Jan. 16, 1940. A. R. MAIER 2,187,623

DRAW-WORKS FOR ROTARY DRILLING APPARATUS

Filed May 28, 1937 5 Sheets-Sheet 1

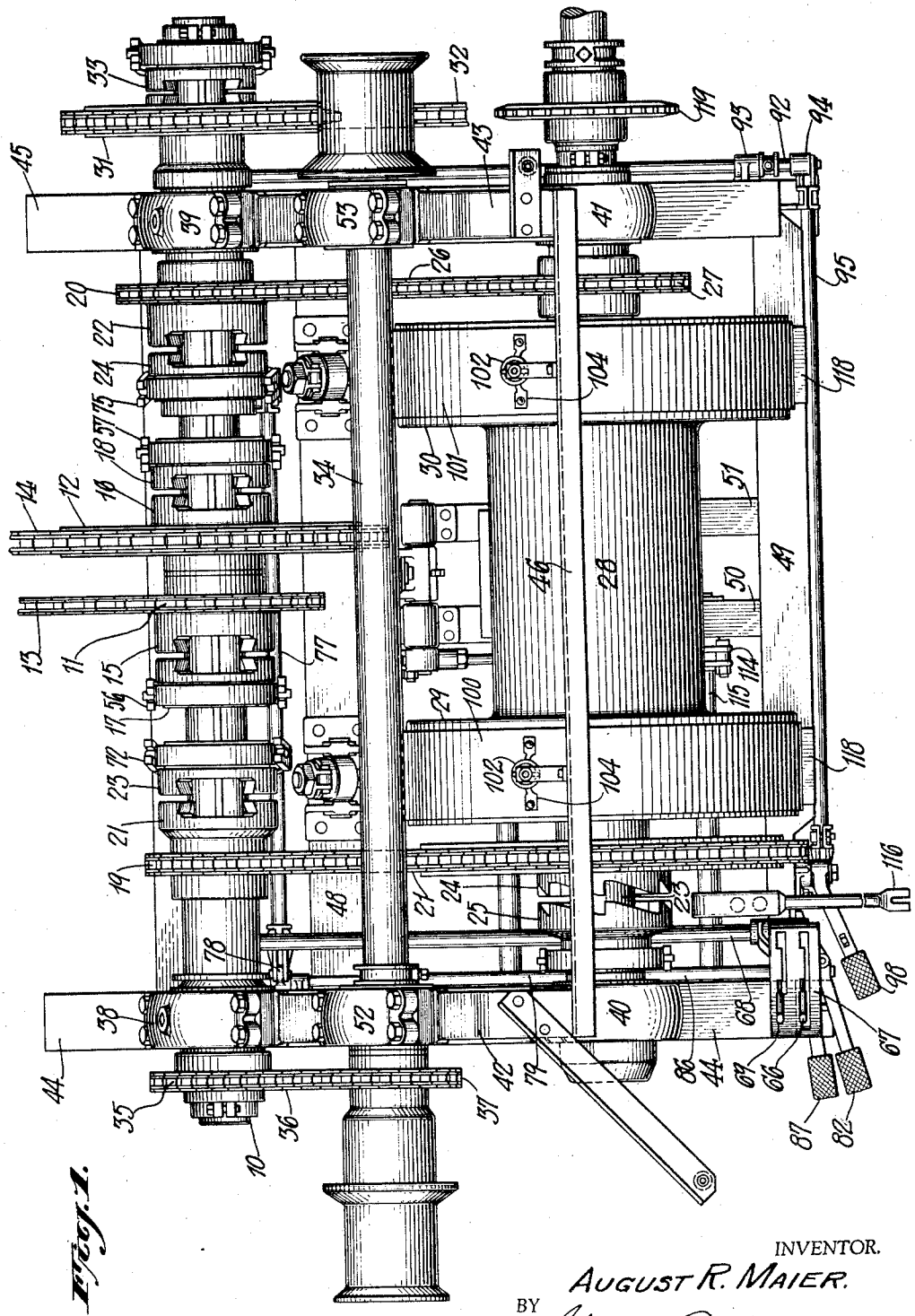


Fig. 1.

