Feb. 2, 1932. G. McCONNELL 1,843,291

WELL DRILLING AND PUMPING APPARATUS

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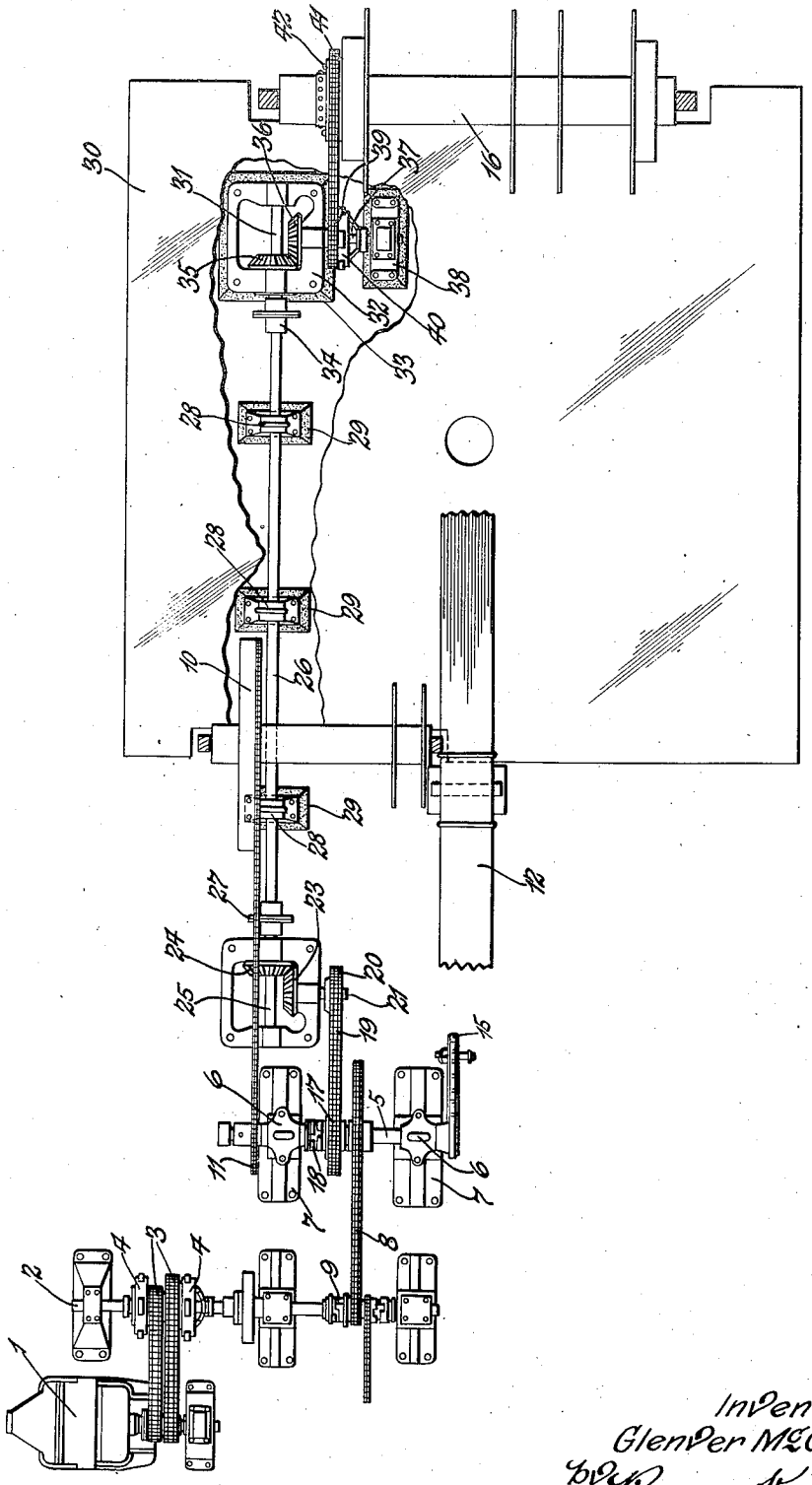


Fig. 1.

