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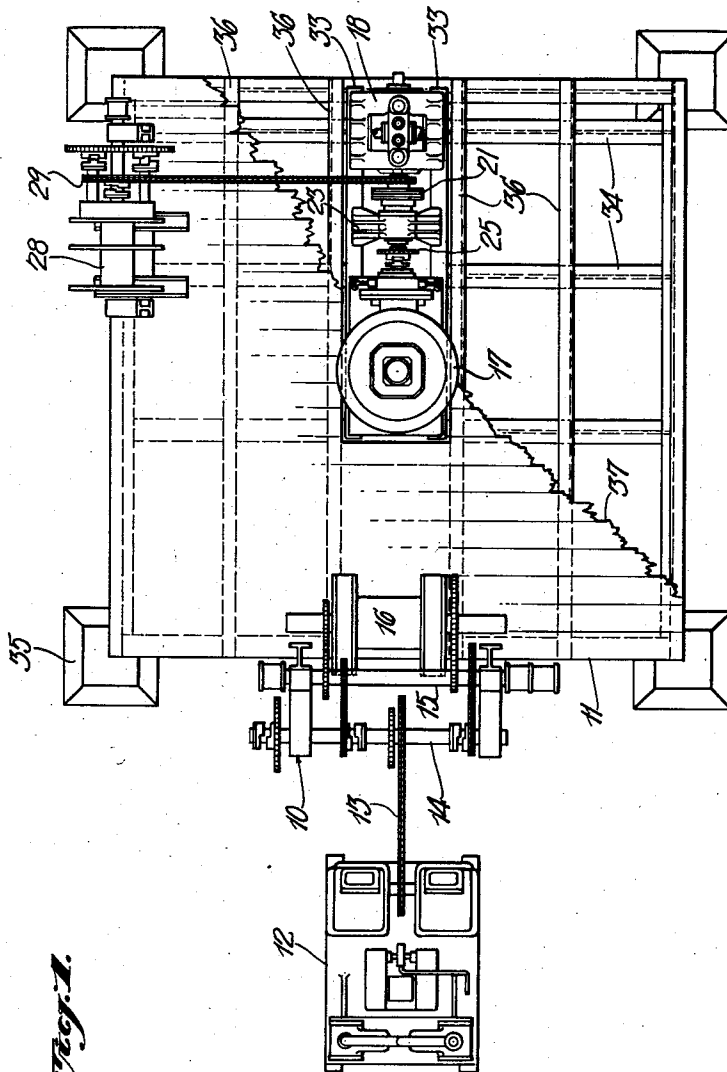
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2,133,017

ROTARY DRILLING APPARATUS

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4 Sheets-Sheet 1



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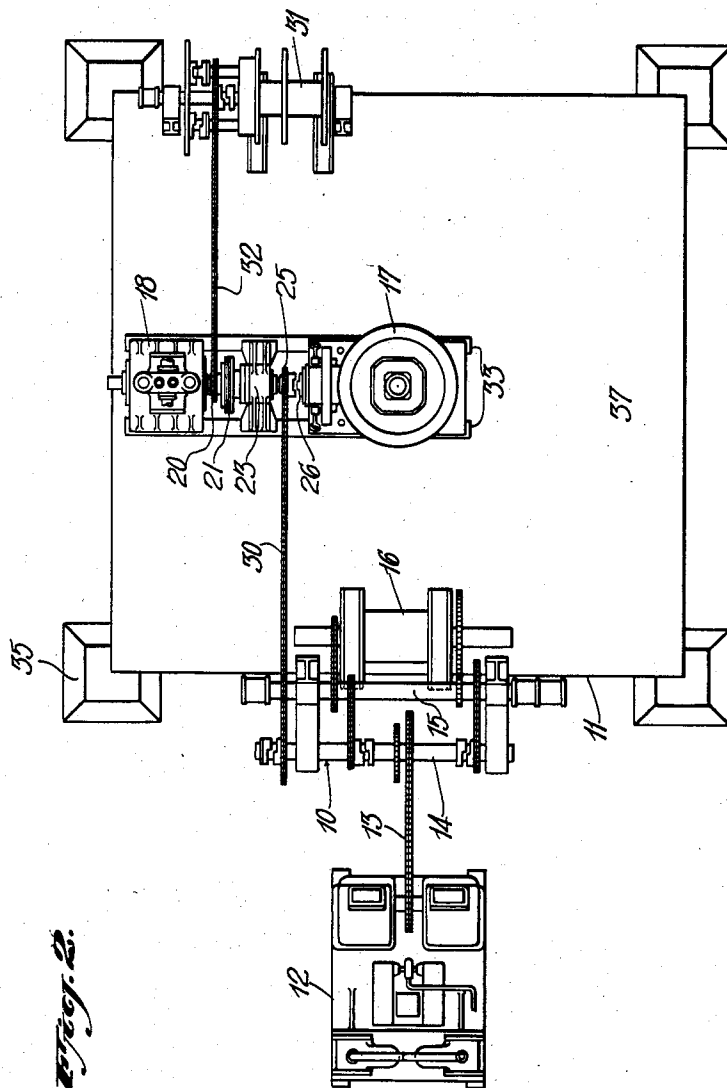
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4 Sheets-Sheet 2



