March 7, 1944. E. L. ALEXANDER ET AL 2,343,517

DRILLING RIG

Filed Feb. 28, 1941 4 Sheets-Sheet 1

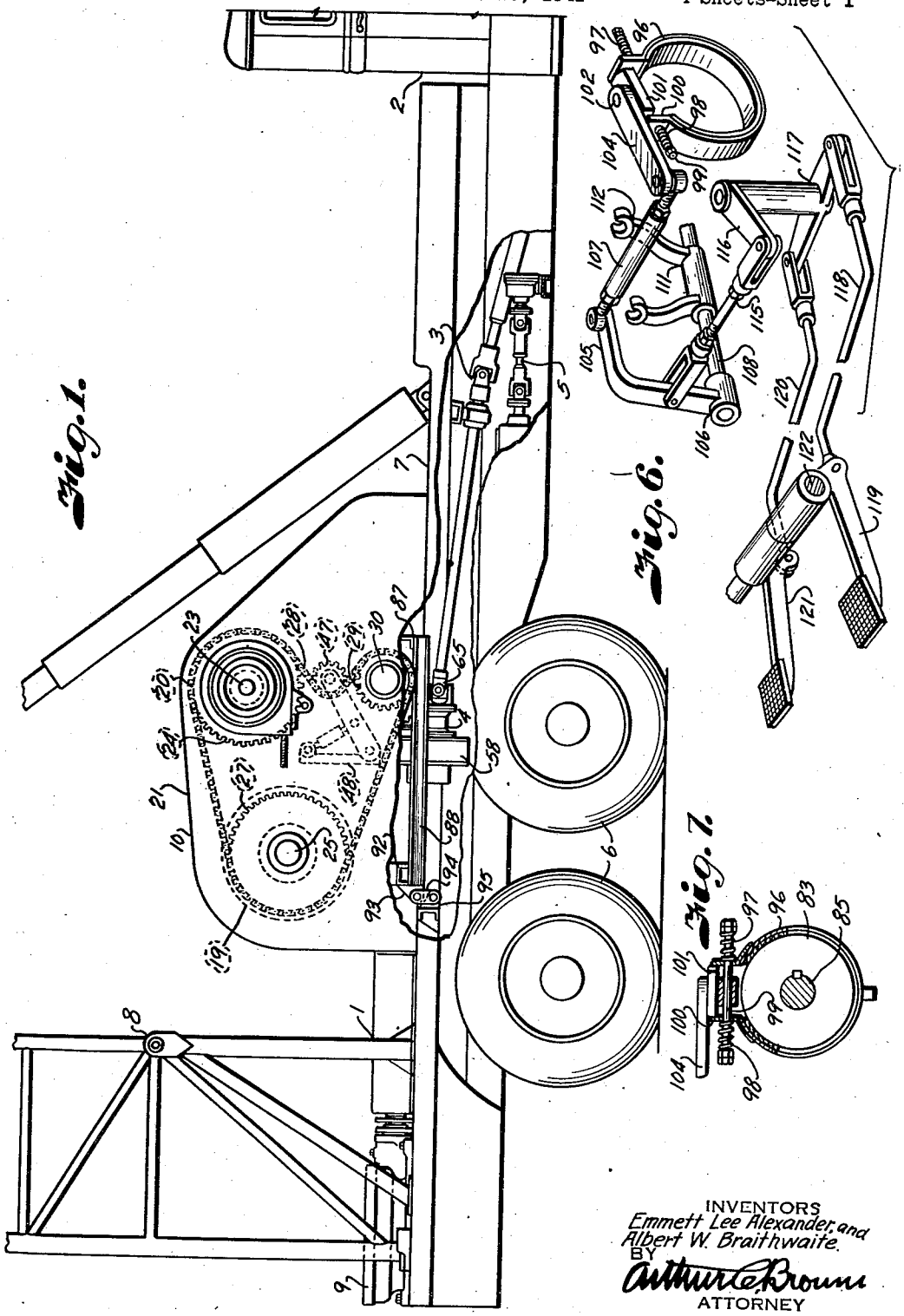

Fig. 1.

Fig. 6.

Fig. 7.

