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SPRING DRILLING APPARATUS.

APPLICATION FILED JUNE 8, 1911.

1,053,189.

Patented Feb. 18, 1913.

2 SHEETS—SHEET 1.

Fig. 2

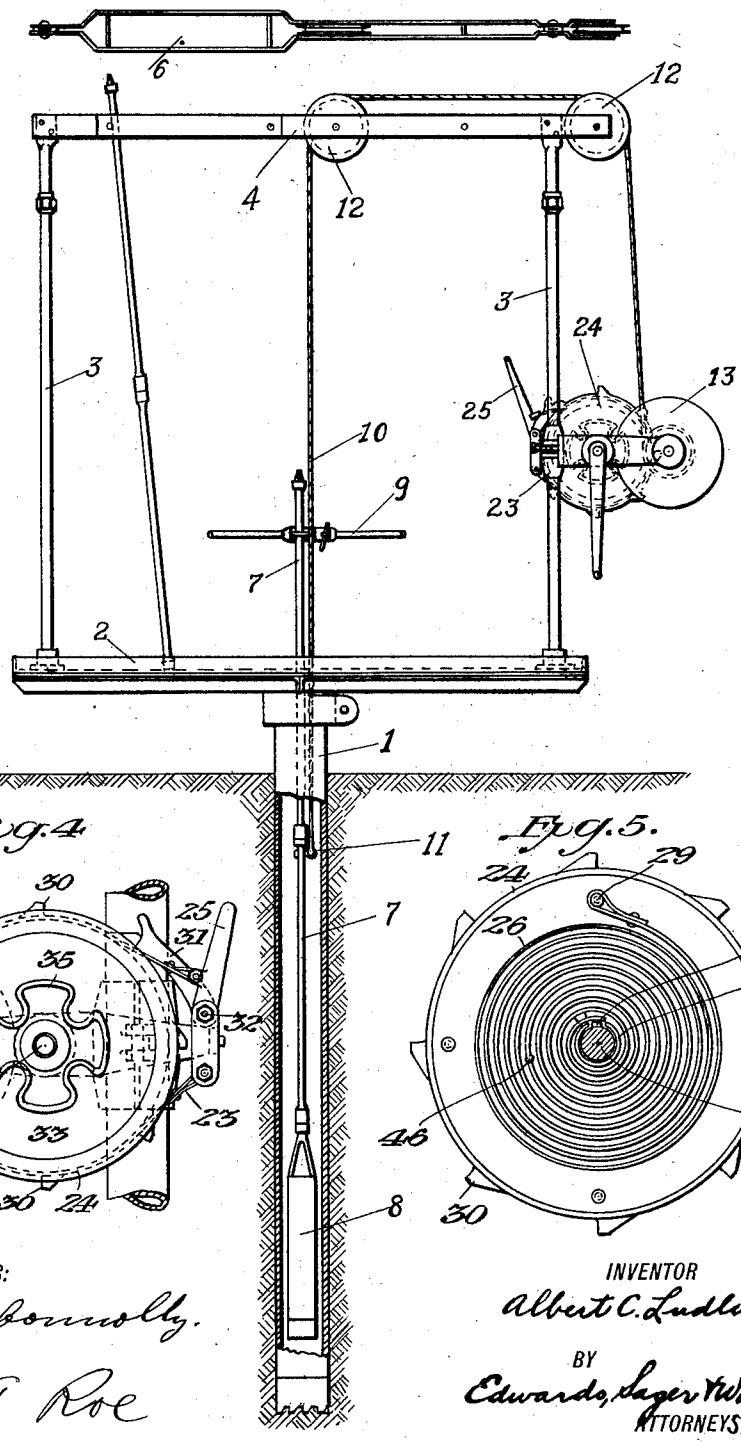

Fig. 1.

Fig. 4

Fig. 5.