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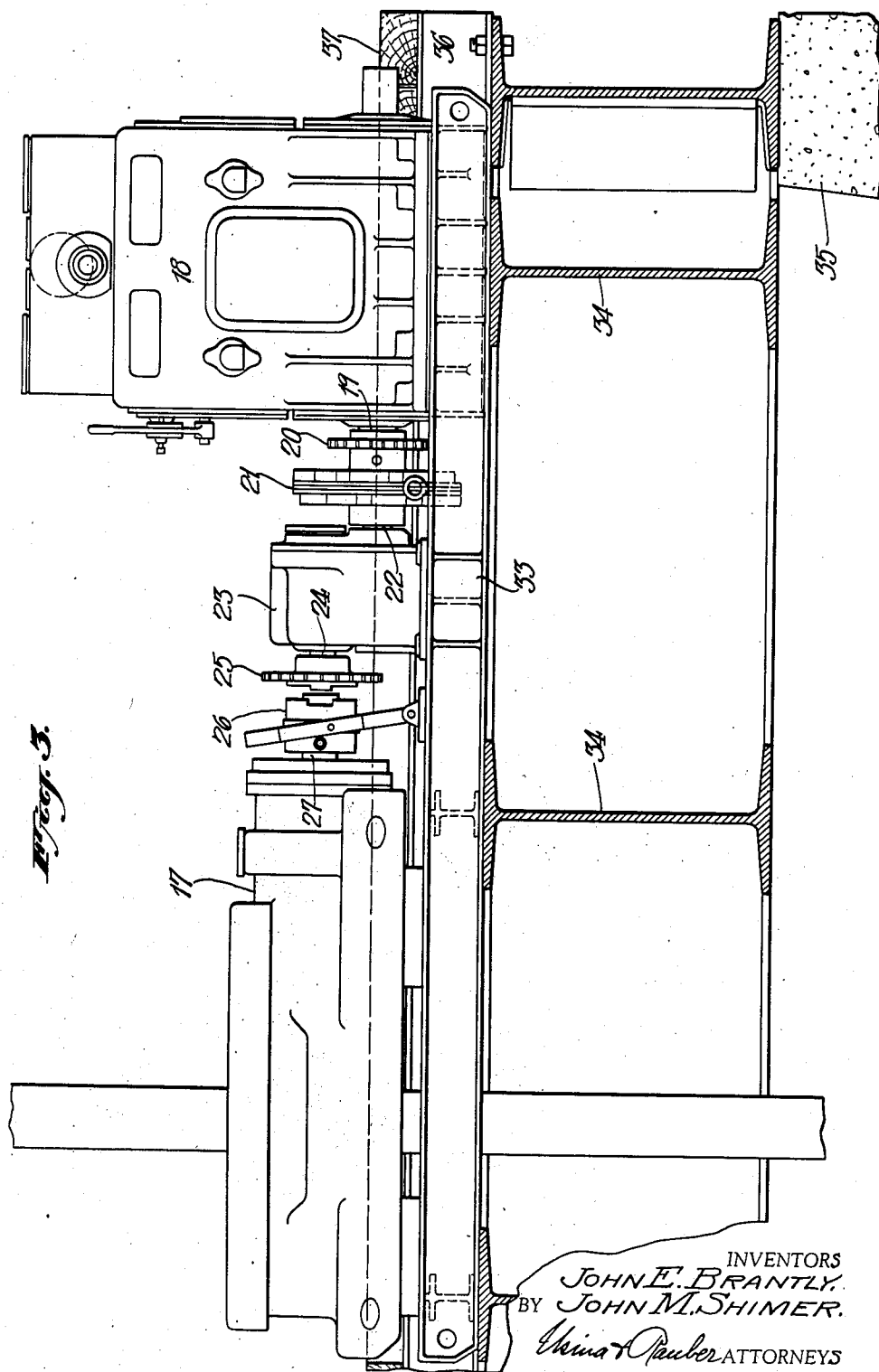
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