INVENTORS
Emmett Lee Alexander and
Albert W. Braithwaite.
BY
Arthur E. Brown
ATTORNEY

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Fig. 2.

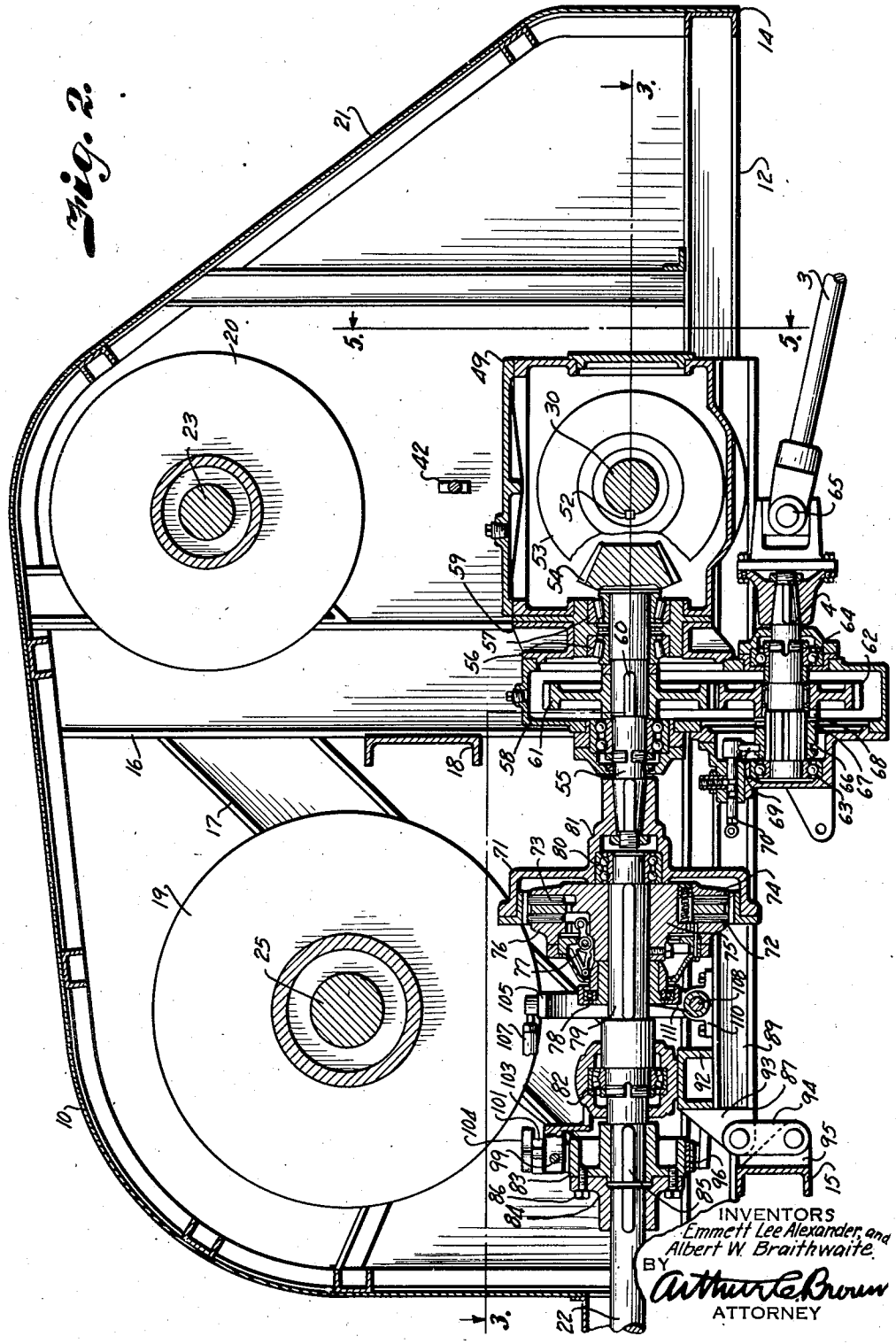

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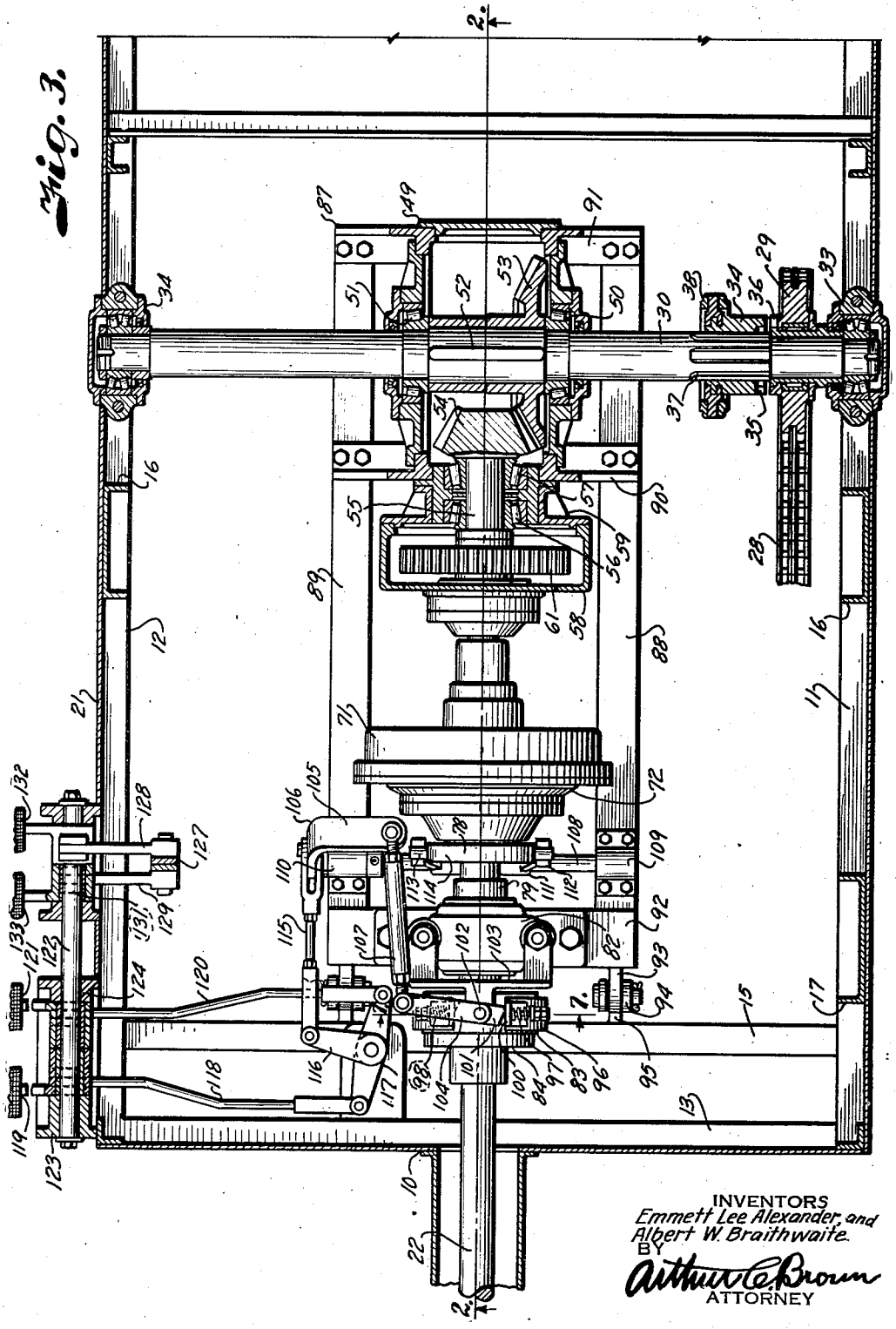
Fig. 3.



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Albert W. Braithwaite.
BY
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ATTORNEY

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Fig. 3.