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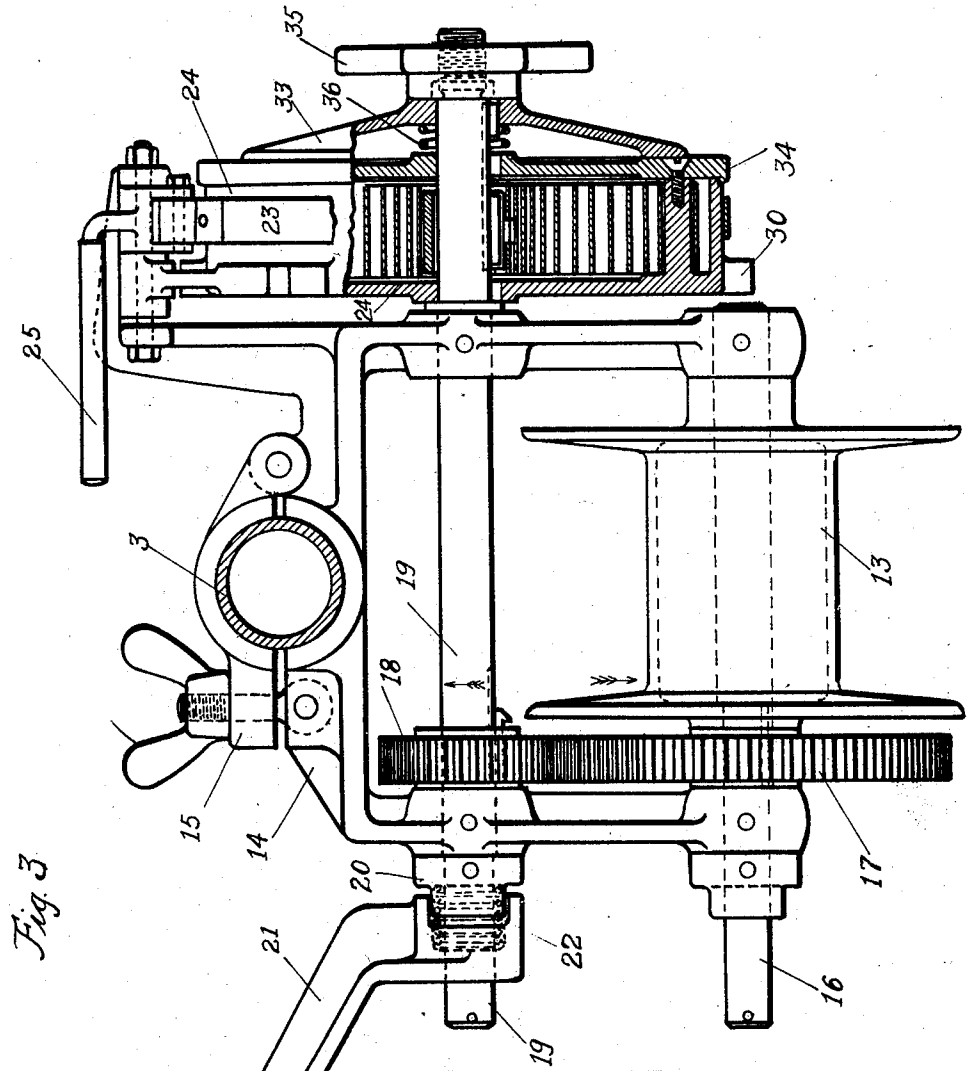

Fig. 3

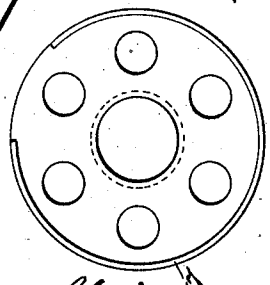

Fig. 6.

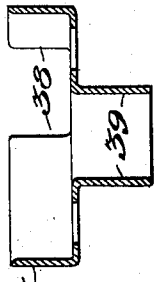

Fig. 7.

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UNITED STATES PATENT OFFICE.

