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AUTOMATIC CONTROL DEVICE FOR WELL DRILLING

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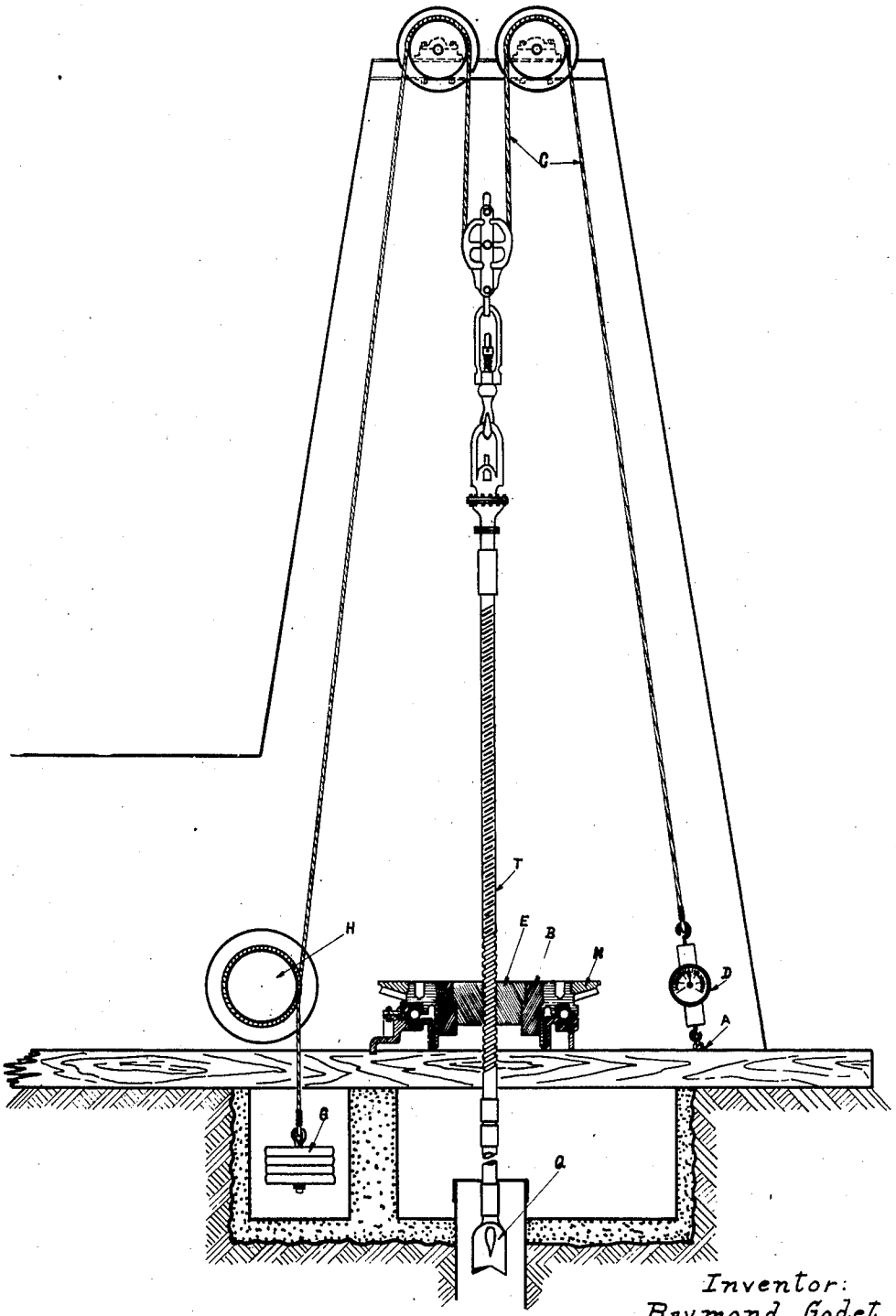

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AUTOMATIC CONTROL DEVICE FOR WELL DRILLING

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The device, the subject matter of the present invention, relates to the automatic control of the drill in wells which are drilled by the rotary method, to insure the automatic lowering of the bit, irrespective of variations of underground conditions and the character of the strata encountered.

The drawing shows a side view partly in section of a preferred form of construction.

The device consists essentially of hollow drill stem T provided with external screwthreads, which engage a nut E by means of internal screwthreads.

The drill stem T may be cylindrical and provided with a thread or a spiral groove or gradient twisted around its axle, the faces of the prism serving the part of a spiral gradient and the nut E being connected so that it receives the stem.

The nut E presents externally sides or pegs and fits into the corresponding perforation in the part B, which is fixed to the rotary table M so that the rotary motion of the table is transferred to the nut E and through its intermediary to the drill stem T.