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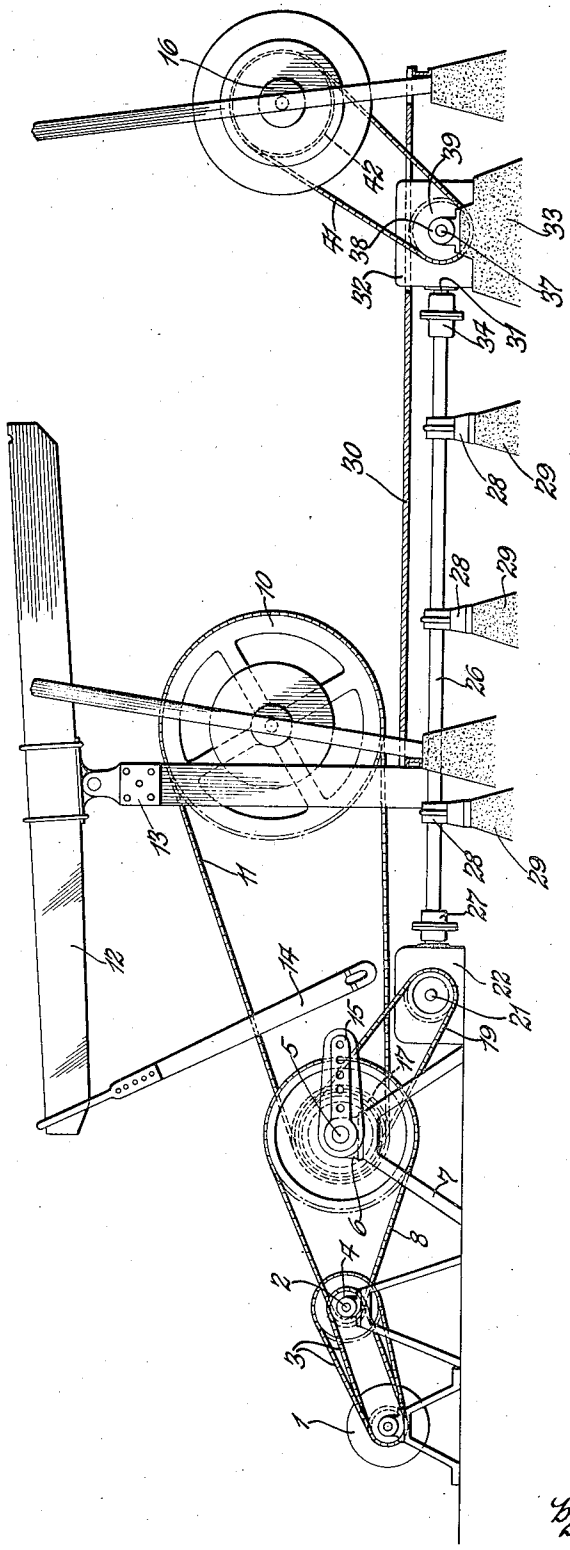


Fig. 2.

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UNITED STATES PATENT OFFICE

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WELL DRILLING AND PUMPING APPARATUS

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This invention relates to improvements in power transmission mechanism for well drilling and pumping apparatus and consists of the novel construction hereinafter disclosed.

An object of the invention is to provide in a drilling and pumping apparatus an improved power transmission from the crank shaft to the bull wheel, which is adapted to operate the bull wheel efficiently to perform its full range of operations as required for drilling, cleaning or swabbing or for pulling tools, and other purposes in drilling deep wells and in maintaining the wells during pumping operations.

It is well understood in the art that there are certain definite limitations imposed by reason of the character of work required of a drilling and pumping apparatus which prevent a radical rearrangement of the several units of the apparatus and, therefore, improvements over the known methods of power transmission must accommodate themselves to the essential disposition of the various units of the apparatus.

In driving the bull wheel from the crank shaft the usual method has been to connect the bull wheel shaft pulley with a pulley carried by the crank shaft by tug ropes, which are thrown on when the bull wheel is to be operated and thrown off when the apparatus is used in pumping operations or in operations not requiring the bull wheel. The tug ropes extend across the derrick floor causing an operation hazard from the exposed rope, and also a hazard to the operators in throwing the tug ropes on and off.

Furthermore, the direct connection of the bull wheel pulley through the tug rope transmission with the crank shaft is an inflexible power transmission by which it is difficult to control the speed of operation of the bull wheel to adapt it to the various operations in which the bull wheel is required in drilling and maintenance of a well.

The problem, therefore, that is solved by the present construction includes the provision of a power transmission, which eliminates the objectionable features of the tug rope transmission now in use, to afford flexibility of the application of power from the crank shaft to the bull wheel, whereby the maintenance cost of the tug rope transmission is eliminated, and economy in operation of the transmission is effected.

Additional objects of the invention will be readily apparent from the following detailed description thereof, taken in connection with the accompanying drawings in which

Fig. 1 is a plan view of a drilling and pumping apparatus embodying the invention.

Fig. 2 is an elevation of the apparatus.