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DRAW-WORKS FOR ROTARY DRILLING APPARATUS

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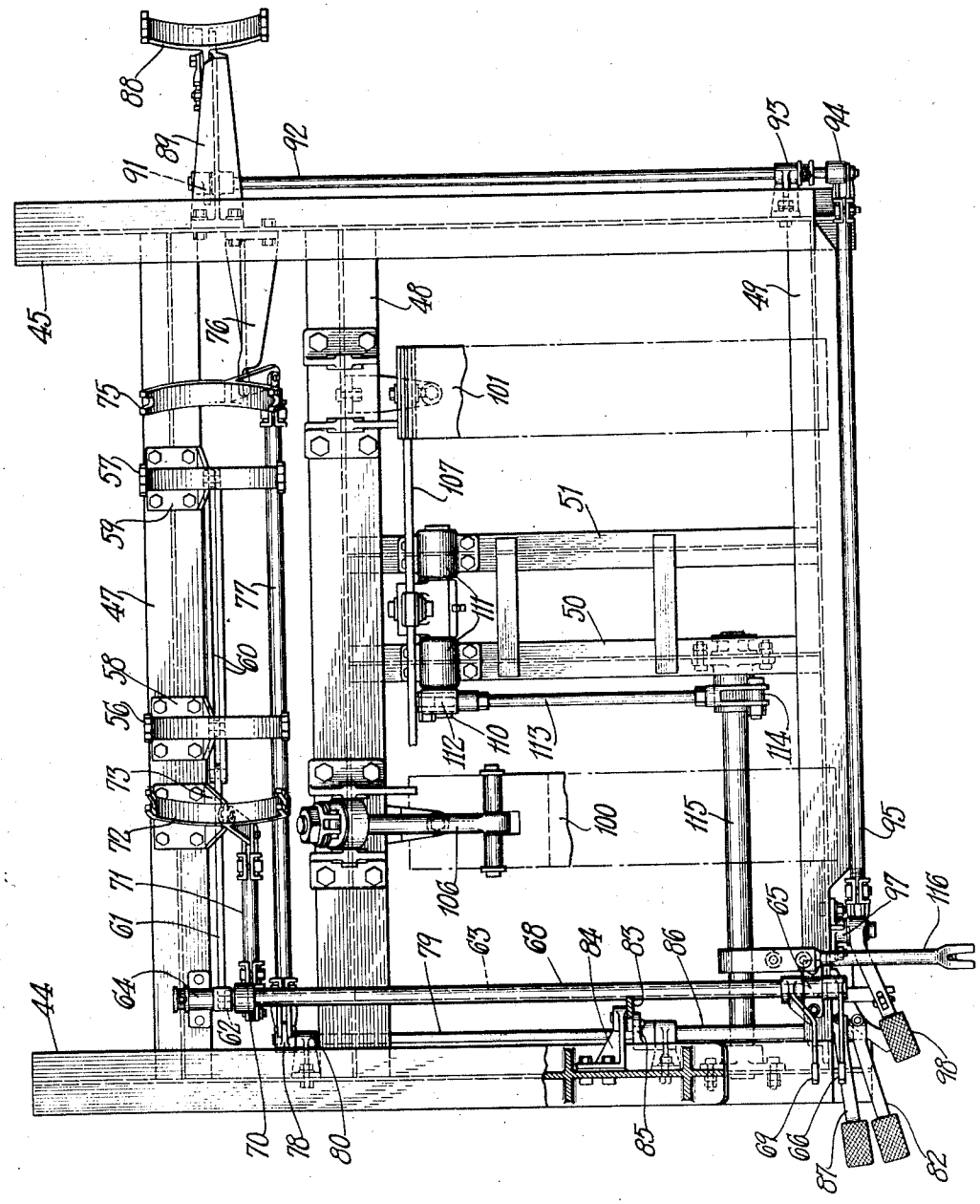


Fig. 2.

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DRAW-WORKS FOR ROTARY DRILLING APPARATUS

