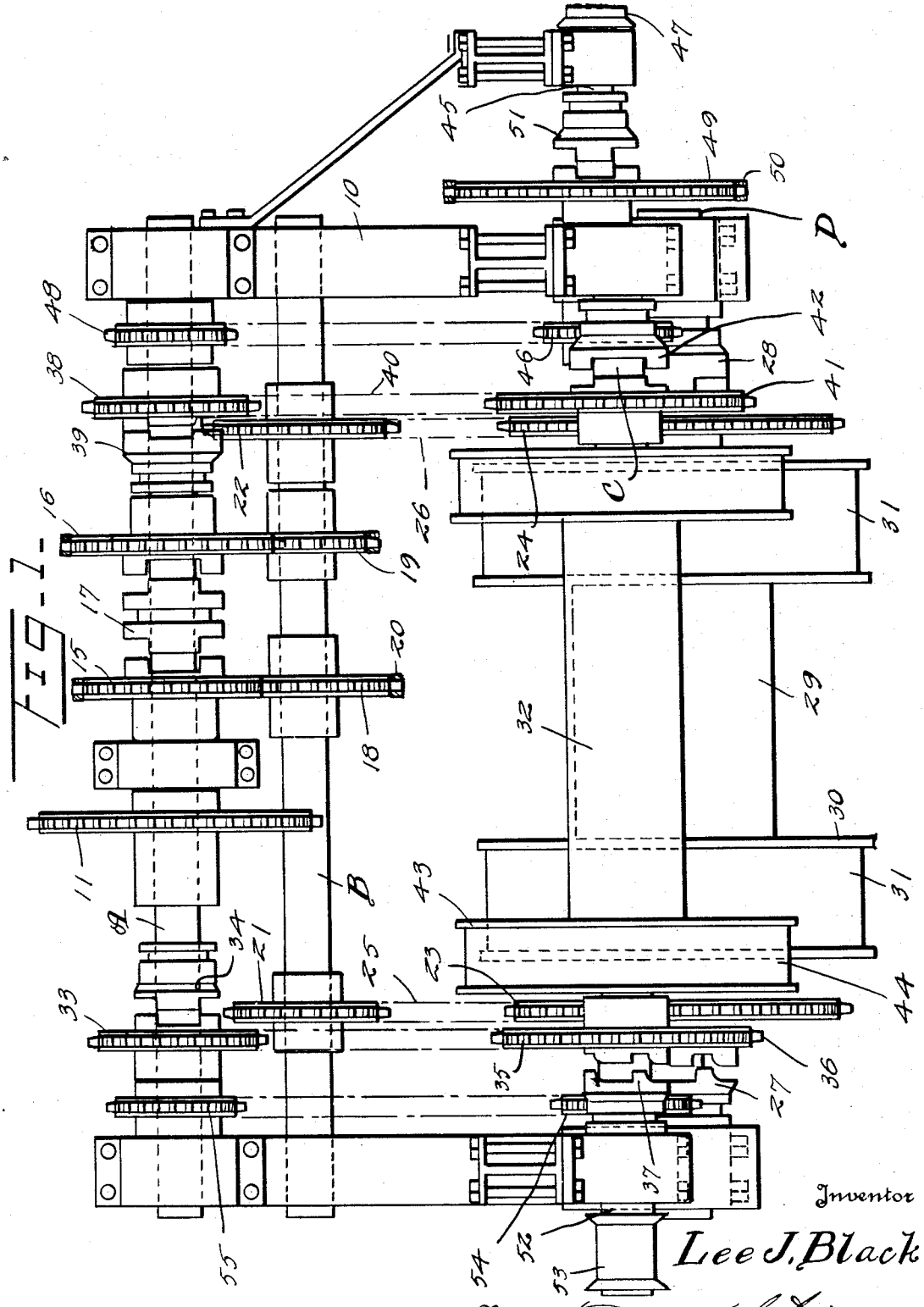
Oct. 31, 1933. L. J. BLACK 1,932,684

DRAW WORKS FOR ROTARY DRILLING MACHINES

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DRAW WORKS FOR ROTARY DRILLING MACHINES

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Fig. 2.

