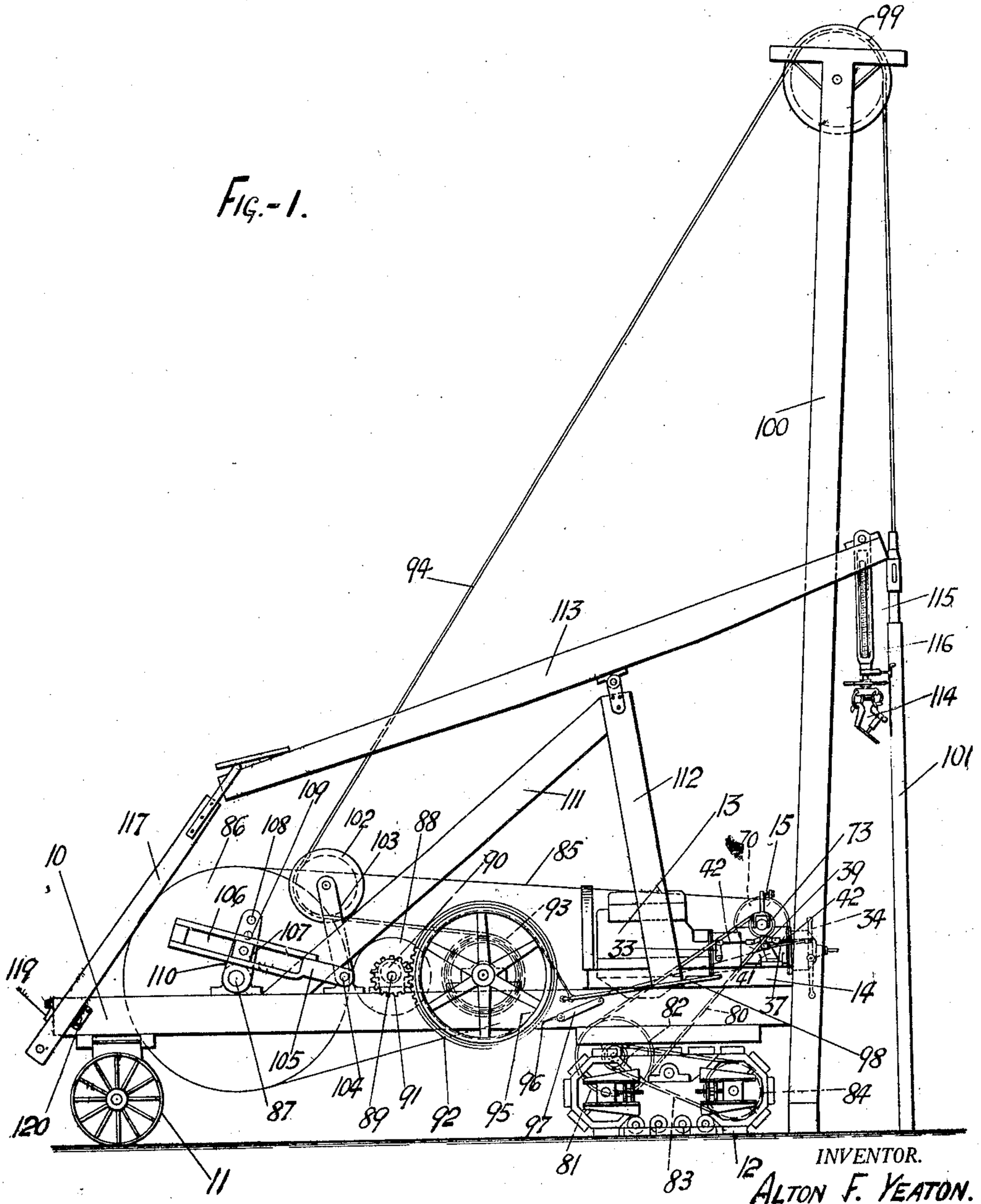
Sept. 4, 1928. 1,683,006

A. F. YEATON

DRILLING MACHINE

Filed Dec. 26, 1924 5 Sheets-Sheet 1

FIG.-1.