Filed May 28, 1937 5 Sheets-Sheet 3

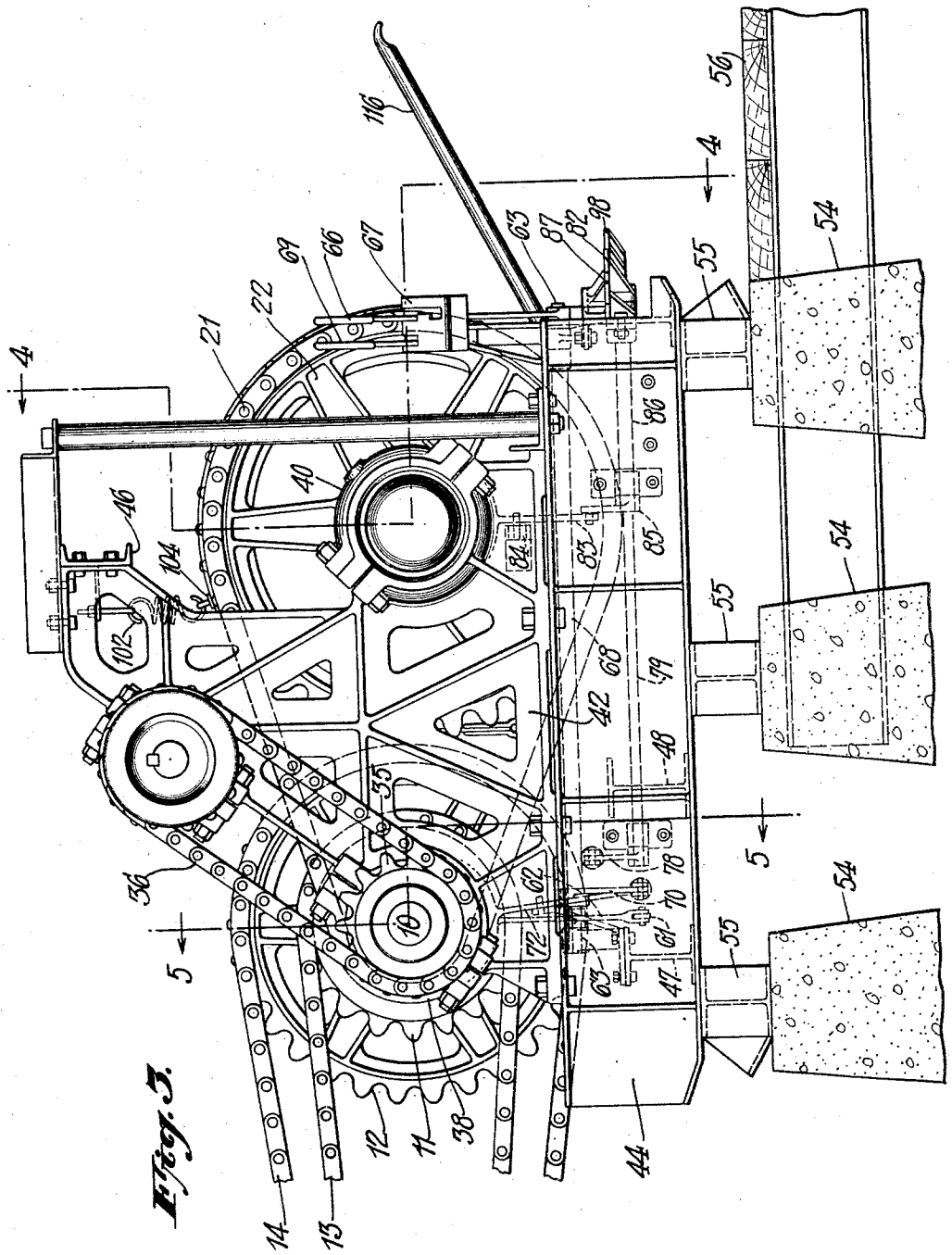


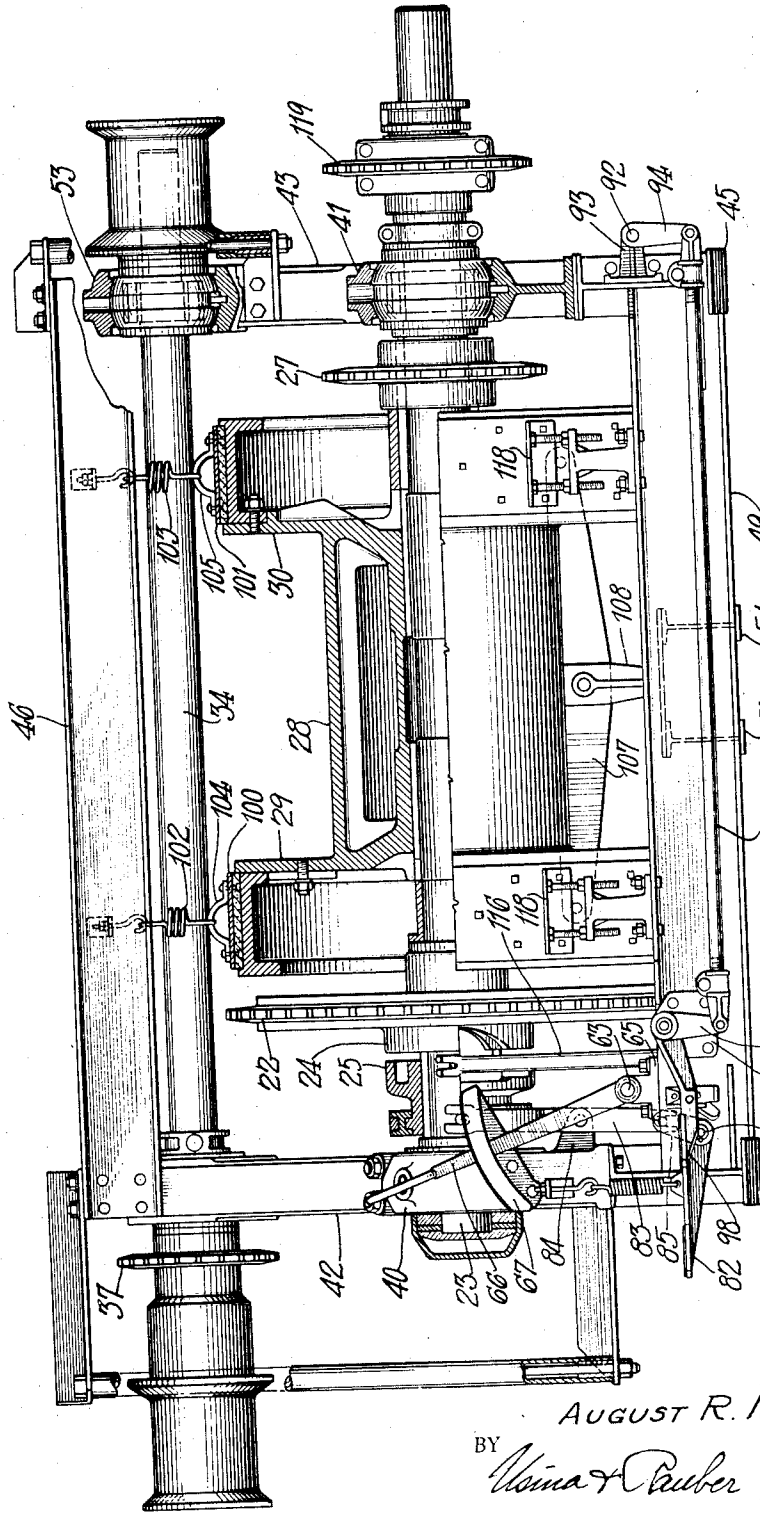
Fig. 3.

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DRAW-WORKS FOR ROTARY DRILLING APPARATUS

Filed May 28, 1937 5 Sheets-Sheet 4



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Jan. 16, 1940. A. R. MAIER 2,187,623