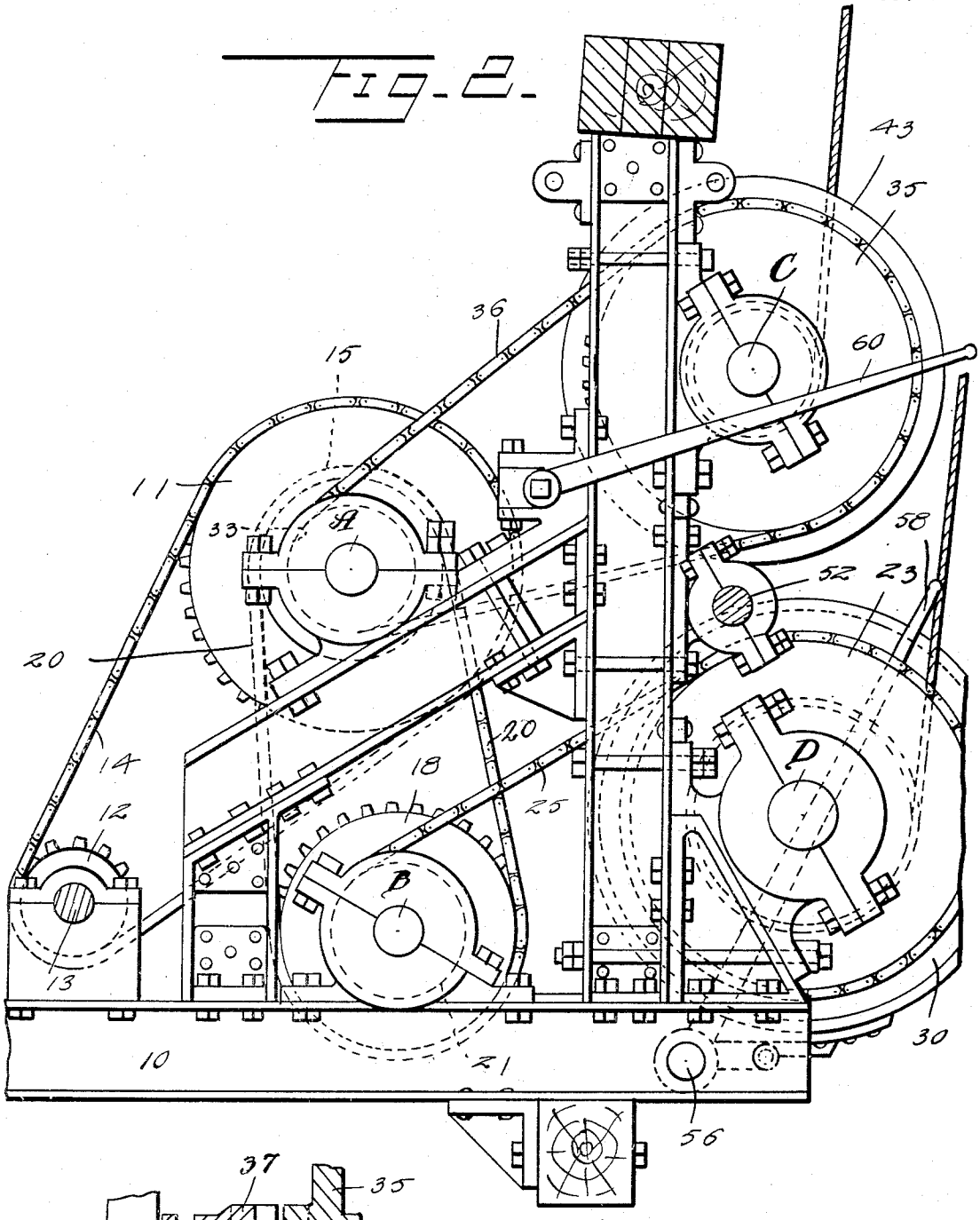
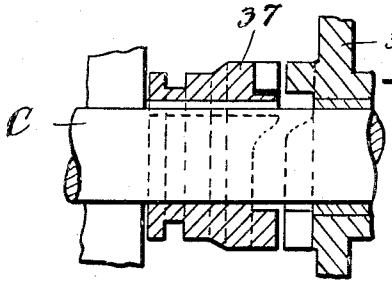


Fig. 4.