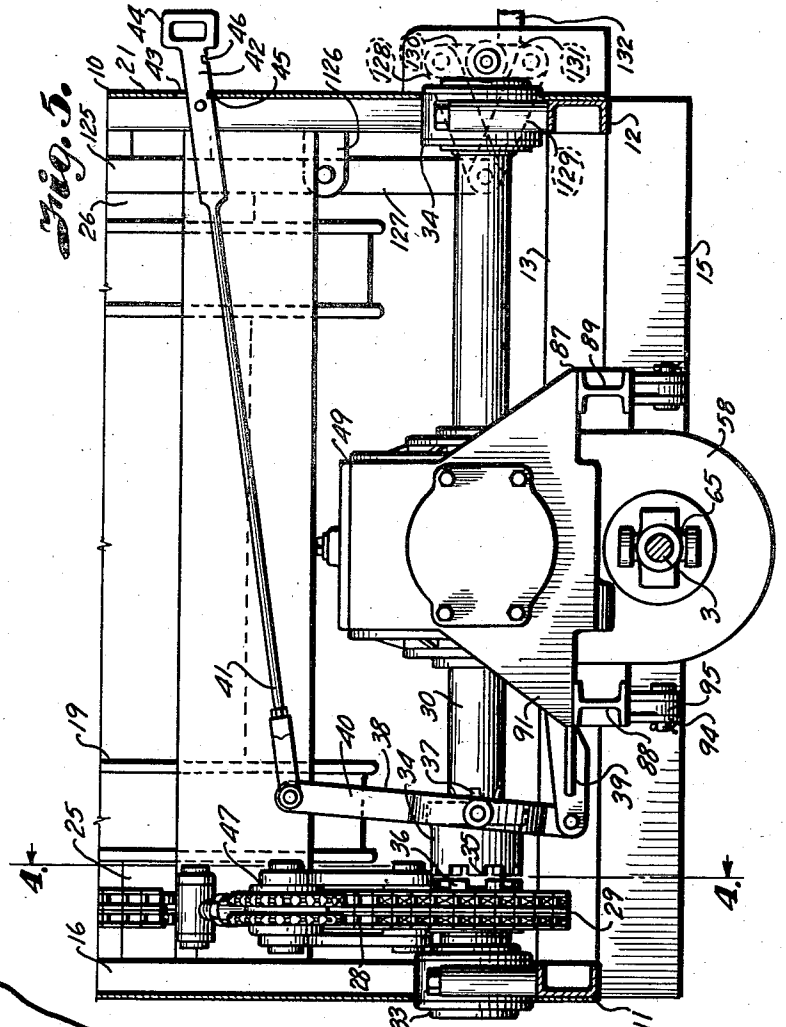
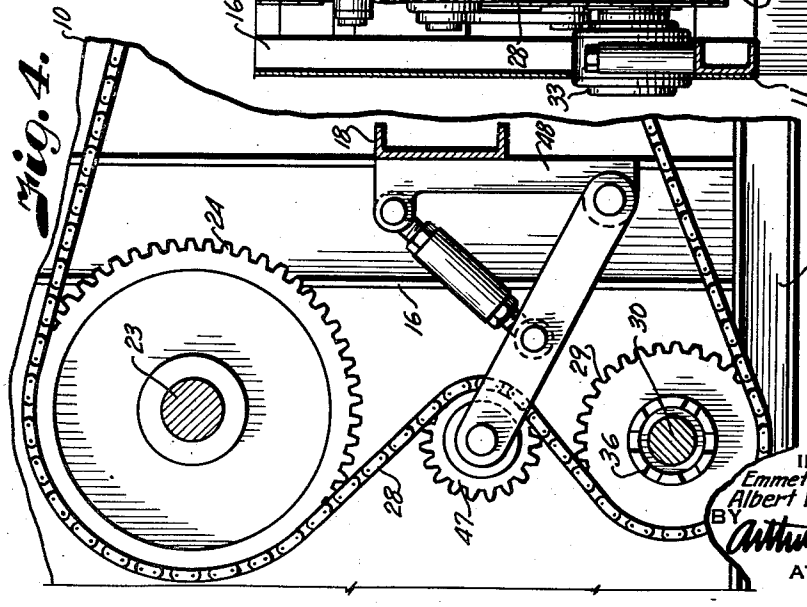


Fig. 4.



INVENTORS
Emmett Lee Alexander, and
Albert W. Braithwaite.
BY Arthur C. Brown
ATTORNEY

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2,343,517

DRILLING RIG

Emmett Lee Alexander and Albert W. Braithwaite, Enid, Okla., assignors to The George E. Failing Supply Company, Enid, Okla., a corporation of Oklahoma

Application February 28, 1941, Serial No. 381,057

5 Claims. (Cl. 255—19)

This invention relates to portable drilling rigs, particularly to the draw-works and rotary table driving mechanism thereof, and has for its principal objects to provide a compact, light weight construction, and to provide controls arranged for better manipulation of the drilling operations.