DRAW-WORKS FOR ROTARY DRILLING APPARATUS

Filed May 28, 1937 5 Sheets-Sheet 5

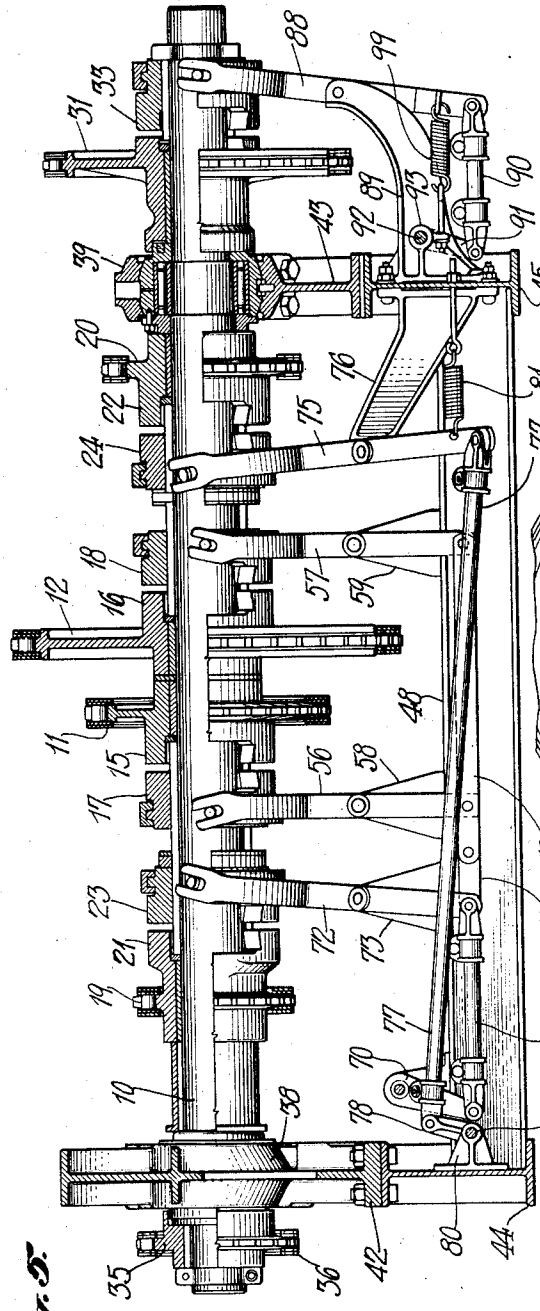


Fig. 5.

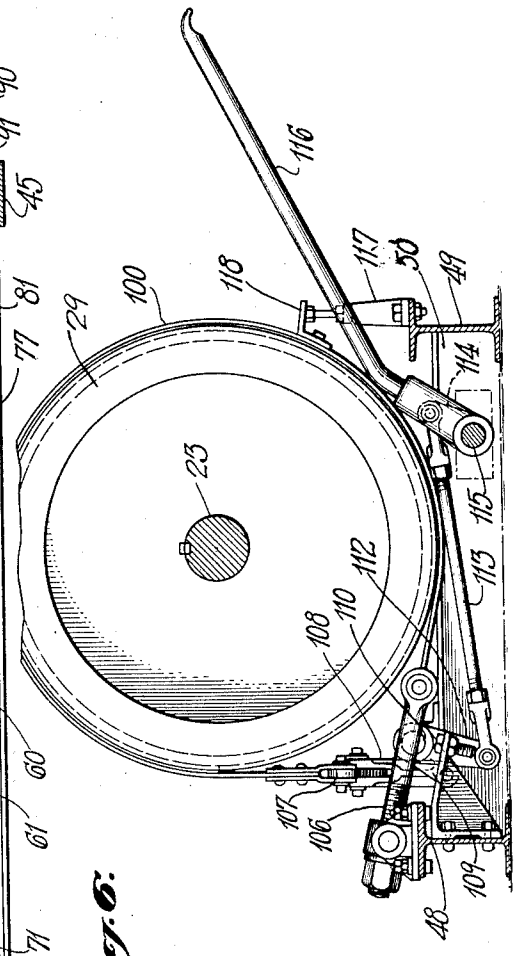


Fig. 6.

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Patented Jan. 16, 1940 2,187,623

UNITED STATES PATENT OFFICE

2,187,623

DRAW-WORKS FOR ROTARY DRILLING APPARATUS

August R. Maier, Dallas, Tex., assignor to Oil Well Supply Company, Dallas, Tex., a corporation of New Jersey

Application May 28, 1937, Serial No. 145,348

2 Claims. (Cl. 254—187)

My invention relates to draw-works for rotary drilling rigs. Rotary drilling rigs have a drill shaft extending forwardly into the well, and a means known as a rotary for rotating the shaft. The shaft is suspended at its upper end and, at times, lifted out of the well so that its lower end may be sharpened, adjusted or repaired for drilling at the bottom of the well. The drill stem is lifted or hoisted by a prime mover or power source through a draw-works and hoisting drum. The rotary may be driven from the same source of power. The hoisting drum is so connected to the driving means through the draw-works that it can be rotated at various selected speeds, while the rotary may be driven at a different speed or speeds.

Draw-works heretofore used have usually been of two types. In one type there is a drum shaft on which the drum is mounted and a line shaft from which it is driven at one of three different speeds by three selective chain drives. Draw-works of this type requires three posts to support the sprockets of the chain drives, and this limits the number of speeds to three. This limitation to three speeds is a disadvantage inasmuch as at times four drum shaft speeds are desired. Moreover, the draw-works is bulky to handle, to transport and to operate. Also it requires aligning of three supporting posts for the shafts and this is, at times, difficult under the conditions existing in the temporarily erected drilling rig.