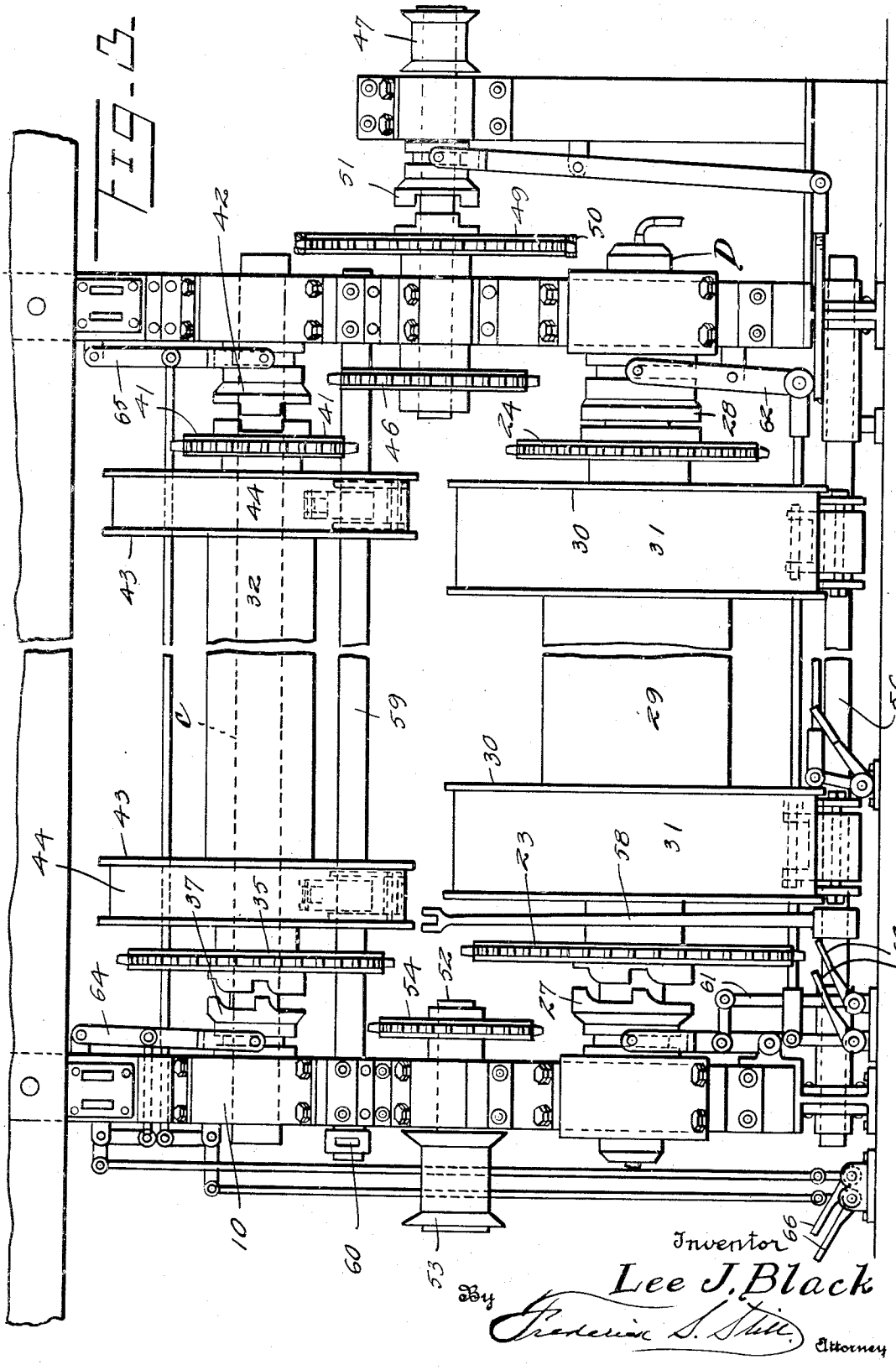
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DRAW WORKS FOR ROTARY DRILLING MACHINES

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Fig. 3.



