Oct. 19, 1937. W. R. WALNE 2,096,150

MULTIPLE ENGINE DRILL

Filed July 8, 1936 2 Sheets-Sheet 1

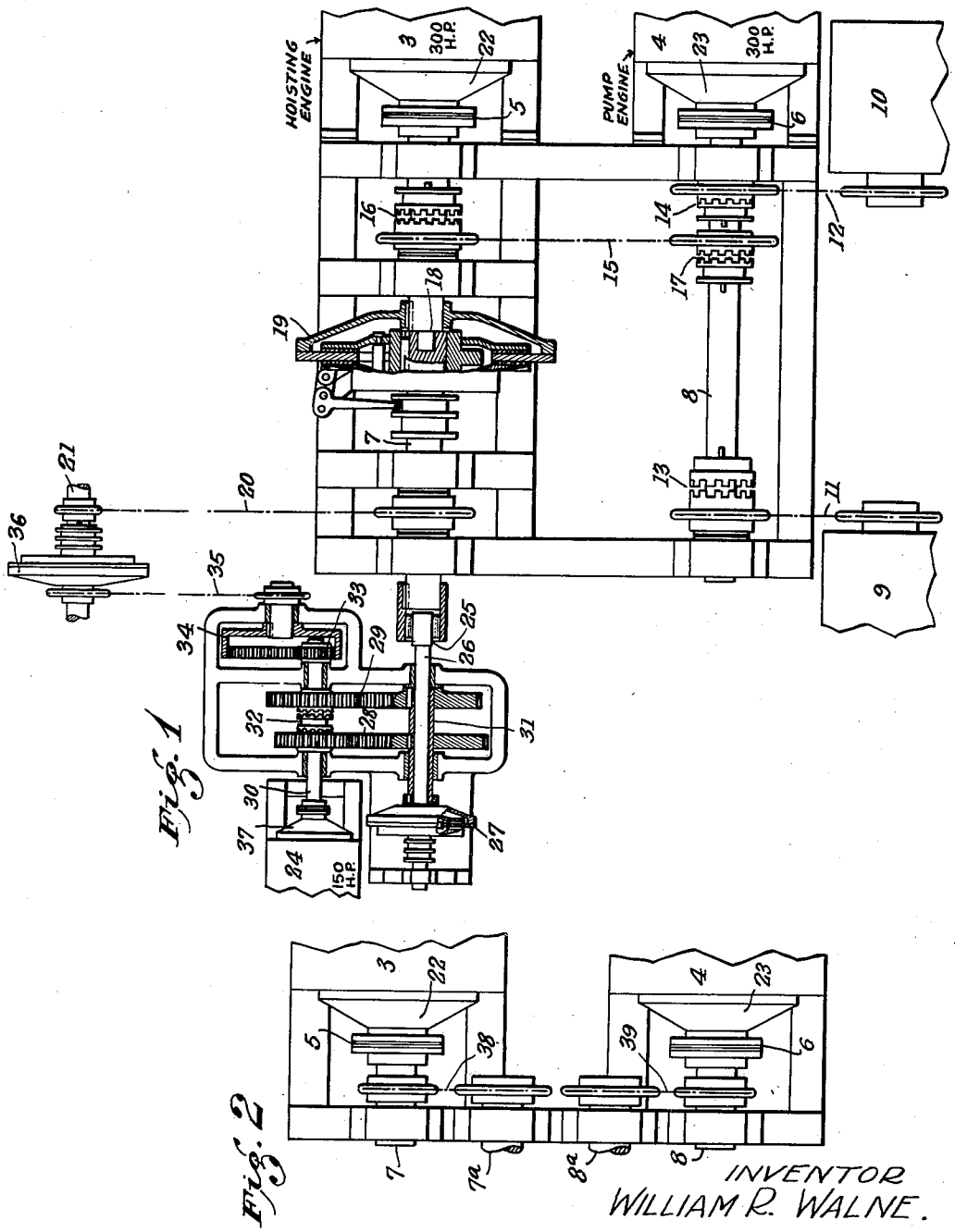


Fig. 1

Fig. 2

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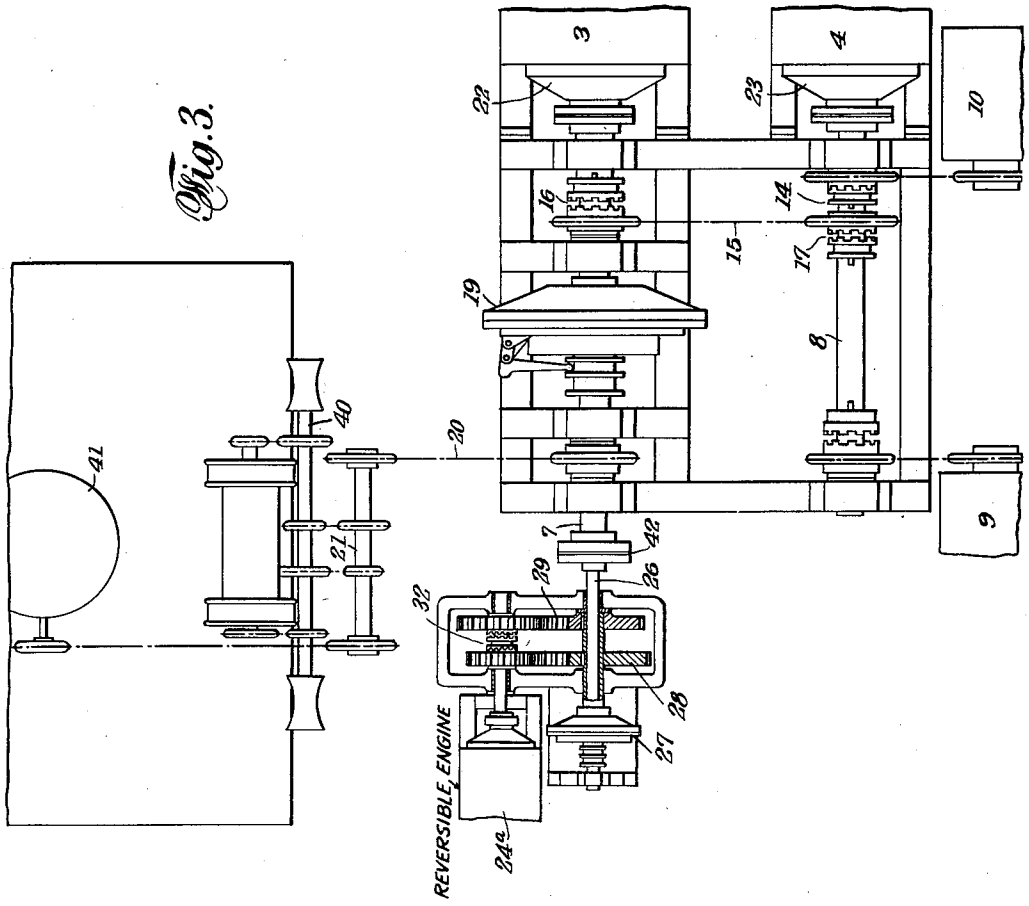
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Fig. 3.



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MULTIPLE ENGINE DRILL

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8 Claims. (Cl. 255—19)

This invention relates to the drilling of wells by engines of the internal combustion type, particularly Diesel engines.

Multiple engine drives have been operated heretofore but subject to certain definite objections; they have been particularly heavy units, taking up considerable space and requiring extensive foundations and complicated controls and accessories; there has been a lack of desirable flexibility such as would enable efficient control of the hoisting mechanism; the power for actual drilling operations in rotating the drill pipe has been too great, resulting in too heavy strain on the drill pipe, causing twist-offs and other troubles; undue strains have been put on the draw-works because of the full horsepower being suddenly applied to the load; and these prior outfits have been costly, expensive to maintain and operate and difficult of repair and replacement of parts.

Without attempting to enumerate all other faults, it may be stated that the objects of this invention are to overcome and eliminate the objections and deficiencies in prior apparatus of this type and in particular to provide relatively simple and compact apparatus which will have the desired degree of flexibility and control, enabling application of a desired low horsepower to operation of a rotary table, the starting of hoisting operations slowly and without initial strain and the application of additional necessary power gradually and as required, the provision of low horsepower for reversing operations, low horsepower and low gear for the finer work about the hoist such as required in "fishing", etc., provision of a complete standby power unit independent of the regular hoisting and pumping engines, in some instances, the running of the reversing mechanism always in the one direction, so as to eliminate need for reversing parts or stopping and then turning in the opposite direction; as well as many other desirable objects and results, as will appear in the course of the following specification.