In the other type of draw-works three shafts are provided and are mounted on two supporting posts. With this construction four speeds are available. However, one of the shafts is positioned at a higher altitude than the others and the driving sprocket chains must, therefore, extend upwardly. Consequently, as the chains wear they tend to ride the crest of the sprocket teeth when the load on the drum shaft is heavy and may then drop off the crest of the teeth with a sudden, severe shock to the shaft that may result in kinking the latter.

These various disadvantages are obviated in the draw-works of my present invention in which four drum shaft speeds may be obtained in a draw-works having two driving shafts, and in which the entire draw-works may be a compact structure that may be moved from one location to another as a unit and, therefore, without the necessity of a troublesome setting up and aligning of various parts.

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

Fig. 1 is a plan view of a draw-works embodying a preferred form of the invention.

Fig. 2 is a horizontal section immediately above the base of the draw-works showing the supporting structure and clutch shifting mechanism.

Fig. 3 is an end elevation of the draw-works taken from the left of Fig. 1.

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 3.

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 3, and

Fig. 6 is a vertical cross section through the drum shaft and supporting structure.

In the draw-works of my present invention power is received from a prime mover by a line shaft and transmitted directly to the shaft of a hoisting drum. Means are provided whereby power may be transmitted to the line shaft at either of two selected speeds and may, in turn, be transmitted from the line shaft to the drum shaft at two relative speeds for each speed of the line shaft. Accordingly but two driving chains and two sprocket wheels are required on the drum shaft and consequently only two supporting posts or bearings are required. However, four speeds are thus made possible.

The rotary may be driven from the line shaft at either of two speeds. The line shaft and drum shaft are preferably at approximately the same horizontal level so that the chains lie horizontally, thus avoiding the tendency for the chains to ride over the teeth of the driving wheel, as may happen with upwardly inclined chains. The speeds may be transmitted selectively from the line shaft to the drum shaft by means of clutches which may clutch either chain drive to the line shaft. A cat shaft may be provided for the usual purposes and driven from the line shaft. This shaft may be located above the level of the line and drum shafts, and its position and function have nothing to do with the present invention.

The various shafts are mounted on a rigid structural base which carries two bearings for each of the shafts. In this supporting base the bearing supports are rigidly mounted in fixed relative positions so that they are always in alignment.

Referring more particularly to the accompanying drawings, the draw-works comprises a line shaft 10 on which are rotatably supported a pair of sprocket wheels 11 and 12 driven by means of chains 13 and 14, respectively, and rigidly secured to clutch elements 15 and 16, respectively. Either of the sprocket wheels 11 or 12 may be

clutched to the shaft 10 by means of sliding clutch elements 17 and 18 which are slidably keyed on the shaft so that they may slide into and out of engagement with the clutch elements 15 and 16.

Also rotatably mounted on the shaft 10 are sprocket wheels 19 and 20 provided, respectively, with clutch elements 21 and 22 which may be engaged by clutch elements 23 and 24 slidably keyed on the shaft 10. The sprocket wheels 11 and 12 are of different diameters so that different speeds are imparted to the line shaft 10 when one or the other of them is clutched thereto, thus making this line shaft a two speed shaft.

The sprocket wheel 19 is connected by means of a chain 21 to a sprocket wheel 22 on a drum shaft 23. The sprocket 22 of the drum shaft is provided with a clutch element 24 and is rotatably mounted on the drum shaft 23. It may be clutched to the shaft 23 by means of a clutch element 25 slidably keyed thereon and movable into and out of engagement with the clutch element 24. The sprocket wheel 20 is connected by means of a chain 26 to a sprocket wheel 27 rigidly mounted on the drum shaft 23. The speed relation between the sprockets 19 and 22 is different from that between the sprockets 20 and 27 so that the drum shaft may be given two speeds for each speed of the line shaft, or a total of four speeds in all. A drum 28 provided at each end with brake surfaces 29 and 30 is rigidly mounted on the drum shaft 23. A sprocket wheel 31 provided with a driving chain 30 to drive a rotary is also rotatably mounted on the line shaft 10 and may be clutched thereto by means of a clutch 33 slidably keyed on the shaft 10. The line shaft 10 also drives a cat shaft 34 through a sprocket wheel 35 on the overhanging end of the shaft 10 and a chain 36 which connects the sprocket wheel 35 to a sprocket wheel 37 fixed on the shaft 34.