Other objects of the invention are to provide the rotary table operating mechanism with a brake for controlling actuation thereof when the driving clutch is disengaged; to provide a simple power transmission for connecting the power with the various operating mechanisms of the drilling rig; to provide a flexible driving connection between the power transmitting mechanism and the winding drum; and to provide a clutch for disconnecting the flexible driving connection from the power when the rotary is actuated thereby, so as to relieve the flexible driving connection and winding drum mechanism from vibrations and back-thrusts incidental to actuation of the drilling string.

In accomplishing these and other objects of the invention, as hereinafter pointed out, we have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevational view of a portable drilling rig equipped with a draw-works embodying the features of the present invention, a part of the truck frame and platform being broken away to better illustrate the driving connection between the draw-works and the motor of the truck.

Fig. 2 is a longitudinal section through the draw-works on the line 2—2 of Fig. 3.

Fig. 3 is a horizontal section through the lower portion of the draw-works on the line 3—3 of Fig. 2, particularly illustrating the power transmission.

Fig. 4 is a fragmentary vertical section on the line 4—4 of Fig. 5.

Fig. 5 is a cross-section on the line 5—5 of Fig. 2.

Fig. 6 is a detail perspective view of the brake and clutch control for controlling actuation of the rotary table of the drilling rig.

Fig. 7 is a detail section on the line 7—7 of Fig. 3, particularly illustrating the brake-drum and band therefor which control rotation of the turntable.

Referring more in detail to the drawings:

1 designates a portable drilling rig, which includes a truck 2, having an engine for operating the truck and which is adapted to actuate the drilling mechanism of the rig through a flexible connection 3 connecting the transmission (not shown) of the truck with the power shaft 4 of the drilling rig. The flexible connection 3 may be connected with the transmission through a suitable power take-off, or it may be connected with a section of the propeller shaft 5 which drives the rear wheels 6 of the truck. Mounted on the frame of the truck is a platform 7, which supports the drilling equipment including a tower 8, a rotary turntable 9, a draw-works 10 and other drilling mechanism (not shown), the present invention being directed to the draw-works 10 and associated mechanism.

The draw-works 10 is constructed in accordance with the present invention, and includes a substantially rectangular base frame comprising longitudinal sills 11 and 12, connected by transverse end sills 13 and 14 and an intermediate sill 15. Supported on the sills 11 and 12 of the base frame, substantially midway the length thereof, are upright members 16, which are connected at their upper ends with the rear ends of the longitudinal sills by brace members 17, the uprights 16 being interconnected by a cross-member 18 to provide the main supporting frame for a winding drum 19 and a sand reel 20, later described.

Also supported by the base frame, in covering relation therewith, is a housing 21 covering the draw-works and the driving connections with the power shaft 4 and the turntable operating shaft 22. The sand reel 20 is rotatably mounted on a shaft 23, having its ends suitably journalled in bearings carried on the rear side of the upright 16 near the upper ends thereof. Connected with the shaft 23 is a sprocket 24 for driving the shaft, as later described.

The winding drum 19 is rotatably mounted on a shaft 25, having its ends journalled in bearings carried by the brace members 17, and is adapted to be connected with the shaft by a clutch 26, located at one end of the winding drum, as shown in Fig. 5. The winding drum shaft 25 is actuated by a sprocket 27 fixed thereto at a point in alignment with the sprocket 24, the sprockets being interconnected by a flexible driving member, such as a chain 28, which also passes over a sprocket 29 on a line shaft 30.

