Oct. 14, 1930. G. P. LEHMANN 1,778,501

WELL DRILLING SYSTEM

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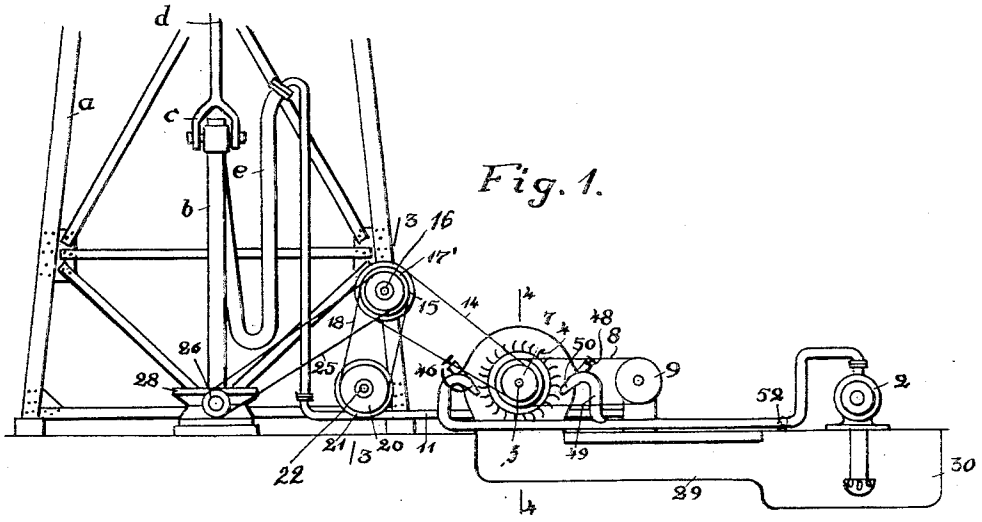


Fig. 1.

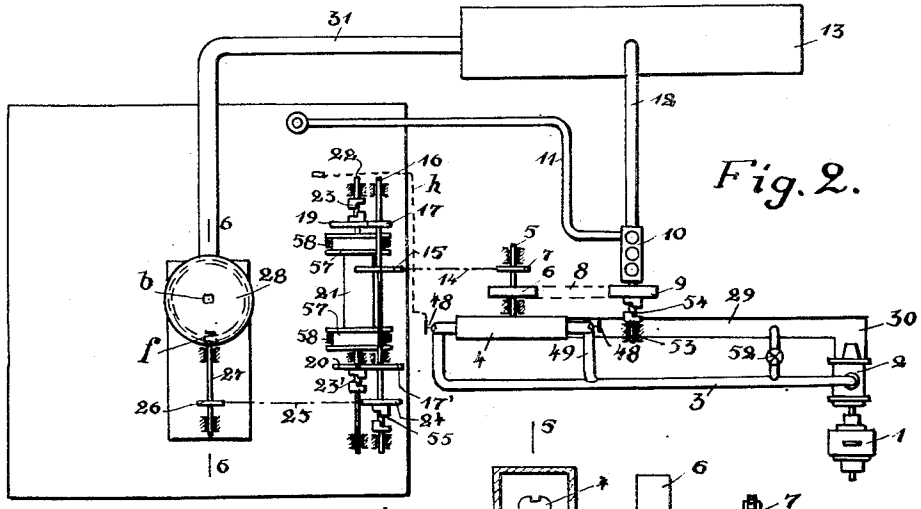


Fig. 2.

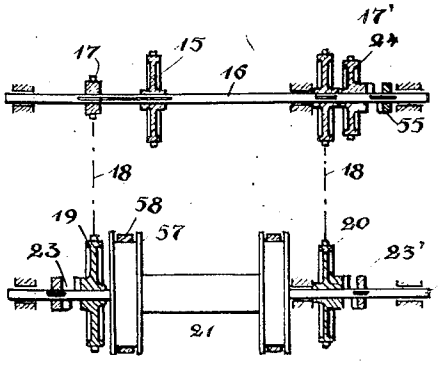


Fig. 3.