The drawings accompanying and forming part of the specification illustrate certain present preferred embodiments of the invention, but as the invention is of broad scope, it will be understoood that the structure may be modified and changed all within the true intent and broad scope of the appended claims.

Fig. 1 is a broken and partly sectional plan view of one embodiment of the invention as particularly designed for direct drive low speed engines.

Fig. 2 is a broken partly sectional detail of a form of the invention designed especially for high speed engines operating through reduction gearing. Fig. 3 is a broken part sectional plan of a further modification.

In these illustrations, there are indicated two heavy duty engines 3 and 4, which for convenience may be termed the hoisting and pump engines, in accordance with their principal duties. These main engines may be duplicates in every respect, for convenience of substitution, replacement of parts, etc., and they are indicated as mounted in substantially parallel relation with their shafts turning in the same direction and connected by couplings 5, 6, with extension shafting 7, 8, which conveniently may be referred to as the hoisting power shaft and the pump power shaft respectively.

The pumps are indicated at 9, 10, operated from the pump shaft 8, through sprocket gearing 11, 12, under control of jaw clutches 13, 14.

Power compounding connections are indicated in the way of sprocket gearing 15, between the shafts 7, 8, governed by the jaw clutches 16, 17, at these respective shafts.

The shafting 7, is shown as "split" at 18, and the two shaft sections as capable of being coupled together by a heavy duty friction clutch 19. The driven portion of this sectional shafting, at the left in Fig. 1, is shown as connected by sprocket chain drive 20, with the jack shaft 21, of the draw-works. This constitutes the forward drive for the draw-works and the rotary connected with the draw-works.

By the combination thus far disclosed, either or both the hoisting and pumping engines may be applied to the driving of either or both pumps or to the draw-works and rotary, or both to the pumps and to the rotary and draw-works. Details of the draw-works 40, Fig. 3, are not shown, but this may be of any standard design in which power applied to the jack shaft may be controlled entirely for hoisting purposes or for driving the rotary, 41, or may be applied to both hoisting and rotary purposes.

It will be seen that with clutch 19, closed, the full power of both engines may be applied to the draw-works when the power compounding clutches 16, 17, are closed, that with clutch 17 open, the power of the hoisting engine only will be applied to the draw-works and that if desired, with both clutches 16 and 17 closed, and the engine clutch 22, of the hoisting engine open, the power of the pumping engine alone may be applied to the draw-works; with the clutch 19

open and the power compounding clutches 16, 17, engaged, the power of both engines may be applied to either or both pumps; with clutch 16 open, engine 4 alone may drive either or both pumps and with the power compounding clutches 16, 17, engaged and the engine clutch 23 of the pumping engine open, the power of the hoisting engine alone may be applied to the operation of one or both pumps.

For the lighter operations, such as simply turning the rotary table and for reversing the draw-works, a separate lesser horsepower engine 24, Fig. 1, is provided. In a typical example, if the main engines are 300 horsepower each this special, lighter engine may be on the order of 150 horsepower.

For low horsepower forward speed drive, the engine 24 is shown connected with the forward speed drive shaft 7, by an overrunning or so-called free wheeling clutch 25, interposed between the left hand driven section of shaft 7, and an aligned shafting 26, carrying a friction clutch 27, by which it may be coupled to engine 24.

In this particular illustration, a two speed reduction gear set is interposed between engine 24 and clutch shaft 26, the same comprising the two sets of different speed gears 28, 29, between shaft 30 of engine 24 and the clutch carrying sleeve 31, on shaft 26. These two lines of different speed gears are shown as controllable by a reversely acting jaw clutch 32, which in Fig. 1, is shiftable to the left to couple up one set of gears 28, and to the right to couple up the other set of transmission gears 29.