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SPRING DRILLING APPARATUS.

1,053,189. Specification of Letters Patent. **Patented Feb. 18, 1913.**

Application filed June 8, 1911. Serial No. 632,054.

To all whom it may concern:

Be it known that I, ALBERT C. LUDLUM, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Spring Drilling Apparatus, of which the following is a full, clear, and exact specification.

This invention relates to spring drilling apparatus, and has particular reference to means for counterbalancing a part of the weight of drill rods and tools, together with means whereby the drill rods and tools can be more rapidly hoisted or lowered with less labor, than heretofore.

In placer drilling for instance, as where it may be desirable to obtain samples of dirt at considerable depth, considerable difficulty is now experienced in manipulating the reciprocating drilling tools and rods, because of the increasing weight as the depth of the bore increases, this weight having to be lifted and dropped in order to loosen the material so that it can be lifted from the bore. Whenever the dirt is to be removed from the bore it is necessary to remove the rods and the drill tool, and then to replace the tool with a pump and then lower the pump and rods again into the bore. It has heretofore been proposed to counterbalance a portion of the weight of the drill rods by what is called a "spring pole," but this is cumbersome and not capable of ready adjustment as the weight of the rods in the bore increases, and also not readily permitting the rods to be hoisted quickly or conveniently.

By the present invention, there is provided a spring mechanism for counterbalancing the weight of the rods to any desired extent, and which counterbalancing effect automatically increases as the bore increases. Also there is provided a winch in combination with the spring device whereby the rods can be readily lifted, together with clutch mechanism for throwing the spring into and out of operation. When the spring is out of operation, as for lowering the rods, a brake mechanism is provided so that the speed of descent can be controlled, and when the rods reach the bottom of the bore the spring will be thrown into operation to partially counterbalance the rods, thereby permitting the men to drill at any desired depth without increasing the weight of tools and rods to be lifted at each reciprocation.

The invention will be more fully understood in connection with the description of the accompanying drawings, wherein—

Figure 1 is an elevation of a drilling apparatus constructed according to this invention; Fig. 2 is a plan view of the cross-bar; Fig. 3 is a plan view partly in section of the winch, spring, clutch, and associated parts; Fig. 4 is an end elevation; Fig. 5 is a detailed view showing the mounting of the spring, and Figs. 6 and 7 show in detail a spring container for permitting the spring to be removed and inserted.

1 represents a drill rod casing carrying the platform 2 provided with uprights 3, 3 and a cross-bar 4, the cross-bar 4 being divided as at 6 to form a space for the sections 7 of the drill rods, as they are separated. The drill rods are made in sections which screw together, and when these sections are not being used they are stood up on end on the platform 2 as shown in Fig. 1.

8 represents a tool secured to the lower rod 7, and which for the purposes of this invention may be a chisel, earth auger, pump, drill, or other implement customarily employed in boring operations, the particular character of the tool carried by the rods 7 being immaterial to this invention.

9 represents a wrench or handle which is clamped to the upper rod 7, and by which the men lift and lower the rods in loosening and removing the excavated material.

10 represents a rope which is attached preferably to the lower rod section 7, as at 11, and which runs vertically over pulleys 12, 12 to the hub of a winding drum 13. The winding drum 13 is mounted on a frame 14 which is adjustably secured to one of the uprights 3, as by a clamp 15.

16 is a short shaft on which the winding drum 13 is keyed and also carrying a large gear 17 which meshes with a small gear 18 mounted on a shaft 19. The shaft 19 carries a dog 20 which is engaged by a sliding handle 21 when it is desired to hoist the rods out of the bore or lower them into the bore.

22 is a spring which ordinarily holds the handle 21 out of engagement with the dog 20.

The parts thus far described are those of an ordinary winch, by which the drill rods can be hoisted or lowered as desired. When doing this, a brake mechanism 23 operating

on the surface of a drum 24 by means of a lever 25 is employed, so that the speed of lowering the rods and tool into the bore can be easily controlled.