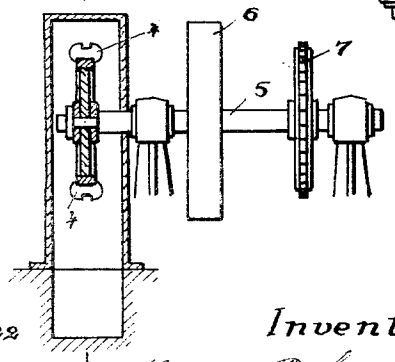


Fig. 4.

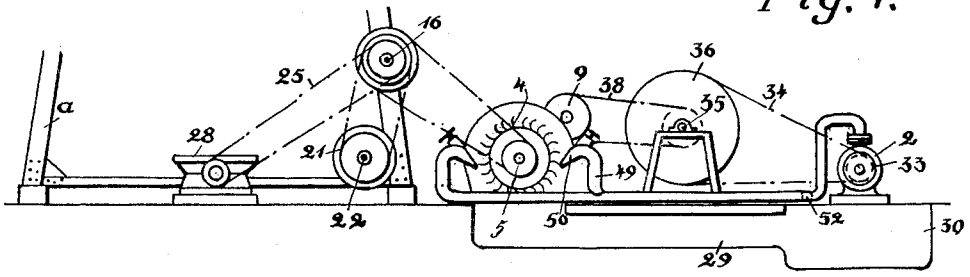
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WELL DRILLING SYSTEM

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Fig. 7.



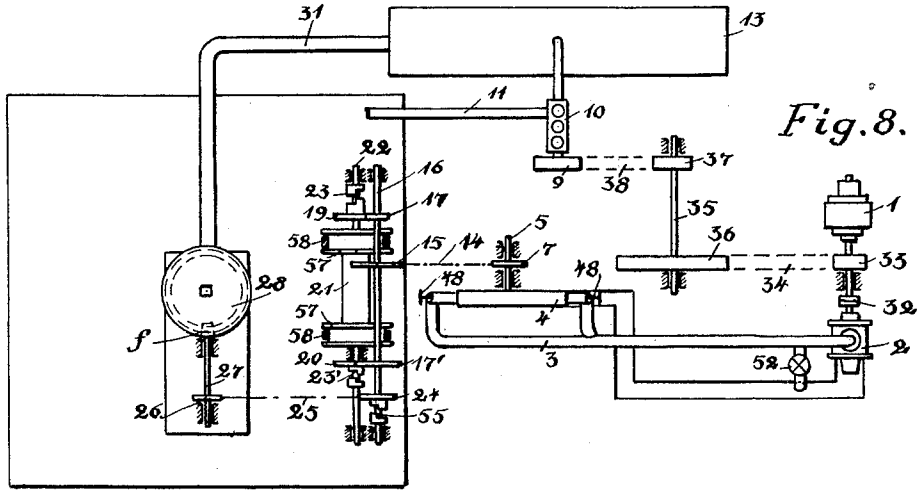


Fig. 8.

Fig. 5.

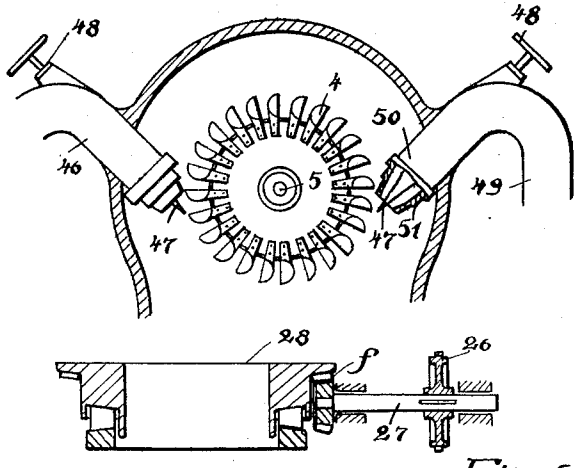


Fig. 6.

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Fig. 9.