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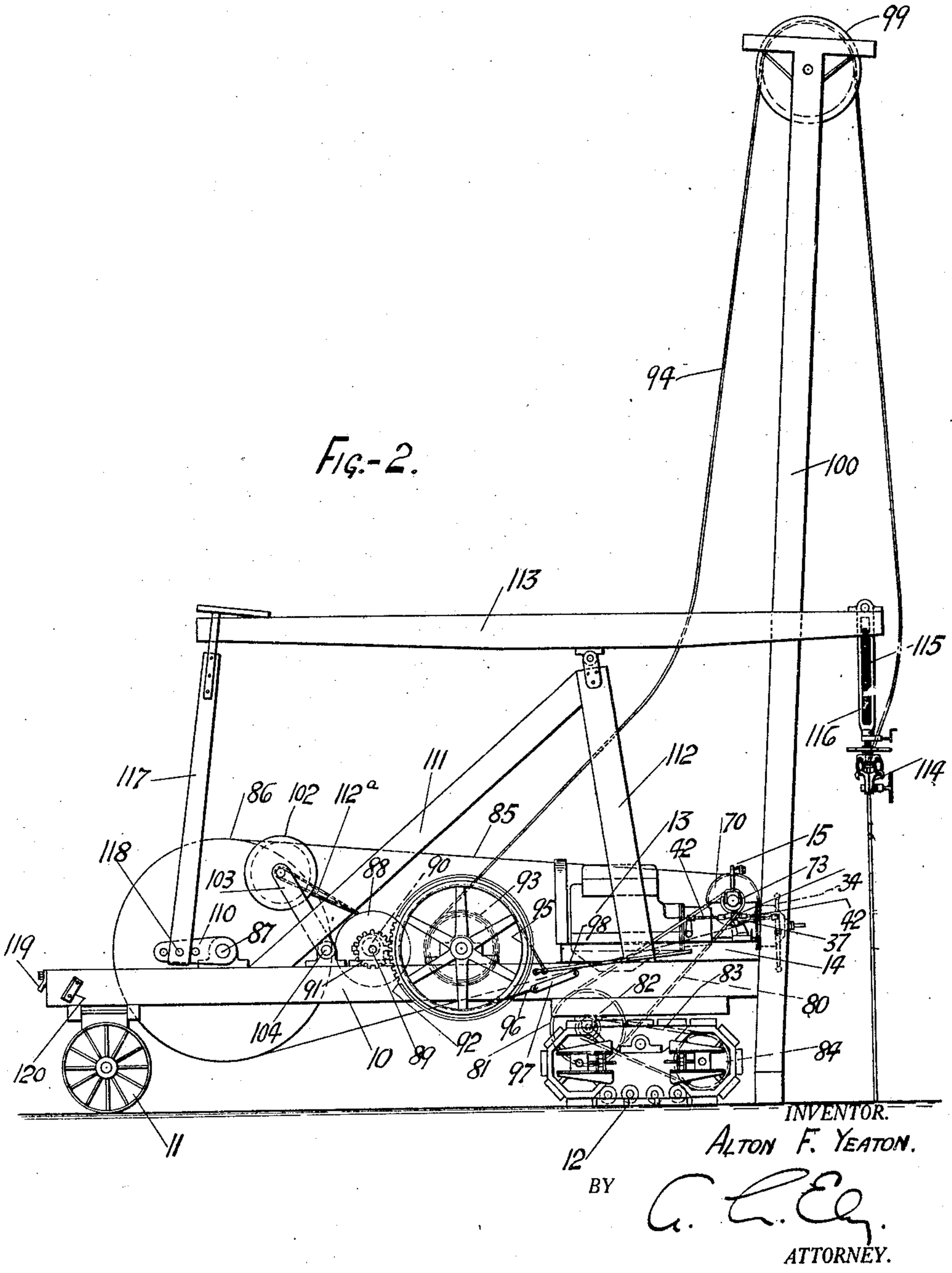
Filed Dec. 26, 1924 5 Sheets-Sheet 2

FIG.-2.