In the embodiment of the invention illustrated in the drawings the transmission is shown in association with the drilling and pumping apparatus. A prime mover 1 of any suitable design, either a steam or gas engine or electric motor, is provided. There is a power take-off from the power shaft of the prime mover to a counter shaft 2, the counter shaft being arranged for rotation on an axis parallel with the axis of the power shaft of the prime mover. The power take-off from the power shaft of the prime mover in the embodiment shown, comprises a dual differential chain and sprocket drive 3 for driving the counter shaft 2 at selected speeds from the prime mover. The respective pulleys of the drive on the bull wheel are optionally engaged with the shaft 2 by clutches 4. The crank shaft 5 of the apparatus is supported for rotation in bearings 6 carried by jack posts 7, and the crank shaft is driven from the counter shaft by a chain and sprocket transmission 8, which may be optionally connected or released from the shaft 2 by a clutch device 9.

The calf wheel 10 is journaled for rotation, and disposed at one side of the derrick. The wheel 10 is driven directly from the crank shaft by a chain and sprocket drive 11. When the apparatus is used for pumping operations the walking beam 12, pivoted at its upper end to a sampson post 13, is also operated from the crank shaft by connecting the pitman 14 with the crank arm 15.

It is seen, therefore, that the drive both for the calf wheel and for the walking beam is from the crank shaft, which is also the

common source of power for the operation of the bull wheel.

At the side of the derrick opposite the position of the calf wheel, and journaled in bearings supporting the same above the derrick floor, is a bull wheel 16, which it will be understood is used for drilling, cleaning or swabbing, pulling tools and other hoisting operations required in connection with drilling and maintenance of the well hole. Obviously, these operations require a wide range of speed and power, as well as normal and reverse rotations, and reciprocating operations.

The problem, therefore, of providing a power transmission for driving the bull wheel involves essential difficulties, the solution of which is limited by the necessary disposition of the various units of the apparatus in respect of the well hole and derrick.

The construction about to be described provides an efficient form of transmission adapted to the various requirements essential to the operation of the bull wheel, and also one that is readily incorporated into the general combination of the various units comprising the combined drilling and pumping apparatus.

A sprocket 17 is adapted to be engaged and disengaged from the shaft 5 by a clutch 18. A chain 19 transmits power from the sprocket 17 to the sprocket 20 on a stud shaft 21 journaled in a housing 22. The housing 22 is located near the base of the jack post 7 that supports the forward bearing for the shaft 5. The shaft 21 extends through one wall of the housing 22 and is parallel with the shaft 5. The shaft 21 has a beveled gear 23 connected thereto, which meshes with a beveled gear 24, the axis of which is at right angles to the gear 23. A short shaft 25 carries the beveled gear 24 and extends outwardly through a wall of the housing 22, that is at right angles to the wall in which the shaft 21 is supported. The gear ratio between the sprocket 17 and sprocket 20 is such that the stud shaft 21 will be driven at an increased speed in respect of the speed of rotation of the shaft 5.

It will be noted that the housing is substantially below the crank shaft 5, thus avoiding interference with the chain drive of the calf wheel. It will also be noted that the distance between the centers of the shaft 5 and the shaft 21 is short and, therefore, that there is a convenient arrangement for driving the shaft 21 from the shaft 5 through a short chain connection. A relatively long section of shafting 26 extends from the outer end of the shaft 25, to which it is connected by a shaft coupling 27, to a point adjacent to the remote side of the derrick floor. The shafting section 26 is supported in a plurality of bearings 28 carried by pedestals or base supports 29 positioned below the derrick floor 30, so that the shaft section 26 does not afford an obstruction above the derrick floor, but leaves the derrick floor free from interference and available for the well operators.

It should be noted that the clutch 18 may be arranged for convenient operation through a lever system controlled from a point near the well hole, if desired.

The forward end of the shaft section 26 is connected with a stud shaft 31 journaled in the housing 32, said housing being supported by a base 33, the upper face of which is a sufficient distance below the derrick floor to support the housing 32 below the derrick floor. A releasable shaft coupling 34 serves to connect the shaft section 26 with the shaft 31. The shaft 31 carries, at its inner end and within the housing 32, a gear 35 that meshes with the bevel gear 36 also within the housing, and the axis of which extends at right angles to the axis of the gear 35. The gear 36 is carried by a shaft 37 that extends through a wall of the housing 32 and is supported at its outer extremity in a bearing 38 mounted on the base 33. The shaft 37 intermediate of the housing and the gear is provided with a sprocket that is adapted to be connected and released in respect of the shaft 37 by a friction clutch 40 of a type that may be adjusted to withstand predetermined loads without slipping. A chain drive 41 extends upwardly from the sprocket 39 to a sprocket 42 carried on the bull wheel shaft. The ratio of the sprockets 39 and 42 is such that the bull wheel is driven at a decreased speed in respect to the speed of rotation of the shaft 37. The clutch 40 may be operated by any convenient lever mechanism under the control of the operator.