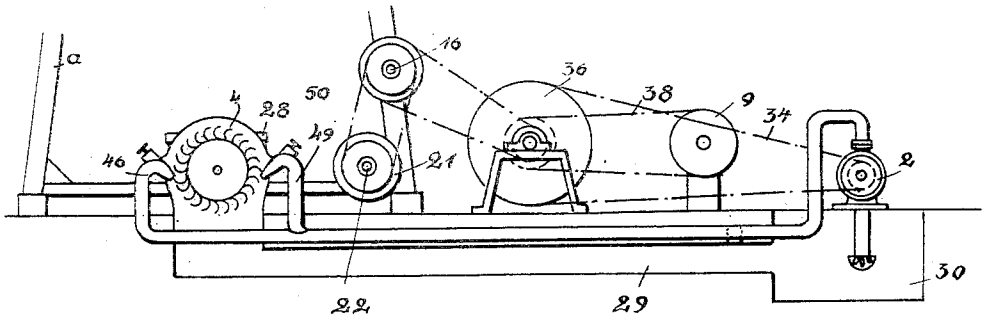
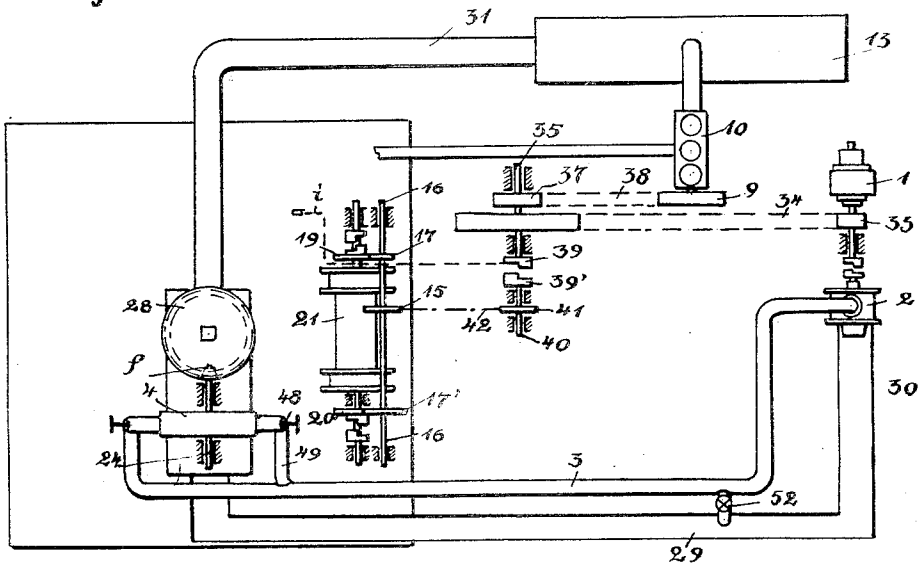


Fig. 10.



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UNITED STATES PATENT OFFICE

GERHARD P. LEHMANN, OF PLOESTI, RUMANIA

WELL-DRILLING SYSTEM

Application filed January 20, 1926, Serial No. 82,619, and in Rumania January 26, 1925.

My invention relates to improvements in well drilling systems, and more particularly in systems of the type in which the drill is mounted on a drive stem passed through a rotary table, and suspended from a derrick. The object of the improvements is to provide a system in which the blows exerted by the drill finding a sudden increase of the resistance are not transmitted to the motor, and with this object in view between the primary motor such as an electromotor, an internal combustion engine, a steam engine or the like, and the rotary table an intermediate motor is provided which comprises a yielding driven member. In the preferred construction the said intermediate motor is in the form of an impulse turbine having the motive fluid such as water supplied thereto from a pump driven by the said primary motor.

For the purpose of explaining the invention several examples embodying the same have been shown in the accompanying drawings, in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings,

Fig. 1, is a diagrammatical elevation showing my improved system,

Fig. 2, is a top-plan view of Fig. 1,

Fig. 3, is a detail sectional elevation taken on the line 3—3 of Fig. 1,

Fig. 4, is a detail sectional elevation taken on the line 4—4 of Fig. 1,

Fig. 5, is a detail sectional elevation taken on the line 5—5 of Fig. 4,

Fig. 6, is a detail sectional elevation taken on the line 6—6 of Fig. 2,

Fig. 7, is a diagrammatical elevation similar to the one shown in Fig. 1 and illustrating a modification,

Fig. 8, is a top-plan view of Fig. 7,

Fig. 9, is a diagrammatical elevation showing another modification, and

Fig. 10, is a top-plan view of Fig. 9.