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5 Sheets-Sheet 3

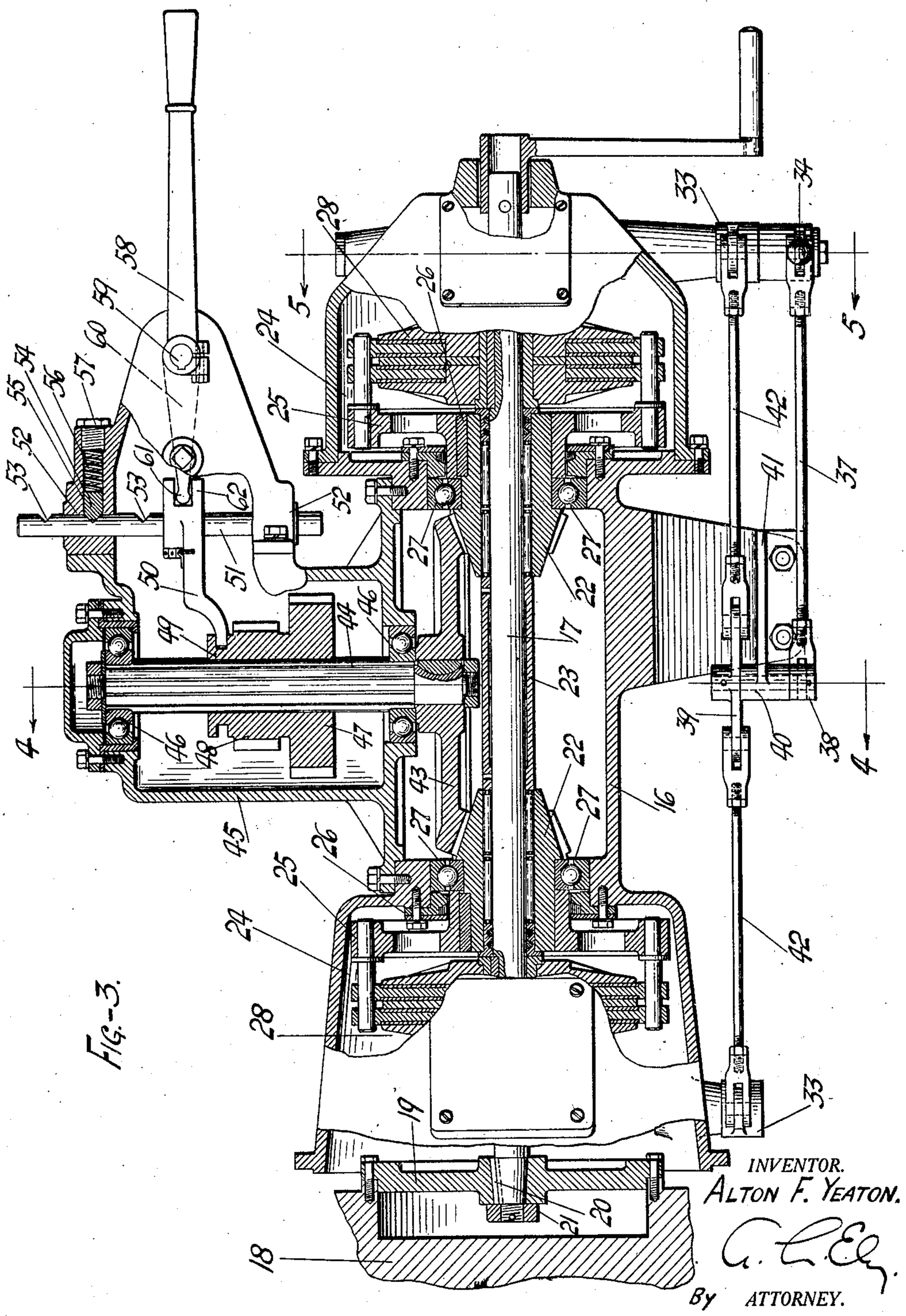

FIG.-3.