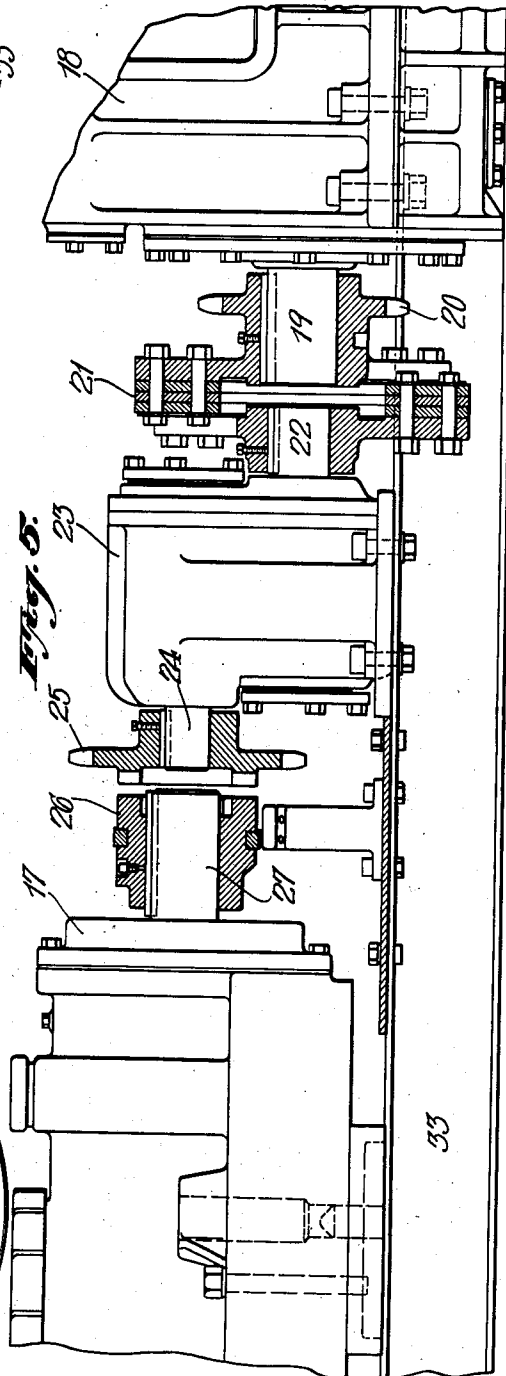
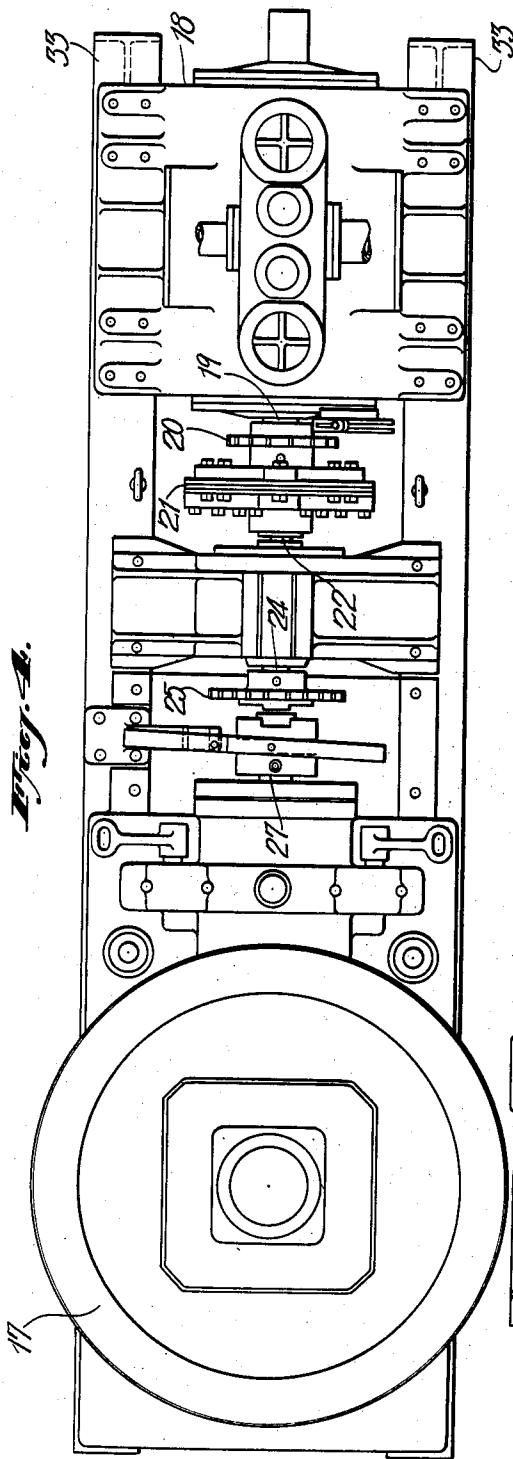
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,133,017