In order to counterbalance the weight of the drill rods and tool a spring 26 is attached at its inner end to a bushing 27, which bushing is split so as to slide over a lug 28 on shaft 19, and at its outer end the spring is attached to a pin 29 on drum 24, which drum is loosely mounted on shaft 19. Preferably at one edge, the drum 24 is provided with ratchet teeth 30 with which a pawl 31 may engage to hold the drum against rotation by the spring, the pawl being pivoted on the frame 14 at 32. It will thus be seen that the weight of the drill rods exerted through rope 10 on drum 13, gears 17, 18 and shaft 19 will be opposed by the tension of the spring through the pawl 31 and ratchet teeth 30, and that by turning the drum 24 by the ratchet teeth in one way to wind up the spring the weight of the drill rods can be more or less counterbalanced according to the tension of the spring. When the desired amount of counterbalance is secured, the men will reciprocate the drill rods by the wrench 9 in the usual manner, and it will be seen that the amount of uncounterbalanced weight they will have to lift each time, will be independent of the length of drill rods, while the uncounterbalanced weight will be sufficient to drop the drill rods to break up the material at the bottom of the bore, or to allow loosened material to be pumped up.

In order to permit the winch to be employed to lift or lower the drill rods without loosening the tension of the spring, means is provided for clamping the drum 24 to the shaft 19 consisting of a clutch disk 33 which engages a removable plate 34 secured to the drum 24, together with a hand screw 35 by which the disk 33 may be frictionally clamped to the drum plate 34.

36 is a spring which normally tends to hold the clutch disk 33 out of engagement. By clamping the disk 33, which is splined on the shaft 19 to the drum 24, and by then lifting the pawl 31, it will be seen that the winch can now be employed in the usual manner to lift or lower the rods, the brake 23 being used to control the descent of the rods. Inasmuch as the weight of the rods tends normally to wind up the spring, it will be seen that as the depth of the bore increases the tension of the spring increases so that it is not ordinarily necessary to change the initial tension of the spring which is secured by turning the drum, though the tension of the spring can at any time be increased by turning the drum or decreased by applying the brake and lifting the pawl 31 and then allowing the spring to revolve the drum backward to the desired degree and then again dropping the pawl to hold the spring under the desired tension.

For deep bores, where the weight of the rods becomes considerable, a heavier spring would be required, but the same result is attained without changing the spring by what may be termed a compound spring, that is, the inner portion preferably, which winds up first, may be made lighter than the outer portion. These two springs will be connected end to end by a joint 46, and in a broad sense form a single spring. When the rods are light, it will be seen that the light spring will wind up first and only slightly wind up the heavier spring, and when the weight becomes such as to exceed the limit of the light spring, the heavier spring winds up, thus exerting an increased pull on the rope commensurate with the increased weight to be counterbalanced. The action would be the same if the heavier spring were inside.

In case it is desired to remove the spring, or to insert a new one, considerable difficulty would ordinarily be experienced by reason of the size of spring necessary, but by reason of the particular attachment of spring herein described and the spring cup 37, shown in Figs. 6 and 7, a spring can very easily be removed or inserted while under tension. This cup 37 comprises a flanged body having a slot 38 to straddle the pin 29 and a central hub 39 which fits over the shaft 19 when the ratchet wheel 35, spring 36, clutch disk 33, and plate 34 have been removed. Having inserted the cup 37 the spring is then allowed to expand within the cup, thereafter the spring with the bushing 27 can be pulled lengthwise off the shaft 19, the bushing disengaging from the lug 28.

By attaching the rope 10 to the drilling tool itself, or to one of the lower rod sections, it will be seen that the tool can be lowered or raised and the rods readily coupled or uncoupled, and that because of the counterbalancing force of the spring the rods can be hoisted by winding up the drum with very slight effort.