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DRAW WORKS FOR ROTARY DRILLING MACHINES

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Application April 29, 1930. Serial No. 448,323

8 Claims. (Cl. 254—185)

This invention relates to drum driving mechanism and particularly to the draw works of rotary well drilling mechanism, which mechanism is used for drilling operations in deep wells. At the present time, in rotary well drilling, a string of drill pipe is rotated by suitable equipment located on the derrick floor and adjacent the draw works. The drill stems are formed usually of six inch pipe, but seven inch pipe is coming into use and some operators are even using eight inch pipe. This eight inch pipe will weigh approximately 32 lbs. per foot. The six inch pipe will weigh approximately 26 lbs. per foot and inasmuch as frequently six thousand feet of six inch pipe are used in a drilling system producing a weight of 156,000 lbs., which has to be handled continually, an equipment of unusual strength is necessary to be used, and modern practice requires that this shall be capable of easy and rapid operation.

The tendency of these long strings of heavy drill pipe is to bend and vibrate and this together with the changes in the formation through which the drill is operating causes the bit to leave the perpendicular and to drill crooked or slanting holes. Therefore, it is necessary to determine by suitable instruments from time to time the straightness of the hole heing drilled and such determination is usually made at each one hundred feet of hole or at any rate as often as the formation changes.

To operate these testing instruments, it is common to have a drum separate from the main drum upon which the operator can wind a line of sufficient length to run single with the measuring instruments or other means attached to the end of the line and it is not uncommon in present day practice to require a line of eight thousand feet. To meet this condition, operators have been installing separate units with winding drums operated from a second source of power. This is expensive and because of the congestion on the derrick floor, is hard to suitably install.

With these considerations in mind, the object of my present invention is to meet these conditions by providing a single operating unit driven from the source of power which will provide means for driving a main drum at a plurality of speeds, will provide a second drum upon which the testing line or other equipment may be reeled, which equipment shall not take up too mch room on the derrick floor, but be of sufficient compact formation as to allow space to stand the sections of the drill stem on the derrick and provide room for the operators to properly function.

A further object is to provide a single unit which will perform all of the operations performed by two units, with two sources of power, provide multiple speeds to handle the different operations, make the structure so compact that it will occupy less space in the derrick than present standard drawworks, and provide a construction which will permit operations to be carried on with ease and expedition.

Other objects will appear in the course of the following description.

My invention is illustrated in the accompaying drawings, wherein:—

Figure 1 is a top plan view of a draw works constructed in accordance with my invention;

Figure 2 is a section on the line 2—2 of Figure 1;

Figure 3 is a front elevation of the structure shown in Figure 2;

Figure 4 is a fragmentary detailed view through the shaft A showing in section one of the sprocket wheels and the coacting spiral clutch.

Referring to these drawings, it will be seen that I have mounted upon a supporting frame designated generally 10, the shafts A, B, C and D all of which shafts extend longitudinally of the frame. The shaft A is a driving shaft common to the shafts C and D and the shaft B is a countershaft operatively connected to the drum shaft D as will be later described to drive it.

The shaft A drives the upper drum shaft C directly and the lower or main drum shaft D indirectly through shaft B. Considering the driving shaft A, and particularly with reference to Figure 2, there is splined upon this shaft the sprocket wheel 11. This sprocket wheel is the main driving sprocket wheel and secures its power from a sprocket wheel 12 mounted upon a power shaft 13 by means of the sprocket chain 14. Thus it will be seen that the shaft A is directly driven by the power shaft.