ROTARY DRILLING APPARATUS

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Application August 16, 1935, Serial No. 36,572

2 Claims. (Cl. 255—19)

This invention relates to rotary drilling apparatus of the type used in drilling deep petroleum wells.

Rotary apparatus for drilling wells comprises a rotary having a rotating table, through which a drill stem is rotated, and hoisting mechanisms for raising and lowering the drill stem, casing pipe, etc. Heretofore, the rotary and the hoisting apparatus have commonly been driven from a common source of power through a drawworks on which a hoisting drum was mounted. Power to rotate the rotary was transmitted by a sprocket chain extending from the drawworks at the side of the derrick to the rotary at the center of the derrick.

This arrangement for driving the rotary and the hoisting mechanisms has a number of disadvantages, among which are the space taken up within the derrick by the rotary chain and its guard, the noise and wear of the rotary chain and the difficulty in setting the rotary in position to drill a "rat hole" to receive the girth stem when the latter is hauled out of the well and disconnected from the hoisting apparatus. Moreover, a more powerful engine is required to operate the hoists than to rotate the rotary and, in driving the rotary from an engine common to the hoist as is necessary in the drawworks arrangement heretofore used, the engine is run inefficiently a large part of the time because it is only required for short intervals for driving the hoists and but a small part of its power is used when driving the rotary alone.

The control of the drilling operations is also more cumbersome when the rotary and hoisting mechanisms are driven from a common source of power because each operation is governed to some extent by the requirements of the other.

These various disadvantages are obviated and avoided in our present invention, in which the rotary is driven independently of the motive power for driving the hoisting mechanism or drawworks and in which a smaller power suited for driving the rotary efficiently may be employed.

The various features of the invention are illustrated in the accompanying drawings, in which

Fig. 1 is a plan view of a California rig embodying a preferred form of the invention; Fig. 2 is a plan view of a Mid-Continent arrangement embodying the invention; Fig. 3 is a side view of the rotary drilling unit; Fig. 4 is a plan view of the rotary unit; and Fig. 5 is a side view similar to that of Fig. 3 but on a larger scale with parts

broken away to show the construction of the parts.

In our invention we provide the usual drawworks and hoist mechanism and an engine for driving them. We also provide a rotary and a separate engine for driving it. The rotary driving engine is of smaller power than that for operating the hoist inasmuch as less power is required to rotate the rotary than is required to hoist the drilling equipment. The rotary driving engine may be of only sufficient power to drive the rotary under normal drilling conditions and to stall when such resistance to the rotation of the drill is encountered as might twist off or break the drill stem or other parts being driven from the rotary. The rotary and its driving unit are mounted independently of the drawworks and its drill so that it may be moved to various positions on the derrick floor. The engine for driving the rotary may also be provided with auxiliary connections to the drawworks or to the hoisting mechanisms to operate the latter and hoist the tools in the event that the main hoisting engine or the drawworks become broken or inoperative. For these emergency purposes the rotary may be disconnected from its driving engine and the latter connected to the auxiliary hoist operating mechanism.

Referring more particularly to Figs. 1 and 2 of the accompanying drawings, drawworks 10 is mounted at one side of a derrick 11 and is driven from a hoisting engine 12 through a sprocket chain 13 which drives the jack shaft 14 of the drawworks. The power is transmitted in the usual form from the jack shaft 14 to the line shaft 15 and thence to the hoisting drum 16.

Placed centrally of the derrick floor and directly over the well to be drilled is a rotary table 17. This rotary table is mounted independently of the drawworks 10 and is driven by an engine 18. The engine 18 is preferably such as to provide power to rotate the rotary under normal drilling conditions but with insufficient power to drive the rotary if any part of the drilling tools become fast in the well and therefore insufficient to break the drill stem or other part of the drilling apparatus in the event of a stoppage of the stem or drilling tools.