The drill stem T and the nut E are threaded in the same direction as the rotary motion of the table; and if, as usual, the table is rotating counter-clockwise, the thread twists itself in the manner of a normal corkscrew.

The nut E may be made from a single block or in two or more parts so that it may be easily taken apart. More generally, any device allowing the stem T to attain a spiral motion with regard to the nut E can be adopted.

The drill stem T is suspended by the rope C in the usual way by the intermediary of a travelling block, provided with one or more pulleys.

The two ends of the rope pass over the two pulleys at the top of the derrick. One of the ends of the rope is fixed to the floor at A through the intermediary of the dynamometer D and the other end, instead of being secured to a drum as in the ordinary and known rotary method, is secured to any type of device which insures the maintenance of a constant tension on the rope C irrespective of the position of the drill stem. The tension counterweighs a part of the weight of the drill rods.

Various devices may be used as, for instance, a frictional resistance or counterweights, either direct or indirect through the intermediary of travelling blocks, drums, gearings, etc.

The end of the rope secured to the dynamometer and the latter at A could be attached to any tension device, so that both ends could be used for the purpose of maintaining a constant tension on the cable.

The drawing shows a simple and practical device in which a counterweight G is fixed to a rope which winds itself on the drum H and thus insures the desired constant tension, at the same time allowing the free displacement of the series of drilling pipes.

The operation is as follows:—

The torque applied through the nut E on the drill stem T results in the rotation of the stem in the same direction as the rotating table so that the drilling proceeds in the same manner as in the ordinary rotary method. Under the action of the drilling bit Q, the ground is removed and as a result the resistance of the ground decreases which allows the bit and the drill stem to drop under the weight of the series of drilling pipes. At the same time, the drilling pipes assume a spiral motion with regard to the rotary table until, due to the lowering of the bit, the resisting torque increases.

When the ground is homogeneous, both actions take place at the same time. The resisting torque is maintained constantly steady and the down motion of the bit is also constant. If the nature and quality of the ground varies as, for instance, becomes harder, the resisting torque changes and in this case increases. In the case of the usual rotary method, without a spiral stem, this resistance is reduced within acceptable limits by the driller who decreases the speed of the lowering of the bit. If this is not correctly executed, one of the following three alternatives will happen: the engine will stop; a drilling pipe may twist off, which frequently happens; or, if the variation of the resistance is small, the pressure on the bottom of the

hole is much greater than necessary and the drilling proceeds under the poorest conditions resulting in the bit wearing off rapidly, and the lowering of the bit is too slow.

On the contrary, in case a spiral drill stem is used, the increase of the resisting torque has the effect of decreasing immediately the lowering of the bit.

More than that, the resisting torque cannot pass a certain limit which can be regulated by the present construction.

Let R be the resisting torque, P the effective weight of the series of pipe, that is to say, the total weight of the pipes minus the counterweight caused by the rope tension, and *a* the angle of the helix with the horizontal. As a consequence of the spiral connection between the drill stem T and the nut E, the equation is as follows: $R=Ptg.a$. For sake of simplicity, the unimportant effect of the frictional forces is not considered, which by the way does not change or effect the conclusions

If the resisting torque R tends to pass the value $Ptg.a$, equilibrium is broken and the drill stem T is raised which results in decreasing the resisting torque R and to bring it again to the value $Ptg.a$; this value being thus a maximum for the factor R.

$Ptg.a$ is also a minimum value for R since, if the resisting torque tends to decrease under this value the equilibrium is broken in the reverse direction as in the former case, the drill stem lowers itself which, as a result, increases the resisting torque and the equilibrium is restored. One may see that as a consequence of the existing spiral connection, the resisting torque is constantly and automatically brought to the value $Ptg.a$, which may be regulated, and the angle *a* being given, and acts on the factor P, that is to say, on the weight of the series of pipes and on the cable tension.

Thus is effected, irrespective of the nature of the ground, an automatic control of the lowering of the bit, thereby admitting the fixing of the resisting torque to a value which may be regulated at will, and which affords among other advantages, the maximum utilization of the engine power, the doing away with the twisting off of the pipes, and the drilling proceeding automatically under the best conditions possible.

I claim:

1. A rotary drilling device comprising a drill stem having spirally arranged screw-threads thereon; a rotary table having screw-threads cooperating with the threads on the stem to permit helicoidal motion of the stem relative to the table; means for supporting said stem; and a constant tension device for the means to maintain a constant tension thereon.

2. A rotary drilling device comprising a drill stem having spirally arranged screw-threads thereon; a rotary table having screw-threads cooperating with the threads on the stem to permit helicoidal motion of the stem relative to the table; means for supporting said stem; a constant tension device for the means to maintain a constant tension thereon; and a dynamometer for said means.

In testimony whereof I have signed my name to this specification.

RAYMOND GODET.