It will be apparent that through the transmission last described, the lighter or lesser horsepower engine 24, may be used to drive draw-works and rotary at different speeds, according to the setting of the clutch mechanism at 32, and according to whether or not the clutch 27 is engaged. The free wheeling clutch 25 is effective to drive the shaft 7 in this forward running direction. At such times, the clutch 19 on such shaft ordinarily will be disengaged. If however, at any time the power of one or the other, or both, the main engines is required, this clutch can be thrown in and the one way clutch 25 will simply start "free wheeling" as the main engine or engines pick up and take the load away from the small engine.

Thus the low horsepower engine may be used to start lifting and then one or the other, or both the main engines may be cut in to gradually take the load off the smaller engine.

Reverse operations are effected from the low horsepower engine, connections for this purpose consisting in the illustration Fig. 1, of the pinion 33, on the engine extension shafting 30, in engagement with an internal gear 34, connected by sprocket chain drive 35, with the reverse clutch 36, on the jack shaft 21. With this drive, the free part of the reverse clutch 36 will be turning slowly so long as the small engine is in operation, with the engine clutch engaged at 37. Consequently reversal of parts can be effected quickly, without shock and without waiting to stop certain parts.

The low horsepower engine, in addition to its use for reversing purposes and for driving the rotary table, may be used, at any time, as an auxiliary for rigging up operations, for hoisting at shallow depths, for starting or turning over either of the main engines, etc. In the latter operations, the main clutch 19 would be engaged and as soon as it started, the one way clutch at 25 would permit the main engine to run under its own power independently of the auxiliary engine.

The main engines usually will be Diesel engines. These have a more or less constant speed characteristic. The auxiliary or low powered engine may be of the Diesel type, or if desired, be simply a gasoline engine of variable speed characteristics. In the latter event, a greater range of speed might be provided for the lighter operations around the derrick, but for average purposes, the variable speed transmission would provide sufficient range of speed with an ordinary Diesel engine.

With so-called low speed engines, the main engines may be direct connected with the extension shafting 7, 8, but with high speed engines, a gear reduction may be desirable, such as shown in Fig. 2, where these two engines are connected through reduction chain gearing 38, 39, with shafting 7a and 8a, corresponding to the shafting 7, 8, in Fig. 1.

The uses and advantages of the invention are apparent from the foregoing.

In drilling operations, the reverse clutch 36, is out and the low power engine 24 may be used to drive the rotary table through one set of gears 28 or 29, in the variable speed transmission, clutch 27, being engaged so that power will be transmitted through the overriding clutch 25, to the left hand shaft section 7, carrying the forward drive chain 20. Clutch 19 at this time is disengaged and the hoisting engine 3 at the time may be either stopped, idling, or connected with the pump shaft 8, to help pump engine 4. If engine 4 is shut down, the engine 3 may be driving the pumps alone. If, at any time, greater power is required at the rotary, this may be supplied by either engine 3 or 4, with clutch 19 engaged.

In starting to hoist, the main clutch 19, is out, leaving both main engines disconnected from the draw-works. With the lower power engine in operation, clutch 27 may be engaged to start hoisting the load in low gear. Then as the main clutch 19 is thrown in, the power of either or both the main engines 3, 4, may be applied to the draw-works and in so doing, these will pick up the load started by the small engine, leaving the latter free through the free wheeling clutch 25. Clutch 27 may then be opened to uncouple the small engine.

For reversing, the main clutch 19, and the auxiliary clutch 27, are both opened and the reverse clutch 36, on the jack shaft is engaged to impart reverse rotation to the draw-works, and if desired, to the rotary table driven from the draw-works.

In the present invention, all reversing and the driving of the rotary is effected by auxiliary power separate and independent of the main power provided for pumping and hoisting and is combined in such a way that the low speed, low power unit may be employed to start the heavy loads, the over-riding clutch enabling the main power unit to pick up and carry the load thus started.

By using a reversible engine for the low power work, the special reversing connections shown in Fig. 1 may be eliminated and the structure be considerably simplified.

In Fig. 3 a reversing engine is indicated at 24a, driving the power shaft 7, through the two speed transmission 28, 29, but in this particular instance, the drive from the transmission shaft 26 to shafting 7 is through an ordinary coupling 42, instead of through an over-running clutch,

such as used in Fig. 1. Reverse drive is effected by reversing the engine **24a**, which then, through the same sprocket chain connections at **20**, can turn the draw-works and the rotary if necessary, in the reverse direction. Thus by comparison with Fig. 1, it will be seen that the use of the reversible engine eliminates the need for the reverse gearing **33**, **34**, the reverse chain **35**, the reverse clutch **36**, on the jack shaft and substitutes a simple coupling **42**, for the free wheeling clutch **25**.

