

Figure 4 is a perspective view showing details of the cross head.

Figure 5 is a side elevation partly in section through a modified form of my improved derrick.

Figure 6 is a cross section taken along the line 6—6 of Figure 5.

Figure 7 is a section through the upper end of the derrick.

Figures 8 and 9 are perspective views of the clamps used respectively in fastening the tie rod in place and pivotally supporting the derrick.

Figure 10 is a cross section taken along the line 10—10 of Figure 5.

Referring now in detail to the several figures, the numeral 1 represents a frame which is adapted to be carried by any suitable form of vehicle, not shown, said frame being suitably anchored to sleepers 2 and having at some desirable point an eye 3 forming a bearing for the pivotal connection of the boom. Said boom, which constitutes the derrick proper, consists of telescopic tubular sections 4 and 5. The lower section 4 is pivotally connected to the frame 1 by means of a clamp 6 embracing said section and having an extending lug 7 formed with an elliptical slot 8 to receive the pivot bolt 9. By virtue of this pivotal connection the boom is capable of assuming any position from a horizontal position across the vehicle, when being transported by the latter, to inclined position beyond the vertical.

Hoisting of the boom is accomplished by means of a drum shaft 10 suitably operated through a gear 11 for winding a cord or cable 12 one end of which is attached to the lower end of the boom by any desirable means such as the snap 13. Starting with the boom in a horizontal position the shaft 10 is rotated winding up the cable 12 until the boom assumes its normal inclined position, as shown in Figure 1 at which point the lower end thereof rests upon the cross member 14.

The inner section 5 of the boom is preferably made somewhat smaller than the outer section being slidable within annular spacing members 15 the latter being made of wood or any other suitable material. In the present instance they are held in fixed position within the outer section by a friction fit. The lower end of the section 5 is furnished with a cap 16, preferably detachable, which rests upon the cross-head 17, the latter bearing the weight of the boom. The invention is not limited to any specific form of cap but

the one here shown is quite practical being provided with a slot 18 embracing the cross-head and having a pin 19 intersecting said slot and bearing in a suitable notch 20′ in the cross-head.

The cross-head 17 passes through slots 20 in the section 4 of the boom and extends therebeyond, being provided with links 21 for connecting it with supporting cables 22, said cables running longitudinally along opposite sides of the boom. The cables 22 are suitably suspended at their upper ends from the oppositely extended lugs 23 of a clamp 24, and their length is such that the weight of the inner section 5 is carried by the cross-head clear of the bottom of the slots 20. Said cables are made of elastic material, preferably fibrous rope, so that they possess a certain degree of elastic elongation. In the event that they should stretch excessively in use so as to cause the cross-head 17 to engage the bottom of the slots 20, the turn-buckles 25 are provided whereby the effective length of said cable may be diminished, or should the necessity arise, be increased. The slots 20 are made sufficiently long to include the normal elastic range of said cables.

A detachable sheave harp 26 is provided at the top of the inner section 5, said harp necessarily partaking of the reciprocatory movement of the section 5 due to the stretching and contracting of the cables 22 in use. The sides of said harp are therefore provided with guides 27, suitably attached, which operate in guideways 28 the range of movements of said guides in said guideways being the same as that of the cross-head 17 in the slots 20. The sheave 29 is journalled in suitable bearings in the sides of the sheave harp. The jerk-line, which is preferably of wire, passes over the sheave 29 one limb 31 of said jerk-line being anchored to a drum, not shown, on the drilling machine and the other end being secured to the tool 30. When the limb 31 of the jerk-line is released the tool descends to the limit of the inelastic wire cable, the momentum of said tool being then continued through the elasticity of the cables 22 which permit descent of the sheave 29. Upon rebound of the tool the thrust communicated to the wire cable causes the weight of the tool and wire cable to be momentarily taken off of the sheave 29 permitting it to rise to normal position, the shock which would otherwise be communicated to the machine being absorbed by the contraction of the cables 22. Additional means for lessening the transmitted shock is provided in the elliptical form of the slot 8 forming the pivotal connection between the boom and the fixed part of the machine, said slot providing lost motion between the boom and pivot pin when the former is in operative position.

It often happens in deep wells where the drilling operation is carried on through a fiber cable that the range of elasticity is so great as to materially shorten the stroke of the tool as well as to lengthen the periodicity of the strokes, additional time being required for the contraction of the rope after the normal rebound of the tool. By the present device I have provided an elastic link the elastic range of which is fixed regardless of the depth of the well being drilled.

It will be observed that both the inner and outer sections of the boom are constructed of conveniently short sections of tubular stock, threaded at the ends as shown at 32 said ends being held together by threaded coupling rings 33. The sheave harp and cap 16 are also preferably secured by similar couplings.

A ladder is provided for convenience in climbing the boom for the making of repairs or other purposes, said ladder being constructed of clamps 34 surrounding the outer section and having outwardly extending lugs 35 arranged in alternation on opposite sides of the boom, as shown in Figure 1, said lugs being formed with means, for example the angularly bent ends 36, to which the side strips 37 may be secured, the lugs acting as steps and the side strips as hand holds to be grasped in climbing the ladder.