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5 Sheets-Sheet 4

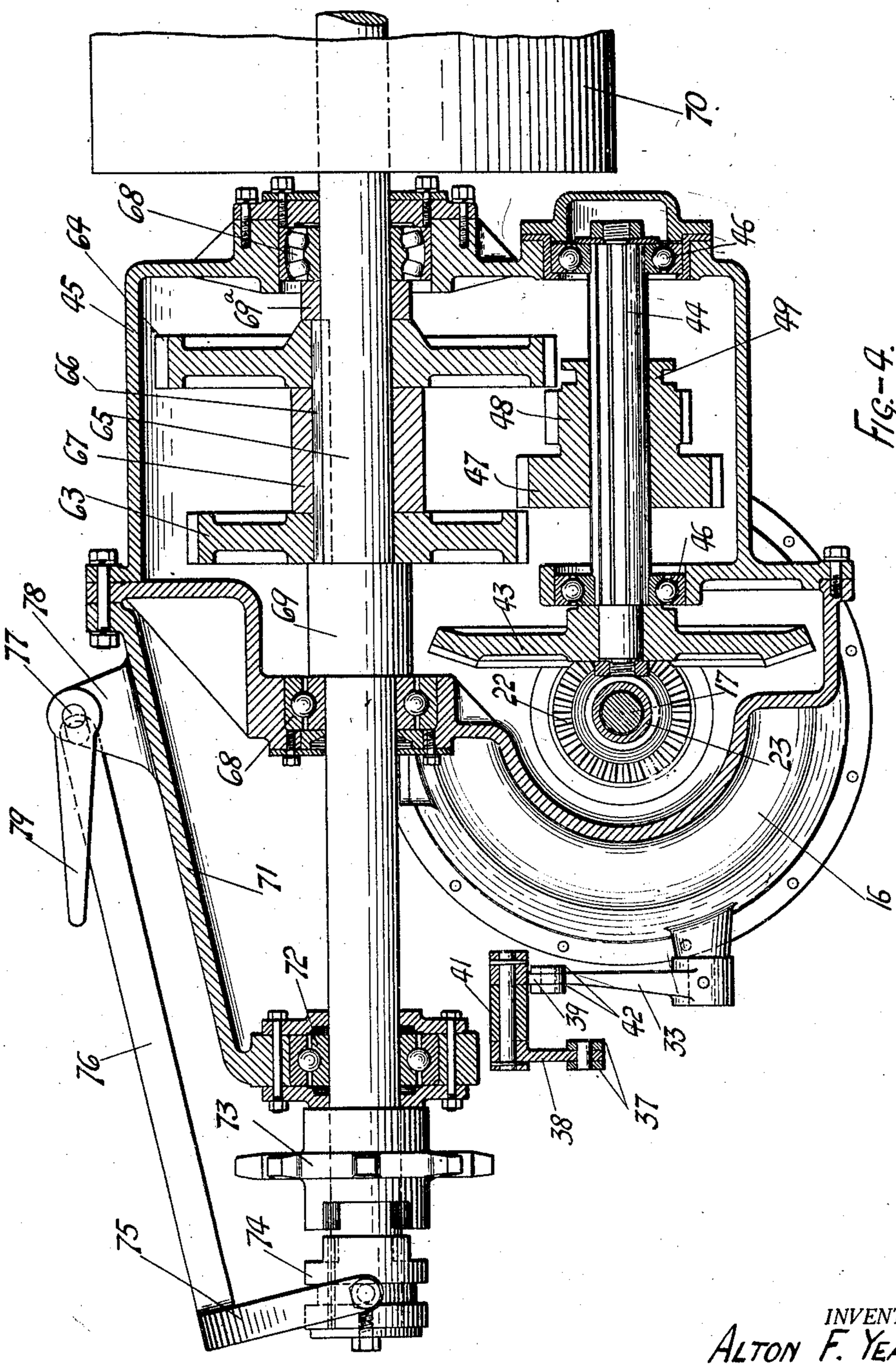

FIG.-4.