The shaft 10 is supported near its ends in bearings 38 and 39 and the drum shaft 23 is supported in bearings 40 and 41. The bearings 38 and 40 are, in turn, supported in a bearing member 42 which may preferably be of cast ribbed construction. Similarly, the bearings 39 and 41 are supported in a bearing member 43 of similar construction. The bearing members 42 and 43 thus fix the bearings 38, 39, 40 and 41 in fixed positions for fixed positions of the bearing members.

The bearing members are mounted and supported on a pair of parallel beams 44 and 45, respectively, and are rigidly secured at their upper ends in fixed spaced relation by means of a crossbeam 46. The beams 44 and 45 are held in fixed spaced positions by means of crossbeams 47, 48 and 49 preferably spaced so as to mount the elements of the clutch shifting mechanism. The beams 48 and 49 are also preferably reinforced and braced by means of connecting beams 50 and 51 which also serve to support a part of the drum brake operating mechanism. The bearing members 42 and 43 also carrying bearings 52 and 53 for the cat shaft 34. The entire structure is thus supported on a rigid, uniform base which may be mounted on concrete piers 54 and crossbeams 55 in suitable position relative to a derrick floor 56. This construction not only provides a compact, rigid and strong support for the various shafts, but also enables the actuating mechanism for shifting the clutches and operating a drum brake to be conveniently and securely mounted.

As shown in Figs. 2 and 5, the clutch elements 17 and 18 are shifted by means of pivoted levers 56 and 57, respectively, forked at their upper ends to fit about the clutch elements 17 and 18, and pivoted on upright brackets 58 and 59 on the crossbeam 47, and connected at their bottom ends by means of a link 60. The link 60 is, in turn, connected by a connecting link 61 to a depending crank arm 62 of a shaft 63 journalled in bearings 64 and 65 mounted on the crossbeams 47 and 49 respectively. The free end of the shaft 63 is provided with a crank lever 66 working in a segment 67 having retaining notches at the two ends and at an intermediate position. It will be apparent that the elements 56 and 57 move in unison and that, in intermediate position, neither will engage the clutch elements 15 and 16 of the driving sprockets 11 and 12 and that, when shifted to one or the other of the extreme positions, will cause one or the other of the sprockets 11 or 12 to be clutched to the drive shaft.

A hollow shaft 68 is mounted on the shaft 63 and is provided at one end with a hand lever 69 passing through the segment 67, and at the other end with a depending lever 70. This lever is connected through a link 71 with the lower end of a rock lever 72 mounted on a bracket 73 on the crossbeam 47, and having its upper end forked to engage opposite sides of the clutch element 23. By shifting the hand lever 69 to one position or the other, it will cause the clutch elements 21 and 23 to mesh or unmesh and thus connect or disconnect the shaft 10 to and from the sprocket 19.

The clutch element 24 is shifted by means of a forked shifting lever 75 pivoted on a bracket 76 mounted on the beam 45 and having its lower end connected by means of a link 77 to a clamp arm 78 of a shaft 79 journalled in brackets 80 on the side of the beam 44. The shifting lever 75 is normally held in unclutched position by means of a spring 81 connecting the lower end of the lever to the beam 45, and is shifted into clutching position against the action of the spring by means of a pedal 82 on the end of the shaft 79. The clutch element 25 on the drum shaft may be shifted by means of a forked lever 83 pivoted on a bracket 84 on the bearing member 42 and engaged at its lower end by a crank 85 carried on a hollow shaft 86 enclosing and mounted on the shaft 79. The hollow shaft 86 is actuated by means of a foot pedal 87 adjacent the foot pedal 82.

The clutch element 33 for connecting and disconnecting the rotary drive sprocket 31 is shifted by means of a forked lever 88 pivoted on a bracket 89 extending outwardly and upwardly from the beam 45 and connected by means of a link 90 to the lower end of a crank 91 mounted on the shaft 92. The shaft 92 is journalled in bearing brackets 93 secured to the beam 45. At its free end is secured a crank arm 94, Fig. 4, which in turn is connected by means of a link 95 to a crank arm 96 journalled in a bracket 97 on the crossbeam 49 and provided with a foot pedal 98. The forked lever 88 is urged to non-engaging position by means of a spring 99 connected between the lower end of the lever 88 and a part of the bracket 93. The lever 88 is tilted to engaging position against the action of the spring 99 by depression of the pedal 98.