It will be observed that the location of the spring on the hoisting shaft 19 is not essential, as it might be placed, with the clutch 33 on the drum 13, but an important advantage flows from having the spring on the shaft 19 which is geared to the winding drum through a reduction gear. This advantage consists in permitting a greater reciprocation of the tool in the bore with a more flexible or smaller spring than would be required with the spring on the winding drum. In the latter case the spring and drum would have to be very large to avoid excessive winding up of the spring on the down stroke of the tool, with consequent objectionable increase of the counterbalancing effect, while a smaller and weaker spring on a shaft mak-

ing more revolutions than the winding drum maintains a more constant counterbalancing effect with a given reciprocation of the tool.

In ordinary hoisting and lowering of the rods and tools out of and into the hole, the spring counterbalance is not used, the clutch being clamped to the drum, but when the rods have been lowered to the bottom of the bore ready to be reciprocated to break up the earth or to load a pump with loosened earth, the clutch will be opened thus throwing the spring into operation and causing it to partially or wholly counterbalance the weight of the rods and tool. Thus the men on the platform can, by winding up the ratchet adjust the tension of the spring, and having once obtained this adjustment it automatically increases as the weight of rods increases with the progress of the bore so that it requires no more effort to manipulate the rods and tools at one depth than at another. Much is saved in the raising, lowering and uncoupling of the rods by this mechanism, and two men on the platform with this apparatus will readily accomplish the same work that has heretofore required four or five men, thus effecting a large saving in the cost of drilling.

Various modifications and changes in the specific embodiment of the invention herein shown may be made without departing from the scope of the appended claims.

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

1. The combination with a drilling rig, of a spring device connected to counterbalance the drilling devices, and a clutch for throwing the spring out of operation when closed.

2. The combination with a winding drum, of a spring tending to rotate the drum in one direction, a clutch for throwing the spring into and out of effective relation without disturbing its tension when opened and closed, and a brake for controlling the rotation of the winding drum when the spring is out of operation.

3. The combination with a winding drum, of a coiled spring tending to rotate said drum in one direction, means comprising a closed clutch for throwing the spring out of effective operation, and means for turning the drum.

4. The combination with a support, a shaft mounted thereon, and a winding drum operatively connected with said shaft, of a coiled spring having one end connected to said shaft, releasable means for connecting the other end of said spring with said support, and means for operatively connecting said other end of the spring with said shaft to prevent uncoiling of the spring when the connection of said spring with said support is released.

5. The combination with a support, a shaft mounted thereon, and a winding drum operatively connected with said shaft, of a movable drum rotatable on said shaft and carrying a ratchet, a releasable pawl carried by said support and coöperating with said ratchet, a coiled spring having one end connected to said shaft and the other end connected to said movable drum, and releasable means for non-rotatably connecting said movable drum with said shaft.

6. In a drilling device, the combination with a shaft having a transversely projecting portion, of a split bushing engaging said projecting portion and adapted to slide longitudinally of the shaft, a spring having one end attached to said bushing, a drum mounted to freely move on said shaft, and means carried by said drum for attaching thereto the other end of said spring by movement longitudinally of the shaft.

7. In a drilling device, the combination with a support, a shaft mounted thereon and a winding drum operatively connected with said shaft, of a movable drum rotatable on said shaft, a coiled spring having one end connected to said shaft and its other end connected to said movable drum, and braking means coöperating with said movable drum.

8. In a drilling device, the combination with a support, of a shaft, a winding drum mounted thereon, a ratchet wheel rotatably mounted to rotate independently of said drum, a releasable pawl carried by said support and adapted to engage said ratchet wheel, a spring operatively connected at one end to rotate said shaft and at the other end to rotate said ratchet wheel, and means for releasably connecting the ratchet wheel to rotate with said winding drum upon release of said pawl independently of the spring.

9. In a drilling device, the combination with a support, of means carried thereby for supporting a vertically reciprocating drilling tool comprising a winding drum having flexible connection with said tool, and a spring operatively connected between said drum and said support for counterbalancing to any desired degree the weight of said tool and connections, said spring rotating said winding drum when said tool is reciprocated in one direction and being compressed when said tool is reciprocated in the other direction.

