April 8, 1958 A. E. WAGNER ET AL 2,829,865

DRILLING RIG

Filed April 2, 1956 3 Sheets-Sheet 1

Fig. 1.

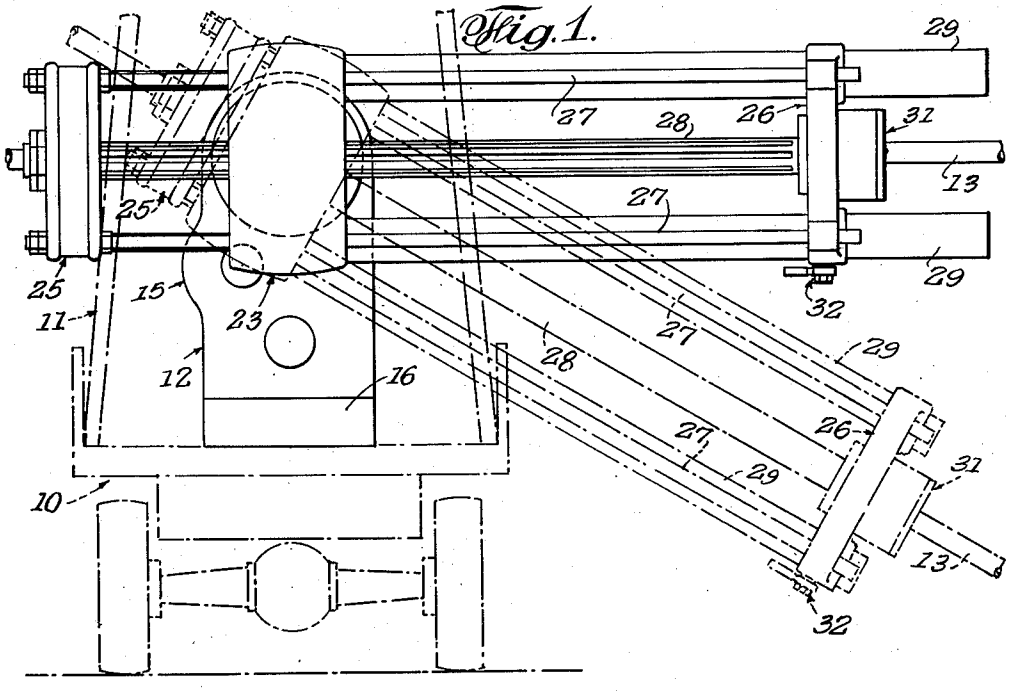


Fig. 7.

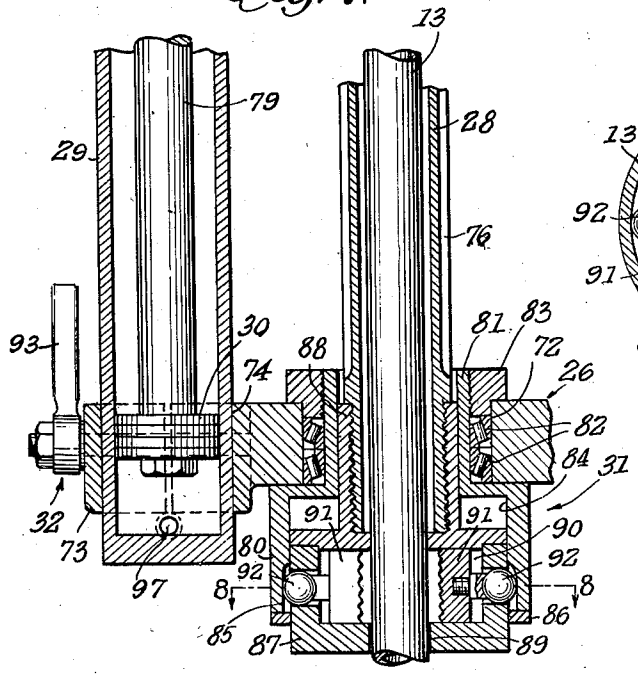
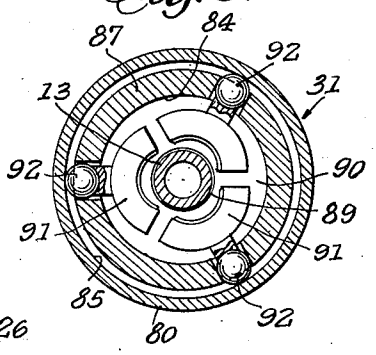


Fig. 8.



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Fig. 2.