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DRILLING MACHINE

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5 Sheets-Sheet 5

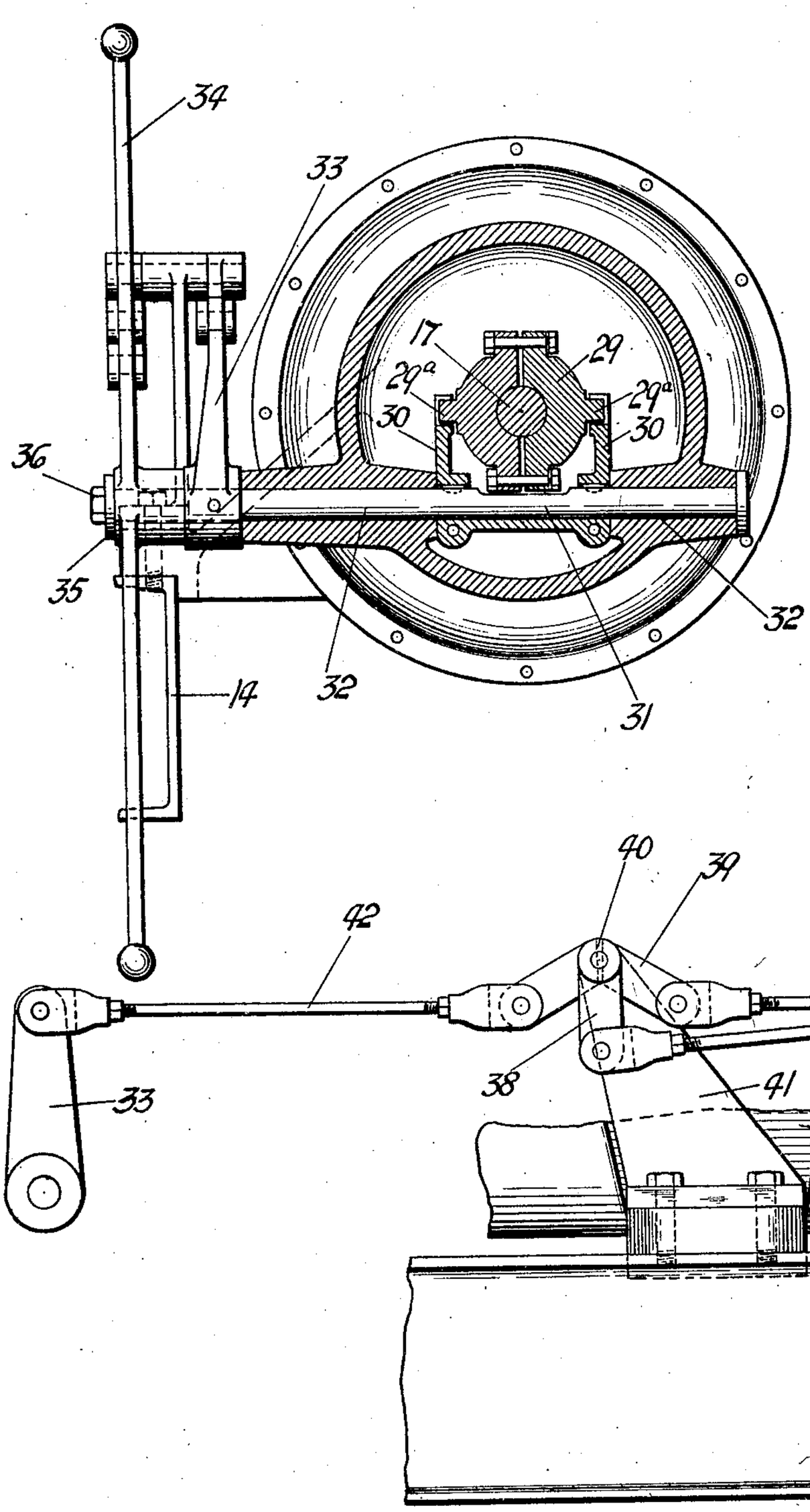

FIG.-5

FIG.-6.

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UNITED STATES PATENT OFFICE.

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DRILLING MACHINE.

Application filed December 26, 1924. Serial No. 757,972.

This invention relates to well-drilling machines and particularly to power transmitting mechanisms adapted to be utilized to operate the drilling tools in either of a number of different ways such as for "spudding" or drilling until tools are buried and for subsequently drilling by the use of a walking beam, as the tools sink to greater depth, the power means also being adapted to drive a suitable tractor by which the drilling machine may be readily transported from place to place for the sinking of different wells.

In the operation of drilling a well, for example, an oil well, the sinking of the tool when starting the well is called "spudding" and is accomplished by reciprocations of the tool-carrying cable over the crown pulley on the mast. This operation is necessary because the tools cannot be efficiently operated by a walking beam due to the length of the tools as compared with the height of the walking beam above the ground. After the tool has been sunk at least its own depth into the ground, the reciprocations of the tool may be accomplished by connecting the tool cable to the walking beam.

The purpose of the present invention, in general, is to provide for the operation of the various instrumentalities described above through a single source of power and a transmission arranged to be selectively connected to each of the instrumentalities.

Other purposes or objects of the invention will become apparent as the following description is read in connection with the accompanying drawings, it being understood that the invention is not limited to the specific form shown and described.