Loosely mounted upon the shaft A are the two sprocket wheels 15 and 16 and between these sprocket wheels is disposed double acting clutch 17 which when in a neutral position, is out of engagement with either of the sprocket wheels 15 or 16, but which when shifted in one direction or the other will engage one or the other of these sprocket wheels. The sprocket wheels 15 and 16 are connected to sprocket wheels 18 and 19 fast upon the shaft B by means of the sprocket chains 20. The sprocket wheel 19 is less in diameter than the sprocket wheel 18 and thus the shaft B may be driven at two different speeds from the shaft A. The shaft B as shown in Figure 2 is disposed

below the shaft A and carries fast upon it the two sprocket wheels 21 and 22, these having different diameters, the sprocket wheel 22 being larger than the sprocket wheel 21. Mounted upon the drum shaft D are the sprocket wheels 23 and 24 having different diameters, the sprocket wheel 23 being larger than the sprocket wheel 24 and the sprocket wheel 23 is connected to the sprocket wheel 21 by means of the chain 25 while the sprocket wheel 22 is connected to the sprocket wheel 24 by means of the chain 26. The sprocket wheel 23 is loose upon the shaft D of the main drum and is adapted to be engaged with this shaft D of the main drum by means of the spiral clutch 27.

The sprocket wheel 24 is loose upon the shaft D of the main drum, but is capable of being clutched to this shaft D by means of the dental clutch 28. It will thus be seen that the shaft of the main drum may be driven at any one of four different speeds or, of course, not driven at all if the clutch 17 be in a neutral position. If the clutch 17 be shifted to engage with the sprocket wheel 15, the shaft B will be driven at one speed and if the clutch 27 be thrown in, the drum shaft D will be driven at a relatively slow speed. If, however, the clutch 28 be thrown in, the drum shaft D will be driven at a relatively high speed. Thus I show a mechanism which is capable of driving the shaft B at either one of two speeds from the shaft A and driving the drum shaft D at either one of two speeds from the shaft B.

The shaft D carries upon it the winding drum 29 which is constructed in the usual manner of winding drums of this type and is provided with the brake flanges 30 over which pass the usual brakes 31. Of course, the shaft A may be driven in either one of two directions by reversing the engine.

Mounted above the drum 29 but in a plane slightly rearward of this drum is the winding drum 32 mounted upon the shaft C. This drum is also capable of being driven at two different speeds. For this purpose there is mounted upon the shaft A the sprocket wheel 33 which is loose upon the shaft A but which may be engaged with the shaft A by means of the spiral clutch 34. This sprocket wheel 33 is engaged by a chain 36 with a sprocket wheel 35 which is loosely mounted upon the shaft C but is engaged with the shaft C by the spiral clutch 37.

When the clutch 34 is thrown in, the sprocket wheel 33 is driven and when the clutch 37 is thrown in, the sprocket wheel 36 drives the upper drum shaft C. Mounted upon the shaft A is the sprocket wheel 38 which is loose upon the shaft A and coacting therewith is the dental clutch 39. The sprocket wheel 38 is engaged by means of a chain 40 with a sprocket wheel 41 which is loose upon the shaft C but may be clutched to the shaft C by the dental clutch 42. It will be understood, of course, that the sprocket wheels 33 and 35 are so proportioned as to drive the drum shaft C at a relatively slow speed while the sprocket wheels 38 and 41 drive the upper drum shaft C at a relatively high speed. The upper drum 32 is also provided with the drum flanges 43 having brakes 44 passing thereover.

Also mounted upon the frame of the machine and projecting laterally therefrom is a shaft 45 which carries upon it the sprocket wheel 46 and which also carries upon it at its outer extremity the cat head 47. This sprocket wheel 46 is driven from a sprocket wheel 48 mounted upon the shaft A and constantly rotating therewith.

Loosely mounted upon the shaft 45 is a sprocket wheel 49 connected by a chain 50 to the rotary (not shown) whereby the rotary may be driven. Slidingly mounted upon the shaft 45 is the clutch 51 whereby the wheel 49 may be clutched to the shaft 45 and driven whenever required. Disposed at the opposite end of the frame and supported in suitable bearings therein is a shaft 52 carrying the cat head 53 and also carrying the sprocket wheel 54. This is driven by a sprocket chain from a sprocket wheel 55 fixed upon and rotated with the shaft A. Thus it will be seen that both cat heads are continuously driven as long as the shaft A is driven.