What is claimed is:

1. A multiple engine drill, comprising in combination with draw-works and rotary table, a main hoist engine, a main pump engine, connections from said pump engine for operating the pumps, power compounding connections between said two main engines, forward drive connections from said hoisting engine to the draw-works, an auxiliary lesser power engine, drive connections from said auxiliary engine to said forward drive connections for the rotary and including an over-riding clutch enabling the hoisting engine to over-ride the drive from the auxiliary engine, and reversely driving connections from said auxiliary engine to the draw-works, including a reverse clutch at the draw-works.

2. A multiple engine drilling organization including in combination, a rotary, draw-works and pumps, a main hoisting engine and a main pumping engine, drive connections for compounding the power of said two main engines for driving the pumps and for driving the draw-works in a forward direction, a lower power auxiliary engine for driving the rotary and for reversing operations, forward drive connections from said auxiliary engine to the draw-works and including an over-riding clutch for enabling the main hoisting engine to take the forward driving load away from the auxiliary engine and reverse drive connections from said auxiliary engine to said draw-works.

3. A multiple engine drill organization, comprising in combination with a rotary and draw-works, a hoisting engine and a pump engine, power compounding connections between the two and forward drive connections from the two to the draw-works, an auxiliary engine, forward drive connections from said auxiliary engine to the draw-works and including a change speed transmission and a free wheeling clutch enabling overdrive by the hoisting and pump engines and reversely running drive connections from said auxiliary engine to the draw-works.

4. A multiple engine drill organization, comprising in combination with a rotary and draw-works, a hoisting engine and a pump engine, power compounding connections between the two and forward drive connections from the two to the draw-works, an auxiliary engine, forward drive connections from said auxiliary engine to the draw-works and including a change speed transmission and a free wheeling clutch enabling over-drive by the hoisting and pump engines and reversely running drive connections from said auxiliary engine to the draw-works, including low speed reduction gearing in the transmission aforesaid.

5. A multiple engine drill, comprising in combination with draw-works and rotary table, a main hoist engine, a main pump engine, connections from said pump engine for operating the pumps, power compounding connections between said two main engines, drive connections from said hoisting engine to the draw-works, an auxiliary lesser power engine and drive connections from said auxiliary engine to said drive connections for the draw-works including clutch means by which said auxiliary engine may be cut into and out of service.

6. A multiple engine drill, comprising in combination with draw-works and rotary table, a main hoist engine, a main pump engine, connections from said pump engine for operating the pumps, power compounding connections between said two main engines, drive connections from said hoisting engine to the draw-works, an auxiliary lesser power engine and drive connections from said auxiliary engine to said drive connections for the draw-works including clutch means by which said auxiliary engine may be cut into and out of service, said auxiliary engine being reversible and whereby the same may be used for both forward and reverse drive through the same connections to the draw-works.

7. A multiple engine drill, comprising in combination with draw-works and rotary table, a main hoisting engine, forward drive connections from said main hoisting engine to the draw-works, an auxiliary lesser power engine for lesser power forward drive and reverse drive of the draw-works, clutch controlled drive connections from said auxiliary engine to said forward drive connections between the main hoisting engine and draw-works and clutch controlled reversely operating drive connections from said auxiliary engine to said draw-works.

8. A multiple engine drill, comprising in combination with draw-works and rotary table, a main hoisting engine, forward drive connections from said main hoisting engine to the draw-works, an auxiliary lesser power engine for lesser power forward drive and reverse drive of the draw-works, clutch controlled drive connections from said auxiliary engine to said forward drive connections between the main hoisting engine and draw-works, clutch controlled reversely operating drive connections from said auxiliary engine to said draw-works, said drive connections from said auxiliary engine to the forward drive connections from the main engine including an over-running clutch faced to start the draw-works from the auxiliary engine and to enable the main engine to pick up and carry the load started by the auxiliary engine.

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