Of the accompanying drawings:

Figure 1 is a side elevation of a drilling machine embodying the invention and arranged for the spudding operation;

Figure 2 is a similar side elevation showing the machine arranged for drilling with the use of the walking beam;

Figure 3 is a central horizontal section through the power transmission;

Figure 4 is a section on line 4—4 of Figure 3;

Figure 5 is a section at 5—5 of Figure 3; and

Figure 6 is a detail side elevation of the clutch shifting mechanism.

Referring to the drawings, 10 is the main frame of the machine which is carried by wheels 11 and track wheels 12. Mounted on the forward end of frame 10 is an engine 13 or other prime mover which is supported on frame 10 by suitable channels 14. Indicated generally at 15 is a transmission also supported on channels 14 and through which all of the various instrumentalities to be described are operated.

By especial reference to Figures 3 to 6, it will appear that the transmission 15 includes a main housing 16 through which extends a shaft 17 connected directly to the fly wheel 18 of engine 13 by a disk 19 secured on shaft 17 by a key 20 and a nut 21 threaded onto the end of shaft 17. Journaled on the shaft 17 are a pair of similar but reversely positioned bevel pinions 22, 22, held in spaced relation thereon by a sleeve 23 on shaft 17 between the pinions 22. The pinions 22 are adapted respectively to be clutched to shaft 17 by disk clutches 24, 24 of which one member 25 of each is secured onto each gear 22 by a key 26, each unit including member 25 and gear 22 being journaled by ball-bearings 27 in housing 16.

For shifting each shiftable member 28 of the clutches, a collar 29 may be slidably mounted on shaft 17 and may be actuated thereon by yokes 30 engaged with projections 29^a on the collar 29. Yokes 30 are secured on a shaft 31 journaled in bearings 32, 32 formed in housing 16, shaft 31 being arranged to project out of the housing and having a clutch operating arm 33 secured thereon.

In the use of the apparatus, as will later appear, it is desirable to have one or the other of gears 22 clutched onto shaft 17 or both disconnected therefrom in a neutral position. To this end improved means are provided for shifting arms 13 so that either or both clutches may be disengaged, or so that one may be disengaged while the other is engaged but both cannot be simultaneously engaged. This means includes a double armed lever 34 loosely pivoted on one shaft 32 and retained thereon by a washer 35 and nut 36, an adjustable link 37 connected to lever 34 and to an arm 38, a bell crank lever 39 to which arm 38 is connected, the lever 39 being pivoted at 40 on a bracket 41 formed on casing 16, and adjustable links 42, 42 connecting the ends of bell crank lever 39, respectively, with the clutch operating arms 33.

Meshing with gears 22 so as to be selectively driven in reverse directions thereby is a bevel gear 43 secured on a shaft 44 extending at right angles to shaft 17 through an auxiliary housing 45 secured on housing 16. Shaft 44 is journaled in ball bearings 46, 46 supported in housing 45 and, splined onto shaft 44, are shiftable gears 47 and 48 operable by a grooved collar 49 thereon which is adapted to be shifted by a yoke 50 secured on a rod 51 which is slidably mounted in bearings 52, 52 in housing 45, the rod 51 being notched as at 53, 53 so as to be locked in predetermined positions by a latch 54 urged into engagement with notches 53 through an aperture 55 leading into one bearing 52, the latch 54 being urged into engagement with the notches by a spring 56 in aperture 55 and retained by means of a screw 57 threaded into the outer end of the aperture. For shifting the yoke 50 and rod 51, a lever 58 secured on a shaft 59 journaled in housing 45 is arranged on the outside of the housing to operate an arm 60 on shaft 59 within the housing which arm is formed on its free end with a ball 61 engaged in a socket 62 in yoke 50.

Gears 47 and 48 are shiftable as described so as to be adapted to be shifted respectively into mesh with gears 63 and 64 secured in spaced relation on a shaft 65 by a key 66 and by a spacer sleeve 67. Shaft 65 extends parallel to shaft 44 and is journaled in bearings 68, 68 in housing 45, the shaft 65 being retained against longitudinal displacement by shoulder 69 and by sleeve 69[a] thereon respectively between gears 63 and 64 and the housing 45. A drive pulley 70 is secured on one end of shaft 65 projecting from housing 45. This pulley is used for operating the drilling tools as will be later described.