Power may be transmitted from the engine 18 to the rotary 17 through any suitable mechanism. The engine and driving mechanisms are however preferably so arranged that in case of emergency the rotary may be declutched or disconnected from the engine and the latter

used to operate the hoisting mechanisms. For this purpose power is transmitted from the engine 18 through a shaft 19 which carries a sprocket 20 and which is connected through a flexible coupling 21 to drive shaft 22 of a speed multiplying mechanism 23. From the latter power is transmitted at an increased speed through the shaft 24 which carries a sprocket wheel 25 and through a clutch 26 to the driving shaft 27 of the rotary. In the normal operation of the apparatus the clutch 26 will be engaged and the engine 18 will drive the rotary 17 independently of the hoisting mechanism and drawworks.

In case of emergency however the clutch 26 may be disengaged or unclutched and the sprocket 25 or 20 may be used to drive an auxiliary hoist. In the California arrangement shown in Fig. 1 a calf wheel 28 to which the dead end of the hoisting cable is attached may be driven from the sprocket wheel 26 through a chain 29. It will be understood, of course, that during normal operations the chain 29 will be removed or in any event will be disconnected from the calf wheel. In the Mid-Continent arrangement shown in Fig. 2 the main drawworks 10 may be driven, after disconnecting the clutch 26 from the sprocket wheel 25, through a chain 30 which may be mounted on the sprocket 25 to connect it to the jack shaft 14 of the drawworks. In case a calf wheel 31 is provided for the dead end of the cable, this calf wheel may be driven from the sprocket 20 through a chain 32. These are only emergency connections and it will be understood that they are not used in normal drilling.

The rotary and its driving mechanism are mounted on a base formed of the skids 33 which rest on supporting beams 34 resting on concrete piers 35. It is therefore mounted below the joists or I-beams 36 upon which the planking 37 of the derrick floor is mounted. This mounting brings the face of the rotary table only slightly above the derrick floor. The invention provides an effective reduction in the floor space occupied by the drilling apparatus because the driving engine for the rotary occupies a space that is otherwise not used and the elimination of the driving chain between the derricks and the rotary leaves this space free.

Our invention also enables the rotary to be moved freely about the derrick whenever required. It is, for example, customary to drill at a short distance from the well an auxiliary shallow well, commonly called a "rat hole" of a depth somewhat less than the length of the grief stem. With our invention the rotary and

its driving mechanism and engine may be moved temporarily to a position to drill the rat hole without the necessity of lining up the drawworks to enable it to drive the rotary as in the arrangements heretofore used.

It will be understood that the engine or power for driving the rotary, being independent of the torque operating the hoists, may be made less powerful. By making the maximum torque exerted by this engine less than the torsional strength of the drill stem all possibility of twisting off of the drill is eliminated. Elimination of the rotary chain and sprocket for driving the rotary from the drawworks saves valuable room on the derrick floor and provides a free passage between the drawworks and the rotary. The noise caused by the rotary chain drive and the wear and replacement cost of the rotary chain are also avoided. Wear on the rotary main engine is avoided. It is no longer necessary to run these large and heavy power elements except when the hoist is being operated. The independence of the rotary from the hoist also is advantageous in spudding because the hoist and the rotary can be operated simultaneously. The table can be turned at any speed desired, and at the same time, the drill stem or pipe can be raised or lowered through the table as often as desired, and provides an effective means for clearing the ball from the bit. The independent drive of the rotary and hoist enables the drill to drill upwardly and thus to drill out bridges or cave ins that may occur above the bit.

What we claim is:

1. A drilling apparatus which comprises a rotary, an engine for driving said rotary, a common supporting base for said engine and said rotary, a speed multiplying mechanism between said engine and said rotary, connecting means between said speed multiplying means and said rotary, an emergency hoist driving sprocket between said engine and said connecting means and driven by said engine, and a second hoist driving sprocket driven by said speed multiplying mechanism.

2. A drilling apparatus which comprises a rotary, an engine for driving said rotary, a speed multiplying mechanism between the engine and the rotary, clutch means between the speed multiplying mechanism and the rotary, a driving sprocket between the engine and the clutch means and driven by the engine, and a second driving sprocket between the clutch means and the speed multiplying means and driven by said speed multiplying means.

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