10. In a drilling device, the combination with a support, of means carried thereby for supporting a vertically reciprocating drilling tool comprising a winding drum having flexible connection with said tool, a spring operatively connected between said drum and said support for counterbalancing to any desired degree the weight of said tool and connections, said spring rotating said winding drum when said tool is reciprocated in one direction and being compressed

when said tool is reciprocated in the other direction, and means for throwing the spring out of operation without relieving its tension.

11. The combination with a support carrying a hoisting shaft adapted to be operatively connected with a weight, of a coil spring operatively connected with said shaft and said support to oppose said weight, the connection between said spring and support comprising a pawl and a rotatable ratchet, and means for clamping the ratchet to said shaft when the pawl is disengaged.

12. The combination with a hoisting shaft adapted to support a weight, of a coil spring connected to said shaft at one end and to an inclosing drum at the other, said drum being rotatably mounted on said shaft, a ratchet carried by said drum, a pawl mounted to engage said ratchet to hold the spring under tension, a clutch disk sliding on said shaft, and means for clamping said disk to said drum.

13. A drilling rig comprising a base, a frame carried by said base comprising an upright and a divided cross-bar adapted to support surplus parts, a pulley carried by said cross-bar, a hoisting rope running vertically through said base and over said pulley, a hoisting shaft operatively connected with said rope, a spring operatively connected at one end with said shaft and detachably held at the other end to said upright and tending normally to wind up said rope, means for manually winding or unwinding said rope, and means for holding the spring under compression when released from said upright.

14. The combination with a winding drum, of a hoisting shaft geared thereto to rotate at a higher speed, a spring device on said shaft tending to rotate said shaft and winding drum in one direction and clutch means for throwing said spring into and out of operation when opened and closed.

15. In a drilling device, the combination with a support, a shaft mounted thereon, and a winding drum operatively connected with said shaft and adapted to be operatively connected with the drilling tool, of a double spring composed of a heavy and a light portion connected in series, the end of one portion being operatively connected with said drum and the end of the other operatively connected with said support.

16. In a drilling device, the combination with a support and a shaft mounted thereon, of a coiled spring having its ends operatively connected respectively with said support and said shaft, said ends being respectively attachable and detachable by movement longitudinally of the shaft.

17. In a drilling device, the combination with a support, of a shaft mounted thereon, a winding drum operatively connected with said shaft, a spring operatively connected between said shaft and said support for counterbalancing the weight of the tool and connections carried by said drum, a handle for operating said shaft to raise and lower the drilling device, and means for holding said handle out of operative relation with said shaft during normal operation of said drilling device.

18. In a drilling device, the combination with a support, a shaft and a winding drum mounted on said shaft, of a second shaft, a spring operatively connected between said second shaft and said support for counterbalancing the weight of the tool and connections carried by said drum, and reduction gearing between said first shaft and said second shaft.

19. In a drilling device, the combination with a support, of means carried thereby for supporting a vertically reciprocating drilling tool comprising a winding drum having flexible connection with said tool, a double spring composed of a heavy and a light portion connected in series, said spring being operatively connected between said drum and said support for counterbalancing to any desired degree the weight of said tool and connections, said spring rotating said winding drum when said tool is reciprocated in one direction and being compressed when said tool is reciprocated in the other direction, and means for throwing the spring out of operation without relieving its tension.

20. In a drilling device, the combination with a support, a shaft and a winding drum mounted on said shaft, of a second shaft, a spring operatively connected between said second shaft and said support for counterbalancing the weight of the tool and connections carried by said drum, said spring comprising relatively heavy and relatively light portions connected in series, and reduction gearing between said first shaft and said second shaft.

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

ALBERT C. LUDLUM.

Witnesses:
J. S. WOOSTER,
GEO. N. KERR.