The form shown in Figure 5 differs from the above described embodiment essentially in that the flexible fiber cables have been dispensed with and a resilient block or column of blocks 38 substituted therefor, said blocks being positioned within the lower end of the outer section 39 and directly supporting the inner section 40. The latter carries at its lower end a detachable base cap 59 engaging the resilient column. For convenience in assembling the resilient blocks a removable cap 41 has been provided at the lower end of the boom, said cap embracing the knock-down feature of the former described modification in that it is detachably connected to the lower end of the outer section by a threaded coupling 42. When the boom is in a horizontal position the cap 41 may be removed and one or more of the resilient blocks 38 taken away from the column or added thereto as the exigencies of use may require. Said blocks are preferably made from rubber and are appreciably smaller than the bore of the outer section in which they are housed, to give them full freedom in expanding.

The operation of the resilient blocks or column of blocks is to contract and shorten, allowing the upper end of the inner section to descend when the tool falls, thus permitting the free exercise of the momentum of the tool against the material to be drilled. And upon rebound of the material, the weight being momentarily lifted from the upper end of the boom, the blocks are relieved in part from their load permitting them to

expand, thereby restoring the resilient column to its original height.

While it is perfectly feasible to substitute a column of resilient blocks for the fiber cable arrangement shown in the first described modification of the invention, I have here chosen to illustrate the present form of the invention in connection with a walking beam 43 which is detachably clamped to the outer section of the derrick at an intermediate point. This walking beam is intended for alternative use with respect to the sheave at the upper end of the inner section. It is well known that for relatively shallow wells, that is to say, wells several feet deep, the resilient support for the inner section is most advantageous, for the purpose set forth in the previous description. But for wells, of relative great depth it has been found that there is sufficient resiliency in the wire cable to obtain all the practical advantages attending the use of resilient supports for shallower depths. It is therefore a matter of great practical convenience to be able to relieve the wire cable from the resilient action of the rubber blocks 38 or their equivalent, when drilling at great depth and to connect the cable directly to the walking beam, as in the manner shown in Figure 5 by means of the usual temper screw 44. This temper screw has a quick detachable clamp 45 for gripping the cable and the latter may be fed into the well as the tool progresses by means of the screw 46. From time to time when it is necessary to draw the tool out of the well, the clamp 45 may be loosened so as to release the cable, the latter being then in position to be drawn over the sheave 29 by the winding action of the drum on the drilling machine, not shown. The walking beam has the additional advantage of imparting a longer stroke to the tool than is practicable with the spudding arm which normally operates the cable over the sheave 29. When the walking beam is used sufficient of the cable must be paid out from the winding drum to form a bight or loop 47 of ample length to permit the unimpeded action of the walking beam.

Said walking beam is preferably formed of angle irons 48, connected by diagonal bars 49 forming a lattice construction. The clamp 50 by means of which the walking beam is secured in place is provided with oppositely arranged trunnions 51 upon which the walking beam is journalled. The ends of the walking beam are preferably bound together by pins 52 and 53, from one of which the temper screw is suspended, the other being connected to a rod 54 by means of which the walking beam is actuated. The pins 52 and 53 may be threaded at each end for the reception of a pair of nuts between which a side of the walking beam is clamped. These nuts furnish a means for adjusting the distance apart of the side members of the walking beam at said pins. It is to be understood that the walking beam may be used in connection with the form of my invention shown in Figures 1 to 4, and that the ladder shown in connection with the disclosure of said figures may be equally adapted to both forms of the invention.

A truss rod 55 may be provided for stiffening the booms preventing the bending of the latter when it is inclined in a position approaching the horizontal. Said truss rod preferably has an eye embracing the pivot bolt 56. The ends of said truss rod are securely clamped against the outer section of the boom by means of the clamps 57. One of said clamps is shown in perspective in Figure 8 and indicates that the clamps may be provided with recesses 58 in which the ends of the truss rod may be housed.

Steps similar to those in Figure 1 may be added to that form of the invention embodied in Figure 5, and in both modifications an auxiliary sheave 60 may be secured at any suitable point on the boom for carrying the cable of a sand bucket. When it is desired to transport the derrick for short distances the boom may be lowered to a substantially horizontal position upon the well drilling machine which, although not shown, is presumed to be of the vehicular type. But when the drilling machine is to be shipped by rail the boom may be knocked-down by unscrewing the several couplings reducing it to the form of a plurality of short tubular sections of such length as to be easily handled and packed for shipment, and a plurality of castings and other small parts of such nature as to be transportable in conveniently sized packages. When the derrick, in knock-down condition reaches a new field of operation the parts may be assembled in a short time, and if need be, by unskilled labor. The weight of a tubular derrick constructed along the lines of the present invention is much less than that of the ponderous wooden derricks now in general use.

While I have above described what I have found to be very practical embodiments of my invention, it is nevertheless to be understood that the tubular derrick may also be exemplified in numerous other alternative constructions and I accordingly reserve the right of adopting all such legitimate changes as may be fairly embodied within the spirit and scope of the invention as claimed.

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

1. A well drilling machine comprising a frame, a tubular boom pivotally connected to said frame, said boom comprising an outer tubular section and an inner section movable longitudinally within it, means interposed between said inner and outer sections for resiliently supporting the inner section from

said outer section, and means for supporting a jerk-line, carried by the upper end of said inner section.

2. A boom for well drilling machines comprising a tubular outer fixed section, an inner section movable axially within said outer section, a plurality of resilient blocks enclosed within said tubular outer section upon which the lower end of said inner section rests, a detachable cap closing the lower end of said outer section and on which said blocks rest and which provides access to said blocks when said cap is detached, and jerk-line supporting means carried at the upper end of said inner section.

In testimony whereof I have hereunto set my hand.

JOHN J. MITCHELL.