The drums 29 and 32 are, of course, provided with the brake flanges 30 and 43 respectively. A brake shaft 56 passes longitudinally beneath the drum 29, is mounted in suitable bearings and carries upon it the usual brake bands 31, the brake bands being actuated by the brake lever 58. The brake shaft for the drum 32 is designated 59 and is disposed immediately beneath the drum 32 and is connected to the usual brake bands 44. The shaft 59 is oscillated by means of the lever 60 disposed in any convenient position. The clutch 27 is actuated by a clutch operating lever 61 while the clutch 28 is actuated by the clutch operating lever 62, these levers being connected by connecting rods to operating pedals or other actuating devices 63. The clutch 37 is operated by means of a lever 64, and the clutch 42 by a lever 65. These levers are operatively connected to pedals 66 or other means whereby they may be actuated, these pedals and the pedals 63 being disposed adjacent the front of the machine. The clutches 34, 17 and 39 are operated by like means (not shown) as the particular means for operating these clutches may be of any ordinary construction and disposed in any suitable relation to the machine.

It will be particularly noted that the clutches 37 and 27 are spiral clutches while the clutches 28 and 42 are dental clutches. Thus when either of the clutches 28 or 42 is thrown in, the spiral clutches 37 or 27 will be automatically thrown out in a manner obvious to those skilled in the art. The clutches 39, 17 and 34 may be of any suitable character. It will be obvious that the clutch 17 can never connect up the sprocket wheels 15 and 16 to the shaft A at the same time but that when the clutch 17 is thrown into engagement with the sprocket 15, it must be thrown out of engagement with the sprocket 17 and vice versa.

In the operation of this mechanism, by shifting the clutch 17 to a neutral position, both shaft B and shaft C are stopped. By engaging the clutch 17 with either one of the sprockets 15 or 16, the shaft B can be driven at two different speeds and from this shaft B, power will be transmitted at either one of two different speeds to the main drum shaft D. By throwing in the clutches 34 or 39, the upper drum shaft C may be driven at either one of two different speeds by using the clutches 37 or 42. It will be particularly noted that the lower drum shaft and the upper drum shaft may be driven together at any desired combination of speeds. When the clutch 17 is disengaged and in fact when all the clutches are in neutral position, only the cat head shaft 52 would be running on one side of the rig, and the shaft 45 carrying the rotary driver 49 would be running on the other side of the rig. Therefore, all chains leading from the upper to the lower shaft,

that is, from shaft A to shaft B and all chains running from shaft A to the upper drum shaft or to the lower drum shaft would be idle. This is particularly valuable because it stops the wear on the chains while drilling operations are going on, which is more than 75% of the time. It also stops the noise because as draw-works are at present constructed having a three speed drum, all sprocket chains are always in operation. Therefore, there is constant wear on the chains and constant noise. Furthermore all clutches are open and the operator need only engage those necessary to perform the desired changes that may be necessary. The rotary can be stopped or started independently through the clutch 51 engagaing the sprocket 49.

In this rig, the upper drum will operate the line for bailing, taking cores or samples from the bottom of the hole and running the measuring instruments to determine if the hole is perpendicular. This upper drum can be operated independently of the lower drum and the lower drum can be operated independently of the upper drum or both drums can be operated simultaneously. Speed changes may be made on either upper and lower drum while either is in operation without interfering with the other drum or with the drive for the rotary. The drive for the rotary may be operated while both drums are still or operated while both drums are in operation at any desired speed.

It will be seen that I have provided draw works with a power receiving shaft A, a power distributing shaft B, an upper drum shaft, a lower drum shaft, means for transmitting power directly from the power receiving shaft to the upper drum shaft at variable speeds, means for transmitting power from the power receiving shaft to the lower drum shaft at variable speeds, and means for transmitting power from the power receiving shaft to a short intermediate shaft for the purpose of rotating drill pipe. I am aware of the fact that in standard draw works, a line shaft is provided which is the equivalent in a general way to my power receiving shaft A and that a secondary line shaft is provided which is the equivalent in a degree to my power receiving shaft B and that there is a lower drum shaft which is equivalent to my lower drum shaft, but in no draw works known to me is there an upper drum in combination with these same shafts. Furthermore, in the present standard draw works, the power is not transmitted from the power receiving shaft at variable or two speeds, but in the assembly which I have illustrated power is transmitted from the power distributing shaft at variable speeds.