The line shaft 30 extends transversely of the base frame and has its ends 31 supported in self-aligning bearings 32 and 33 carried by the side sills of the base frame, as best shown in Figs. 3 and 5. The sprocket 29 is loosely mounted on the line shaft, but is adapted to be connected there-

with by a clutch collar 34, having teeth 35 engageable with teeth 36 on the hub of the sprocket, the collar being slidably secured to the shaft by splines 37. The collar is shifted by means of a shipper yoke 38, which is pivotally supported on a bracket 39 located below the line shaft 30. The yoke includes an upwardly extending arm 40 that is connected by a link 41, terminating in a flat head 42 which projects through a slot 43 in a side of the housing, the head being provided with a handle 44 whereby the link 41 is adapted to be shifted to move the clutch into and out of engagement with the sprocket, the head 42 being provided with notches 45 and 46 which engage the lower edge of the slot 43 to hold the clutch collar in one or the other of its respective positions. The driving chain is provided with a tightener, including an idler sprocket 47 adjustably supported from the cross-member 18 by a bracket 48, Fig. 4.

Mounted on the line shaft 30 is a gear casing 49, the sides of the gear casing being provided with suitable antifriction bearings 50 and 51. Located within the gear casing, and fixed to the line shaft by means of a spline 52, is a bevel gear 53, having meshing engagement with a drive pinion 54 that is fixed to a stub-shaft 55 supported in thrust bearings 56 and 57 at the forward portion of the gear casing, as shown in Fig. 3. The stub-shaft 55 extends into a gear case 58 that is supported from the gear casing 49 by means of a bracket 59, which also cooperates with the gear casing in mounting the thrust bearings 56 and 57. Located in the gear case 58, and fixed on the stub-shaft by a spline 60, is a spur gear 61, which meshes with a spur gear 62 that is rotatably mounted on the shaft 4.

The shaft 4 is mounted in suitable antifriction bearings 63 and 64 carried in the lower portion of the gear case, as shown in Fig. 2, the shaft 4 being connected by a universal joint 65 with the flexible connection 3. Splined on the shaft 4 is a clutch collar 66, having teeth 67 adapted to mesh with similar teeth 68 on the hub of the gear 62. The clutch collar is actuated by a shipper yoke 69 which is manipulated by a shift rod 70.

The shaft 55 projects forwardly from the gear case and carries the bowl member 71 of a friction clutch 72. The clutch, in the illustrated instance, includes interengaged plates 73 having connection with the bowl member, and which are connected in driving relation with plates 74 on the complementary clutch member 75 by means of a pressure plate 76 that is operated by a toggle connection 77 with a shifting collar 78, the clutch member 75 and clutch collar being splined on a shaft 79 that has one end journalled in an antifriction bearing 80 located in the hub 81 of the bowl member. The opposite end of the shaft is rotatably mounted in a bearing 82 supported on a sub-frame, later described. The shaft 79 is connected with the shaft 22 through a brake-drum 83 and a flanged collar 84, the brake-drum being splined to a projecting end 85 of the shaft 79, and the flange collar being splined to the shaft 22, the collar and drum being interconnected by fastening devices, such as cap-screws 86, shown in Fig. 2.

The sub-frame 87 includes side rails 88 and 89 that are connected at their front ends with arms 90 and 91 extending laterally from the lower portion of the gear casing 49 so that the front end of the sub-frame is suspendingly supported from the shaft 30. The forward ends of the rails extend parallel with the shafts and are connected below the bearing 82 with a cross-rail 92. The cross-rail 92 carries ears 93 at the ends thereof, which are connected by links 94 with ears 95 on the platform frame of the truck, as shown in Figs. 2 and 3. With this construction the sub-frame is flexibly mounted so as to compensate for torsional strains produced in the platform and chassis frame of the drilling rig. The specific mounting of the sub-frame forms no part of the present invention, this structure being covered in co-pending application Serial No. 381,056, filed February 28, 1941, and which has matured into Patent No. 2,278,606, dated April 7, 1942.