Each of the drum brake surfaces 29 and 30 is provided with a brake band 100, 101, respectively. Each band is supported by a spring 102, 103 respectively, suspended from the beam 46 and engaging loops or eyes 104 and 105, respectively on the brake bands 100 and 101. Each brake

band extends downwardly about the brake surface and is anchored by anchoring means 106 to the crossbeam 48. The other end of each brake band is secured to the respective ends of a yoke 107 which is in turn connected at its midpoint to a link 108, the opposite end of which is connected to a crank 109 secured to a shaft 110 which, in turn, is journalled in bearings 111 mounted on the bracing beams 50 and 51. The shaft 110 is rocked by means of an arm 112, the lower end of which is connected through a link 113 to a crank arm 114 on a rock shaft 115 journalled between the beam 44 and the bracing beam 50. The shaft 115 is rocked by means of a lever arm 116, Figs. 2 and 6. It will be apparent that as the lever arm 116 is swung clockwise downwardly it will rotate the crank 114 clockwise and the crank arms 112 and 109 counterclockwise, thus swinging the end of the crank 109 downwardly and tightening the brake bands through which it is connected to the yoke 107. The brake bands may be supported near the front of the draw-works by means of standards 117 mounted on the crossbeam 49 and supporting brackets 118 projecting forwardly from the brake bands so as to keep the latter from falling inwardly and braking against the drum brake surfaces.

In addition to the driving means provided by the draw-works, the drum shaft may be provided with an emergency sprocket 119 through which it may be driven in the event of a breakdown in the draw-works or prime mover.

Through the above mechanism, a self-contained draw-works is provided in which a maximum number of speeds may be obtained with a minimum of shafts. Also, there is no danger of overriding of the sprocket chains such as is caused when the chains extend upwardly. Inasmuch as the draw-works may be moved as a unit, it requires no aligning of parts and may be set on a previously positioned foundation in accurate position.

It is to be noted that the sprocket 22 drives the drum shaft at a slower speed than the sprocket wheel 27, and that the clutch 24 is an overriding clutch, so that if both of the sprockets 19 and 20 should be clutched simultaneously to the line shaft, the drum shaft would be driven at the higher speed, overriding the clutch 24.

What I claim is—

1. A draw-works for rotary drilling apparatus which comprises a base having a pair of spaced longitudinal beams, a pair of upright bearing members, one on each said beam, crossbeams connecting said longitudinal spaced beams, a drum shaft journalled in and between said bearing members, a drum rigidly mounted on said drum shaft, a line shaft journalled in and between said bearing members at approximately the level of said drum shaft, a pair of sprockets on said drum shaft, a corresponding pair of driving sprockets on said line shaft, a clutch between each said driving sprocket and said line shaft, a chain connecting each drum shaft sprocket to its corresponding line shaft sprocket, one of said sprocket and chain connections driving said drum shaft at a slower speed than the other, a clutch means between said lower speed sprocket and said drum shaft, means mounted on said frame to connect each of said driving sprockets individually to said line shaft, a pair of driven sprockets rotatably mounted on said line shaft, clutches between each of said sprockets and said line shaft, and a common mechanism to engage one of said driven sprocket clutches and disengage the other alternatively to and from said line shaft.

2. A draw-works for rotary drilling apparatus which comprises a base having a pair of spaced longitudinal beams, a pair of upright bearing members, one on each said beam, crossbeams connecting said longitudinal spaced beams, a drum shaft journalled in and between said bearing members, a drum rigidly mounted on said drum shaft, a line shaft journalled in and between said bearing members at approximately the level of said drum shaft, a pair of sprockets on said drum shaft, a corresponding pair of driving sprockets on said line shaft, a clutch between each said driving sprocket and said line shaft, a chain connecting each drum shaft sprocket to its corresponding line shaft sprocket, one of said sprockets and chain connections driving said drum shaft at a slower speed than the other, a clutch means between said lower speed sprocket and said drum shaft, means mounted on said frame to connect each of said driving sprockets individually to said line shaft, a pair of driven sprockets rotatably mounted on said line shaft, clutches between each of said sprockets and said line shaft, a common mechanism to engage one of said driven sprocket clutches and disengage the other alternatively to and from said line shaft, a lever mechanism to throw said driven sprocket clutches into intermediate or alternate positions, and individual pedal mechanisms to actuate said drum driving sprockets individually.

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