It will be seen that in my mechanism, there is means for transmitting the power from the power receiving shaft A directly to the upper drum shaft, means for transmitting power from the intermediate shaft to the lower drum shaft, means for distributing power from the power receiving shaft, A to the intermediate shaft, means for transmitting power to either upper or lower drum shafts at variable speeds, and means for transmitting power to a rotary drilling machine independently of the hoisting drums or in unison with either or both of the hoisting drums.

While I have described certain arrangements of parts, and certain details of construction which I believe to be particularly effective for the purpose intended, I do not wish to be limited thereto as it is obvious that many changes might be made without departing from the spirit of the invention as defined in the appended claims.

I claim:—

1. In a draw works, a driving shaft driven at a constant speed, a main drum shaft, a winding drum thereon and rotating therewith, an auxiliary drum shaft, the winding drum thereon rotating therewith, an intermediate shaft, manually controlled means for driving the intermediate shaft at either one of two speeds from the driving shaft or disconnecting it entirely from the driving shaft, manually controlled means for driving the main drum shaft at either one of two speeds from the intermediate shaft or disconnecting it entirely from the intermediate shaft, and manually controlled means separate and independent from the first named manually controlled means for driving the auxiliary drum shaft at either one of two speeds from the driving shaft or disconnecting it entirely from the driving shaft.

2. In a draw works, a driving shaft driven at a constant speed, a main drum shaft, a winding drum carried thereby, an auxiliary drum shaft, a winding drum carried thereby, an intermediate shaft, manually controlled means for driving the intermediate shaft at either one of two speeds from the driving shaft or disconnecting it entirely from the driving shaft and including means whereby a lower speed driving means is automatically disconnected when a higher speed driving means is connected between the two shafts, manually controlled means separate and independent of the first named manually controlled means for driving the main drum shaft at either one of two speeds from the intermediate shaft or entirely disconnecting it therefrom including means whereby a lower speed driving means is automatically disconnected when a higher speed driving means is connected between the two shafts, and manually controlled means separate and independent of the first and second named manually operated means for driving the auxiliary drum shaft at either one of two speeds from the driving shaft or entirely disconnecting it therefrom, including means whereby a low speed connecting means is automatically disconnected when a high speed connecting means is engaged between the two shafts.

3. In a draw works, a driving shaft driven from a source of power at a constant speed, a main drum shaft, a winding drum carried thereby, an auxiliary drive shaft, a winding drum carried thereby, an intermediate shaft, means for driving the intermediate shaft including two sprocket wheels of different diameters loose upon the driving shaft and having driving connection with sprocket wheels on the intermediate shaft, manually controlled clutch means on the driving shaft for connecting the loose sprocket wheels thereon with the driving shaft, two sprocket wheels loosely mounted upon the main drum shaft and of different diameters, sprocket wheels mounted upon the intermediate shaft and operatively connected to the sprocket wheels on the main drum shaft, manually operable clutches on the drum shaft associated with the loose sprocket wheels thereon, the clutch associated with the larger sprocket wheel being a spiral clutch and the clutch associated with the smaller sprocket wheel being a dental clutch, sprocket wheels loosely mounted upon the auxiliary drum shaft, loose sprocket wheels mounted upon the driving shaft operatively connected to the last named sprocket wheels, manually operable clutches

therefor, the sprocket wheels on the drum shaft being of different diameters relative to each other, and manually operable clutches on the auxiliary drum shaft associated with the respective loose sprocket wheels, the clutch associated with the smaller sprocket wheel being of a spiral type and that associated with the larger sprocket wheel being of the dental type.