The brake includes a brake-band 96 which is normally engaged with the drum by springs 97 and 98, supported on a rod 99 and pressing against ears 100 on the terminal ends of the band, the ears being spread apart to release the band by a cam member 101, pivotally mounted on a pin 102 that is carried on a bracket 103 which is mounted on the bearing 82, Figs. 2 and 3. The cam is pivoted by an arm 104 fixed thereto and having connection with the arm 105 of a rocker-arm 106 by a link 107. The rocker-arm 106 is fixed to a rock-shaft 108 journalled in bearings 109 and 110 on the sub-frame 87 and located in alignment with the clutch collar 78. The clutch collar is actuated by the rock-shaft 108 through a yoke 111 that is fixed to the shaft and has arms 112 engaging lateral pins 113 on the ring 114 of the clutch collar. With this arrangement the brake is engaged when the clutch is disengaged and vice versa. The rocker-arm is connected by a link 115 with the arm 116 of a T lever 117, one arm of which is connected by a rod 118 with a pedal 119, and the other arm by a link 120 with a pedal 121. The pedals 119 and 121 are mounted on a shaft 122 which is journalled in bearings 123 and 124 attached to the side of the housing adjacent the driller's station. With this arrangement, the clutch is engaged and the brake-band disengaged when the pedal 121 is depressed, and the clutch is disengaged and the brake engaged through reverse movement of the parts upon depressing the pedal 119.

The clutch for the winding drum is engaged and disengaged by a shipper yoke 125 that is pivoted to a bracket 126 on the side of the housing, and has a depending arm 127 which is connected by links 128 and 129 with arms 130 and 131, the arm 130 being fixed to a pedal 132 pivoted on the shaft 122, and the arm 131 being fixed to a pedal 133 also pivoted on the shaft 122. Thus the winding drum is operatively connected with its shaft when one of the pedal levers is depressed, and disconnected when the other pedal lever is depressed.

When the drilling rig has been moved to a drilling location, the flexible connection 3 is connected with the shaft 4 so that the draw-works is operated by the power of the truck engine. All of the clutches of the draw-works are initially disconnected so that the winding drum, sand reel and turntable of the rotary are idle. To render the line shaft 30 effective, the clutch collar 66 is engaged with the spur gear 62 so that the spur gear 62 rotates the gear 61 to actuate the stub-shaft 55, which in turn actuates the bevelled gear 53 through the meshing pinion gear 54. The stub-shaft 55 also effects rotation of the bowl member 71.

To actuate the winding drum shaft 25, the clutch collar 34 is engaged with the sprocket 29. The sprocket 29 is then effective in actuating the

chain 28 to operate the sand reel and winding drum shafts 23 and 25. To effect connection of the winding drum 19 with its shaft 25, the clutch therefor is engaged by depressing the pedal 132, whereby the winding drum 19 may be used in handling the drilling line as in conventional drilling practice, the directional movement of the shaft 25 being controlled by the position of the transmission gears of the vehicle. For example, when the gears of the transmission are in forward speeds, the winding drum 19 is driven in one direction, and when in reverse speed the winding drum 19 is rotated in the opposite direction. When the winding drum 19 is operated, the clutch connecting the shafts 22 and 55 is disengaged and the brake-band 96 is engaged with the drum 93 so that the rotary 9 is retained in non-rotative condition. When the clutch 26 of the winding drum 19 is disengaged by pressing the pedal 132, the winding drum shaft 25 will continue to rotate until the clutch 34 is disengaged from driving relation with the sprocket 29.

To engage the clutch 72, the pedal 121 is depressed, which action also releases the brake-band from the brake-drum 93. The shaft 22 is now effective to actuate the rotary table 9. To stop operation of the rotary table 9, the other pedal 119 is depressed, rocking the shaft 108 in the opposite direction to disengage the clutch 72 and apply the brake so as to stop rotation of the shaft 22 and hold the turntable 9 from rotation. The brake, being applied to the shaft 22, may be used when holding the table 9 from rotation, as when connecting and disconnecting sections of drill pipe, which mechanism may take the place of the usual pawl and ratchet provided in conventional turntables.

With the clutch arrangement described, it is obvious that disengagement of the clutch collar 34 from the sprocket 29 relieves the driving chain 28 from vibrations and back-thrusts imparted through rotation of the drilling string. It is also obvious that we have provided a very compact structure, wherein the parts are closely associated and well adapted for rotary drilling rigs.

What we claim and desire to secure by Letters Patent is:

1. A drilling rig including, a vehicle having a power unit, a rotary table supported at the rear of the vehicle for rotating a drilling string, a draw-works carried on the vehicle between the rotary table and the power unit of said vehicle, a shaft having connection with the rotary table and extending longitudinally of the vehicle below the draw-works, a line shaft extending transversely of the vehicle, means connecting the line shaft with the draw-works, a driving connection between the rotary table shaft and the line shaft including a clutch, a drive shaft extending longitudinally of the vehicle below the line shaft and the rotary table shaft, means connecting the drive shaft with the power unit, and means connecting the drive shaft with said driving connection at a point between the clutch and line shaft whereby power of said unit is applied intermediate the rotary table and the draw-works.