Shaft 65 may when it is desired to drive the tractor, be extended out of the casing at its other end which may be journaled in a bracket 71 secured onto housing 45 by ball bearings 72. The machine, however, may be drawn about by other power means in which case shaft 65 is not extended beyond casing 45. A sprocket 73 freely rotatable on this end of shaft 65 adjacent bracket 71 is adapted to drive the track wheels 12 and to this end is adapted to be clutched onto shaft 65 by a shiftable clutch collar 74 keyed or splined on shaft 65 and shiftable by means of a yoke 75 formed on a pitman 76 connected to a crank shaft 77 journaled on bracket 78 formed on bracket 71, the crank shaft being operable by a hand-lever 79. A chain 80 is trained over sprocket 73 and over a sprocket 81 journaled onto frame 10 and connected with a sprocket 82 to rotate the latter, a chain 83 being trained over a sprocket 82 and a tractor-driving sprocket 84.

Pulley 70 has trained thereover a belt 85 which is also trained over a band wheel or a large drill-operating pulley 86 secured on a shaft 87 journaled on frame 10. Arranged for movement toward and from band wheel or pulley 86 into or away from driving engagement therewith is a friction drive wheel 88 secured on a shaft 89 journaled in an eccentrically adjustable bearing 90 operable by any suitable means, (not shown). On shaft 89 is secured a pinion 91 meshing with a gear 92 secured on a "bull" reel 93 journaled on frame 10 and adapted to reel or unreel the tool operating cable 94. A brake drum 95 is also secured on reel 93 and a brake band 96 encircles the drum and is arranged to be tightened or loosened on the drum by being connected at one end to an arm 97 pivoted on frame 10 and at the other end to a lever 98 pivoted on frame 10 which may be locked in position to brake the reel by suitable means (not shown).

Cable 94 extends upwardly over a crown pulley 99 journaled on the top of a mast 100, which is supported by being secured to frame 10 and by suitable guy wires or braces (not shown), and for the operation of "spudding" for which the apparatus is adapted in the manner illustrated in Figure 1, the cable 94 is connected directly to the drilling tool 101. For obtaining reciprocations of tool 101 for the spudding operation cable 94 is passed over an oscillatory pulley 102 journaled on the end of an arm 103 secured on a shaft 104, the shaft 104 being oscillated by an arm 105 secured thereto and formed with a slot 106, in which is arranged a sliding block 107 connected by a pin 108 into one of a series of apertures 109, 109 in a crank arm 110 secured on shaft 87, the throw of the oscillatory pulley 102 being thus adjustable to vary the stroke of the tool 101. Arm 105 carrying block 107 is easily removable from shaft 104 when not in use and pulley 102 may be secured out of the path of crank 110 when the former is not being used in any suitable manner (Figure 2).

Brace 111 is mounted on frame 10 to support a Samson post 112 on the upper end of which is pivoted a walking beam 113, the beam 113 having a suitable cable clamping device 114 suspended from one end thereof by a temper screw consisting of an adjusting screw 115 threaded through an aperture in a bracket 116 secured on the end of beam 113. Beam 113 has pivotally connected to its other end, a pitman 117, adapted to be secured by a pin 118 to crank 110 by engagement of the pin in any one of apertures 109. For supporting the pitman 117 and beam 113 out of the way during the "spudding" operation brackets 119 and 120 are secured on frame 10 to receive the pitman 117 in the manner illustrated in Figure 1.

In the use of the drilling machine, it is first moved to the exact location where the

well is to be sunk, by starting the engine 13 with both clutches 24 disengaged, with gears 63 and 64 in neutral position shown in Figure 4 and with sprocket 73 unclutched from shaft 65 also as shown in Figure 4. One clutch 24 or the other is then engaged depending upon the desired direction of travel. This is accomplished by moving lever 34 to pull link 37 to the right as shown in Figure 6 or to urge it to the left.