4. In a draw works, a driving shaft driven from a source of power at a constant speed, a main drum shaft, a winding drum carried thereby, an auxiliary shaft, a winding drum carried thereby, an intermediate shaft, means for driving an intermediate shaft including two sprocket wheels of different diameters loose upon the driving shaft and having driving connection with sprocket wheels on the intermediate shaft, a manually controlled clutch upon the driving shaft for connecting either of the loose sprocket wheels thereon with the driving shaft, two sprocket wheels loosely mounted upon the main drum shaft and of different diameters, sprocket wheels mounted upon the intermediate shaft and operatively connected to the sprocket wheels on the drum shaft, manually operable clutches on the drum shaft associated with the loose sprocket wheels thereon, the clutch associated with the larger sprocket wheel being a spiral clutch, and the clutch associated with the smaller sprocket wheel being a dental clutch, sprocket wheels loosely mounted upon the auxiliary drum shaft, loose sprocket wheels upon the driving shaft operatively connected to the last named sprocket wheels, manually operable clutches therefor, the sprocket wheels on the auxiliary drum shaft being of different diameters relative to each other, and manually operable clutches on the auxiliary drum shaft associated with the respective loose sprocket wheels, the clutch associated with the smaller sprocket wheel being of a spiral type and that associated with the larger sprocket wheel being of the dental type, and independently operable manually controlled brake mechanism for each of said drum shafts.

5. In a draw works, a driving shaft, a main drum shaft, a winding drum carried thereby, an auxiliary drum shaft, a winding drum carried thereby, an intermediate shaft, manually controlled means for driving the intermediate shaft at either one of two speeds from the driving shaft or disconnecting it entirely from the driving shaft, manually controlled means for driving the main drum shaft at either one of two speeds from the intermediate shaft or disconnecting it entirely therefrom, manually controlled means for driving the auxiliary drum shaft at either one of two speeds from the driving shaft or disconnecting it entirely therefrom, a laterally projecting shaft carrying a loose drive sprocket; and a cat head, a sprocket wheel on the last named shaft, and a sprocket wheel on the driving shaft connected to the last named sprocket wheel, a clutch for the last named loose sprocket wheel, a second laterally projecting shaft projecting in an opposite direction from the first named laterally projecting shaft and carrying thereon a cat head, and an operative driving connection between this last named shaft and the driving shaft.

6. In a draw works, a driving shaft, a main drum shaft, a winding drum carried thereby, an auxiliary drum shaft, a winding drum carried thereby, an intermediate shaft, manually controlled means for driving the intermediate shaft at either one of two speeds from the driving shaft or disconnecting it entirely from the driving shaft, manually controlled means separate and independent from the first named manually controlled means for driving the main drum shaft at either one of two speeds from the intermediate shaft or disconnecting it entirely therefrom, and manually controlled means, separate and independent from the second named manually operable means, for simultaneously driving the auxiliary drum shaft at either one of two speeds from the driving shaft or disconnecting it entirely therefrom.

7. In a draw works a driving shaft driven from a source of power at a constant speed, a main drum shaft, a winding drum carried thereby, an auxiliary drive shaft, a winding drum carried thereby, an intermediate shaft, means for driving the intermediate shaft including two wheels of different diameters loose upon the driving shaft and having driving connection with wheels on the intermediate shaft, manually controlled clutch wheels on the driving shaft connecting the loose wheels thereon with the driving shaft, wheels loosely mounted upon the main drum shaft and of different diameters, wheels mounted upon the intermediate shaft and operatively connected to the wheels on the main drum shaft, manually operable clutches on the drum shaft associated with the loose wheels thereon, the clutch associated with the larger wheel being a spiral clutch and the clutch associated with the smaller wheel being a dental clutch, wheels loosely mounted upon the auxiliary drum shaft, loose wheels mounted upon the driving shaft and operatively connected to the last named wheels, manually operable clutches therefor, the wheels on the drum shaft being of different diameters relative to each other, and manually operable clutches on the auxiliary drum shaft, associated with the respective loose wheels, the clutch associated with the smaller wheel being of a spiral type and that associated with the larger wheel being of the dental type.

8. In a draw works, a driving shaft driven at a constant speed, a main drum shaft and a winding drum thereon and an auxiliary drum shaft, and a winding drum thereon, an intermediate shaft, manually controlled clutch means for driving the intermediate shaft at a low or a high speed from the driving shaft or disconnecting it entirely from the driving shaft, manually controlled clutch means for driving the main drum at either a low or a high speed from the intermediate shaft or disconnecting it entirely from the intermediate shaft, manually controlled clutch means for driving the auxiliary drum shaft at either low or high speed from the driving shaft or disconnecting it entirely from the driving shaft, the manual operation of the high speed clutch means automatically disconnecting the slow speed clutch means without stopping the hoisting action.

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