2. A drilling rig including, a vehicle having a power unit, a rotary table supported at the rear of the vehicle for rotating a drilling string, a draw-works carried on the vehicle between the rotary table and the power unit of said vehicle, a shaft having connection with the rotary table and extending longitudinally of the vehicle below the draw-works, a line shaft extending transversely of the vehicle, means connecting the line shaft with the draw-works, a driving connection between the rotary table shaft and the line shaft including a clutch, a drive shaft extending longitudinally of the vehicle below the line shaft and the rotary table shaft, means connecting the drive shaft with the power unit, means connecting the drive shaft with said driving connection at a point between the clutch and line shaft whereby power of said unit is applied intermediate the rotary table and the draw-works, and a brake on the rotary table shaft for stopping rotation thereof upon disengagement of said clutch.

3. A drilling rig including, a vehicle having a power unit, a rotary table supported at the rear of the vehicle for rotating a drilling string, a draw-works carried on the vehicle between the rotary table and the power unit of said vehicle, a shaft having connection with the rotary table and extending longitudinally of the vehicle below the draw-works, a line shaft extending transversely of the vehicle, means connecting the line shaft with the draw-works, a driving connection between the rotary table shaft and the line shaft including a clutch, a drive shaft extending longitudinally of the vehicle below the line shaft and the rotary table shaft, means connecting the drive shaft with the power unit, means connecting the drive shaft with said driving connection at a point between the clutch and line shaft whereby power of said unit is applied intermediate the rotary table and the draw-works, a brake on the rotary table shaft for stopping rotation thereof upon disengagement of said clutch, and operative means connecting the brake and clutch.

4. A drilling rig including, a vehicle having a power unit, a rotary table supported on the rear of the vehicle for rotating a drilling string, a draw-works carried on the vehicle between the rotary table and the power unit of said vehicle, said draw-works including a winding drum and a shaft rotatably supporting the winding drum transversely of the vehicle, a shaft having connection with the rotary table and extending longitudinally of the vehicle below the draw-works, a line shaft extending transversely of the vehicle in substantially horizontal registry with said rotary shaft, a connecting shaft between the rotary shaft and the line shaft, a clutch coupling one end of the connecting shaft with the rotary table shaft, gearing connecting the other end of the connecting shaft with the line shaft, a drive shaft extending longitudinally of the vehicle below the line and connecting shafts, means connecting the drive shaft with the power unit, means connecting the drive shaft with the connecting shaft at a point between the clutch and said gearing whereby power of said unit is applied intermediate the rotary table and the line shaft, and a driving connection between the line shaft and winding drum including a clutch on the line whereby the draw-works is adapted to be disengaged when the first named clutch is engaged to drive the rotary table.

5. A drilling rig including, a vehicle having a power unit, a rotary table supported on the rear of the vehicle for rotating a drilling string, a draw-works carried on the vehicle between the rotary table and the power unit of said vehicle, said draw-works including a winding drum and a shaft rotatably supporting the winding drum transversely of the vehicle, a shaft having connection with the rotary table and extending

longitudinally of the vehicle below the draw-works, a line shaft extending transversely of the vehicle in substantially horizontal registry with said rotary shaft, a connecting shaft between the rotary shaft and the line shaft, a clutch coupling one end of the connecting shaft with the rotary table shaft, gearing connecting the other end of the connecting shaft with the line shaft, a drive shaft extending longitudinally of the vehicle below the line and connecting shafts, means connecting the drive shaft with the connecting shaft at a point between the clutch and said gearing whereby power of said unit is applied intermediate the rotary table and the line shaft, a driving connection between the line shaft and winding drum including a clutch on the line shaft whereby the draw-works is adapted to be disengaged when the first named clutch is engaged to drive the rotary table, and a brake on the rotary table shaft for stopping rotation of the rotary table when the first named clutch is disengaged.

EMMETT LEE ALEXANDER.
ALBERT W. BRAITHWAITE.