The positions of the arms 33 in Figure 6 are the positions thereof in which both clutches are disengaged. If upper arm of lever 37 is pulled to the right, this will cause bell-crank lever 39 to move counter-clockwise and will pull link 42 on the left a considerable distance sufficient to engage the rear clutch 24, due to the large horizontal component of the distance of the left arm of lever 39 will move on its arc. The right arm of lever 39 will, however, not force right link 42 far enough to the right to engage the forward clutch 24, for the reason that the horizontal component of the arc over which the right arm of lever 39 will travel will be very slight and the pivotal connection of the right arm with right link 42 will rise higher than the pivot 40 causing the lever 39 to shift link 42 to some extent backward to the left to neutralize the initial movement to the right. In a similar manner forward clutch 24 may be engaged and rear clutch 24 retained out of engagement by operating lever 34 to urge right link 37 to the left whereby lever 39 will be rotated clockwise and will pull right link 42 a considerable distance to the left but will urge left link 42 only slightly to the left.

Operating one clutch 24 or the other into engagement will cause one pinion 22 or the other to rotate gear 43 in the desired direction. Gears 47 and 48 may now be shifted so that gear 48 will mesh with gear 64 to obtain a low speed. This will rotate shaft 65 comparatively slowly. Clutch 74 can then be operated to engage sprocket 73 which will drive tractor 12 by means of chain 80, sprocket 81, sprocket 82, chain 83 and sprocket 84. Driving of the drilling machine at low speed is thus accomplished, it being understood that mast 100 is not yet in position and belt 85 is preferably not yet applied over pulley 70. If desired, after the inertia of starting the machine has been overcome, gears 47 and 48 may be shifted by lever 58 to engage gears 47 and 63 to obtain a higher speed of travel.

When the machine is in position for drilling, clutch 74 and clutches 24 are disengaged, and mast 100 is positioned in place and suitably guyed to support it therein, the cable 94 being carried over crown pulley 99. Arm 105 is secured to shaft 104 and block 107 to crank 110, cable 94 being passed over pulley 102. Tool 101 is connected to the end of cable 94, brake 96 being tightened to prevent the cable from unreeling from the reel 93. Belt 85 is applied to pulleys 70 and 86 and one of the clutches 24 is engaged. Gear shift lever 58 is then operated to obtain the desired speed of shaft 65 by which pulley 70 is thus rotated, driving pulley 86 and crank 110 and oscillating arms 105 and 103 and consequently pulley 102 whereby reciprocations are imparted to tool 101. As tool 101 sinks into the ground brake band 96 is intermittently released to increase the length of cable 94.

After tool 101 has been sunk into the earth, at least its own depth, the clutches 24 may be again disengaged and clamp 114 may be secured to cable 94. Arm 105 may be removed and pulley 102 be secured out of the way by rope 112[a], pitman 119 being connected to crank 110 and cable 94 being permitted to hang slack over crown pulley 99. Rotation of crank 110 may be again effected by engaging a clutch 24 and at the desired speed by shifting lever 58 to oscillate beam 113. As the tool 101 sinks in the ground, screw 115 is adjusted to increase the effective length of the cable 94 suspended from beam 113 and after screw 115 has been adjusted out its entire length, it may be readjusted to the position shown in Figure 2, the clamp 114 being released and secured further up on cable 94, sufficient cable to maintain the slack over pulley 99 being provided from the bull reel.

It is understood that the drilling operations are intermittent with the usual baling-out and other operations incidental to sinking a well and that other mechanism for the purpose of accomplishing the baling-out and other operations are to be mounted on frame 10 or mast 100, these devices not being shown so as to admit of clear illustration of the present invention.

Modifications of the invention may be resorted to without departing from the spirit thereof or the scope of the appended claims.

What is claimed is:

1. In a drilling machine, a drilling apparatus, a prime mover, a transmission connected thereto and including a longitudinal shaft having forward and reverse gearing thereon, a transverse shaft having shiftable reduction gearing thereon and operable by either the forward or reverse gearing, a second transverse shaft parallel to the first shaft and driven by the reduction gearing, means on said second transverse shaft for driving the drilling apparatus, a tractor for bodily transporting the drilling machine, and means on said second transverse shaft adapted to be selectively employed to drive said tractor, whereby driving of the drilling apparatus or tractor is effected directly through only one transmission.

2. In a drilling machine, a frame, drilling apparatus on the frame, means for transport-

ing the frame from place to place, a prime mover on the frame, a transmission unit including forward and reverse and reduction gearing adapted to be selectively connected to the engine, means driven by the transmission adapted to drive the drilling apparatus, means adapted to be selectively connected to the transmission to drive the transporting means, a transmission control lever mounted on said unit, and control means for the selectively connected means also mounted on said unit.

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