In the example shown in Figs. 1 to 6 my improved system comprises a rotary table 28 mounted in the usual way at the top of the well, a derrick *a*, a drive stem *b* passed through the said rotary table and supported through the usual swivel means *c* and the cable *d* from the crown block on the upper end of the derrick. The cable is trained on a windlass 21 loosely mounted on a shaft 22, and water for flushing the well is supplied through a pipe 11 and a flexible tube *e* from a flushing pump 10. All of the said parts are driven from a motor 1 such as an electromotor rotating at constant velocity. These parts are known in the art and I deem it not necessary to describe the same in detail.

Referring now to the novel parts of my improved system, the electromotor 1 is connected with a high pressure centrifugal pump 2 supplying water under pressure through a pipe 3 and a nozzle 46 to an impulse turbine 4.

After having delivered its energy to the wheel of the turbine 4 the water is returned through a passage 29 to a tank 30, from which it is taken into the pump 2 for being again supplied under pressure to the turbine 4. The nozzle 46 is provided with means for regulating the delivery of water to the turbine, and as shown in Fig. 5, the said means is in the form of a plug 47 engaged by a screw 48 adapted to force the same inwardly or outwardly. Further, a pipe 49 is branched from the pipe 3 which is provided with a nozzle 50 provided with regulating means 51 and adapted to throw the water against the rear faces of the buckets of the turbine wheel for reversing the direction of the rotation thereof. Finally, a subsidiary outlet 52 is provided through which the water under pressure may be directly returned into the passage 29, if it is desired to throw the turbine out of operation.

To the shaft 5 of the turbine a belt pulley 6 and a sprocket wheel 7 are keyed, the belt pulley being connected by a belt 8 with a pulley 9 loosely mounted on the shaft 53 of the flushing pump 10 and adapted to be coupled thereto by means of a clutch 54. The suction pipe 12 of the said pump opens into a tank 13 receiving the flushing water and earth coming from the well through a pipe 31. Within the said tank the earth and disintegrated rock raised from the well are deposited so that clean water is supplied to the pump for being returned thereby into the

well. The sprocket wheel 7 is connected by a chain 14 with a sprocket wheel 15 keyed to a shaft 16 and carrying sprocket wheels 17 and 17′ of different diameters. The sprocket wheels 17 and 17′ are connected by chains 18 with sprocket wheels 19 and 20 loosely mounted on the shaft 22 and adapted to be coupled to the said shaft by coupling means 23 and 23′. Thus by connecting either one of the sprocket wheels 19 or 20 with the shaft 22 the windlass 21 may be rotated at different velocities for lifting pipes forming the wall of the well, removing the drill and its drive stem from the well, etc. On the shaft 16 a sprocket wheel 24 is loosely mounted which is adapted to be coupled to the shaft by means of a clutch 55, and which is connected by a chain 25 with a sprocket wheel 26 keyed to a shaft 27 adapted to impart rotary movement to the table 28 by means of a bevel gearing *f*. The windlass 21 is provided with lateral flanges 57 adapted to be engaged by suitable brake shoes 58.

The operation of the system is as follows: The motor 1 is driven at constant velocity, and it supplies water under constant pressure to the turbine 4 through the nozzle 46, which turbine drives the pump 10, the windlass 21 and the rotary table 28. By means of the regulating plug 47 the velocity of the turbine and the rotary table may be regulated within wide limits. By providing the turbine between the electromotor and the driven members any reaction on the motor caused for example by regulating the velocity of the windlass or by an increased resistance of the drill and the variation of the velocity thereof is avoided. Further, if the velocity of the turbine wheel is reduced by a reduction of the velocity of the rotary table caused by an increase of the resistance of the drill the moment transmitted thereto is increased, so that the drilling power of the drill is automatically increased.

Preferably all the parts of the system are controlled from the engineer's stand, as has been indicated in Fig. 2 in a diagrammatical way by lines *h* representing steering rods connected with the regulating means 46.

In order to avoid heating of the motive fluid supplied by the centrifugal pump 2 in case the turbine is out of operation the subsidiary outlet 52 is opened permitting circulation of so much water through the centrifugal pump as is necessary for preventing any objectionable increase of the temperature.