From the foregoing description it will be understood that the power transmission of the present invention has a wide flexibility, for example, when it is desired to operate the pump mechanism or any of the hoisting devices driven from the crank shaft other than the bull wheel, by disconnecting the clutch 18, the transmission will remain idle although available by the manipulation of the clutch for instant service, without the necessity of connecting and disconnecting the tug ropes, as is the present practice.

By providing the clutch 40 the device may be manipulated conveniently for hoisting the various loads imposed on the bull wheel.

I am aware that the invention may be modified in certain particulars without departing from the spirit and scope of the invention. I do not limit myself to the exact mechanism described, but what I claim and desire to secure by Letters Patent is:

1. In a well drilling and pumping apparatus having a crank shaft, means for driving a hoisting drum from the crank shaft thereof, comprising a shaft transmission, a flexible transmission between the shaft transmission and the crank shaft for driving the same at an increased speed, a second flexible trans-

mission between the shaft transmission and the hoisting drum, and selective devices for controlling the drive of said shaft transmission from the crank shaft and from the shaft transmission to the hoisting drum.

2. In a drilling and pumping apparatus having a crank shaft, the combination with the crank shaft thereof, of a hoisting drum located remote from said crank shaft and means for driving the hoisting drum from the crank shaft comprising a shaft transmission journaled for rotation on an axis at right angles to the axis of the crank shaft and to the axis of the hoisting drum, connections between said shaft transmission and the crank shaft, and connections between the shaft transmission and the hoisting drum.

3. In a drilling and pumping apparatus including a derrick having a derrick floor, a hoisting drum journaled for rotation in the derrick, a crank shaft journaled for rotation remote from the derrick and means for driving the hoisting drum from the crank shaft comprising an intermediate shaft drive between the crank shaft and the hoisting drum located below the derrick floor, driving connections for driving said shaft drive from the crank shaft, and driving connections for driving the hoisting drum from said shaft drive.

4. In an apparatus of the class described, a power driven crank shaft, a hoisting drum having an axis of rotation parallel with the axis of rotation of the crank shaft and means for driving the hoisting drum from the crank shaft comprising a longitudinally extending shaft intermediate the hoisting drum and the crank shaft, a chain and sprocket drive geared to rotate said longitudinal shaft at an increased speed in respect to the speed of rotation of the crank shaft, and a chain and sprocket drive between the hoisting drum and said longitudinal shaft geared to rotate the hoisting drum at a decreased speed in respect of the said longitudinal shaft.

5. In an apparatus of the class described, a derrick, a hoisting drum located in the derrick, a crank shaft located remote from the derrick, and means for driving the hoisting drum from the crank shaft comprising an intermediate shaft extending at right angles to the axis of the hoisting drum and to the axis of the crank shaft, driving connections for driving said intermediate shaft from the crank shaft, and driving connections for driving the hoisting drum from said intermediate shaft.

6. In an apparatus of the class described, a derrick, a hoisting drum located in the derrick, a crank shaft located remote from the derrick, and means for driving the hoisting drum from the crank shaft comprising an intermediate shaft extending at right angles to the axis of the hoisting drum and to the axis of the crank shaft, driving connections for driving said intermediate shaft from the crank shaft, driving connections for driving the hoisting drum from said intermediate shaft, and a clutch device for engaging and disengaging said intermediate shaft with said crank shaft.

7. In an apparatus of the class described, a derrick, a hoisting drum located in the derrick, a crank shaft located remote from the derrick, and means for driving the hoisting drum from the crank shaft comprising an intermediate shaft extending at right angles to the axis of the hoisting drum and to the axis of the crank shaft, driving connections for driving said intermediate shaft from the crank shaft, driving connections for driving the hoisting drum from said intermediate shaft, and a clutch device for engaging and disengaging said intermediate shaft from said hoisting drum.

8. In an apparatus of the class described, a derrick, a hoisting drum located in the derrick, a crank shaft located remote from the derrick, and means for driving the hoisting drum from the crank shaft comprising an intermediate shaft extending at right angles to the axis of the hoisting drum and to the axis of the crank shaft, driving connections for driving said intermediate shaft from the crank shaft, driving connections for driving the hoisting drum from said intermediate shaft, a clutch device for engaging and disengaging said intermediate shaft with said crank shaft, and a clutch device for engaging and disengaging said intermediate shaft from said hoisting drum.

9. In a well drilling and pumping apparatus, including a crank shaft for driving the pumping mechanism a derrick, and a prime mover for said crank shaft; the combination of a bull wheel mounted for rotation within the derrick, a shaft drive intermediate the crank shaft and the bull wheel, a chain and sprocket drive between the crank shaft and the shaft drive, a chain and sprocket drive between the shaft drive and the bull wheel, a clutch device for controlling said first named chain and sprocket drive, and a clutch device for controlling said second chain and sprocket drive.

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