The modification shown in Figs. 7 and 8 is similar to the one described with reference to Figs. 1 to 6, and the same letters of reference have been used to indicate the parts the construction of which is the same in all the figures. The system is distinguished from the one shown in Figs. 1 to 6 in that the pump 10 is connected by a positive gearing with the electromotor 1. The centrifugal pump 2 supplies water under pressure to the turbine 4, and the turbine shaft is connected in the manner described with reference to Figs. 1 to 6 with the windlass 21 and the table 28. To the shaft of the motor 1 a belt pulley 33 is keyed which is connected by a belt 34, pulleys 36 and 37 keyed to a shaft 35 and a belt 38 with the belt pulley 9 keyed to the shaft of the pump. The centrifugal pump is adapted to be connected to or disconnected from the motor shaft by means of a clutch 32.

In the system shown in Figs. 7 and 8 the pump is driven independently of the turbine 4 and at constant velocity. The operation of the system will be understood without further description.

In the modification shown in Figs. 9 and 10 the pump 10 and the windlass 21 are in positive driving engagement with the electromotor 1, and the turbine 4 and the centrifugal pump 2 are disposed only intermediate the motor shaft and the rotary table 28. The shaft 35 is disposed between the motor shaft and the pump shaft in the manner described with reference to Figs. 7 and 8, and it carries a coupling member 39 adapted for coupling engagement with a coupling member 39′ keyed to a shaft 40, the said coupling means being adapted to be operated from the engineer's stand as is indicated by the dotted lines *i* representing rods for operating the coupling means. To the shaft 40 a sprocket wheel 41 is keyed which is connected by a chain 42 with the sprocket wheel 15 keyed to the shaft 16, the said shaft being in driving engagement with the windlass 21 in the manner described above.

The turbine wheel 4 is directly keyed to the shaft 24 connected with the table 28 by the bevel gearing *f*.

In the system shown in Figs. 9 and 10 the pump 10, the windlass 21 and the rotary table 28 may be driven independently of one another. The construction shown in the said figures is preferable as compared to the constructions shown in Figs. 1 to 8 in that the chain and sprocket gearing for driving the rotary table is dispensed with. Further, the blows exerted by the drill are not transmitted to the windlass and the pump and the gearings thereof. Thus the wear of the driving gearing, the windlass and the pump 10 and the noise caused by the operation of the drill are reduced. The windlass can be thrown into operation from the engineer's stand by coupling the sprocket wheels 19 or 20 to the shaft 22, and the flushing pump may be operated independently of the drill and the windlass. The velocity of the rotary table can be regulated from the engineer's stand through a suitable gearing indicated in Fig. 10 in a diagrammatical way by a dotted line *i*.

Suitable means are provided in all the examples referred to above for rapidly arrest-

ing the wheel of the turbine. In the example shown in the figures the said means consist of the subsidiary nozzle 50 adapted to deliver the water under pressure or a part thereof to the rear faces of the blades of the turbine wheel. By thus driving the turbine wheel in reverse direction the drive stem can be rapidly unscrewed from the drill without making use of the windlass. Further, in case of the examples shown in Figs. 1 to 8, the said reversing means may be used for reversing the windlass.

An important feature of my improved system resides in that the turbine and centrifugal pump can be provided in systems now in use without materially reconstructing the same.

I claim:

1. A system for drilling wells, comprising a rotary member adapted to be mounted at the top of a well, a prime mover adapted to move continuously, a pump for producing fluid under pressure and adapted to be operated by said prime mover, a turbine adapted to be mounted adjacent the top of said well and to be driven by the fluid from said pump, said rotary member adapted to be driven by said turbine.

2. A system for drilling wells, comprising a rotary member adapted to be mounted at the top of a well, a prime mover adapted to move continuously, a pump for producing fluid under pressure adapted to be operated by said prime mover, a turbine wheel adapted to be mounted adjacent the top of said well and a pipe for delivering the fluid from said pump against the blades of said wheel, said pipe having an outlet for discharging the fluid therefrom before it acts on said wheel, the said rotary member being adapted to be driven by said turbine.

In testimony whereof I hereunto affix my signature.

GERHARD P. LEHMANN.