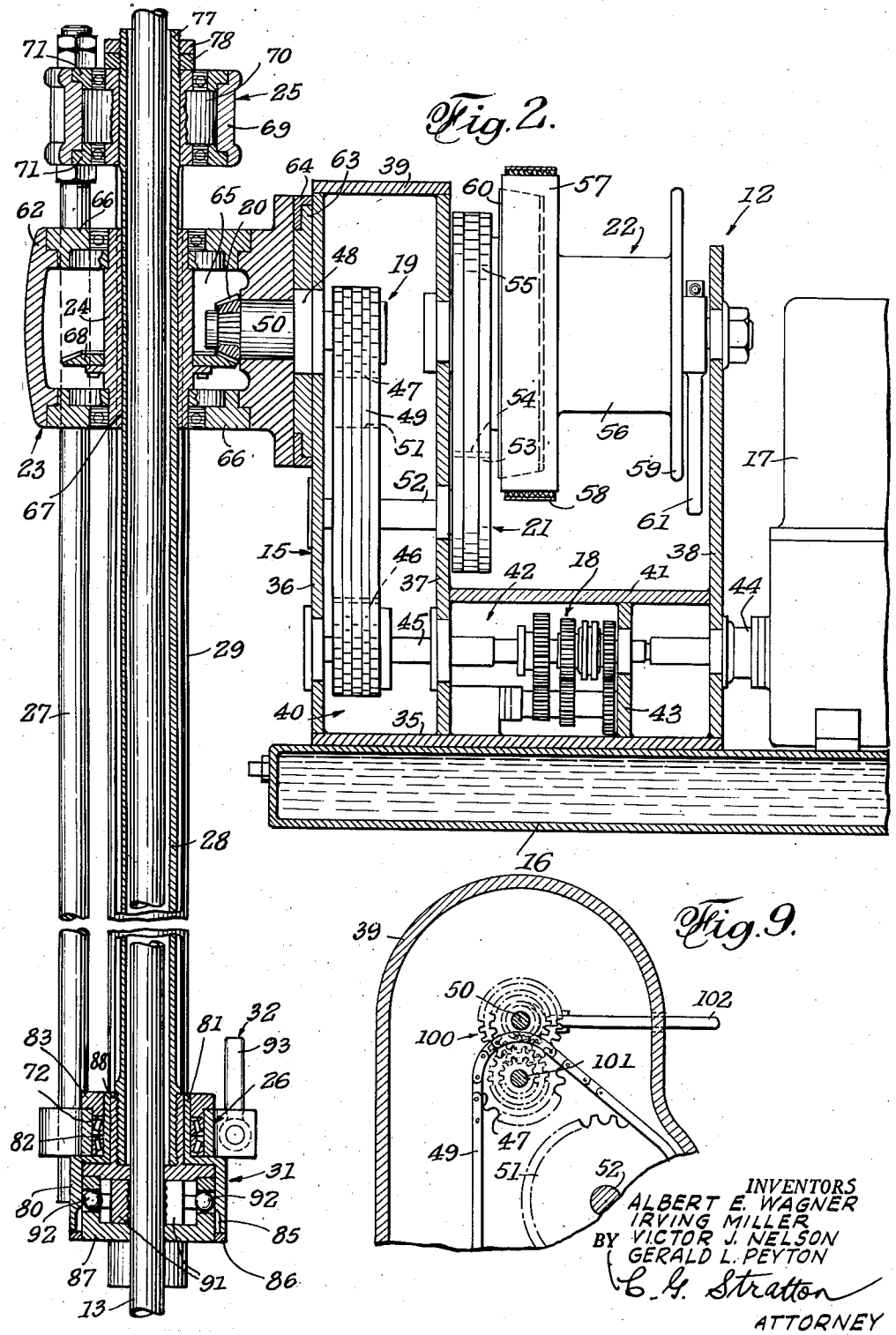


Fig. 9.

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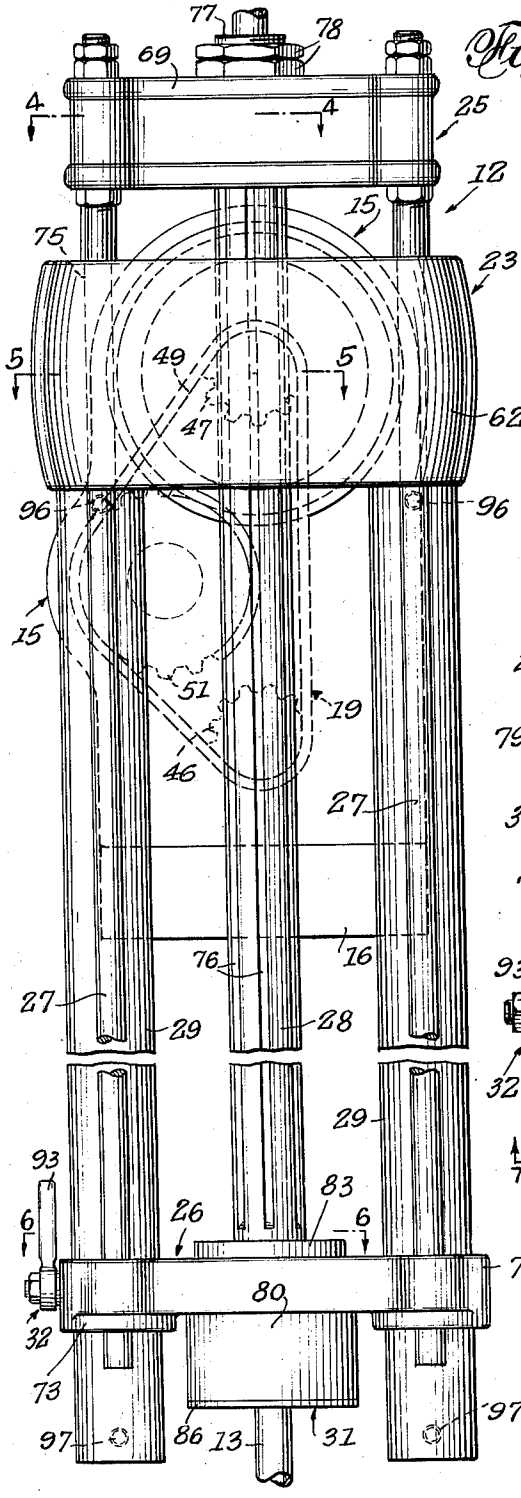


Fig. 3

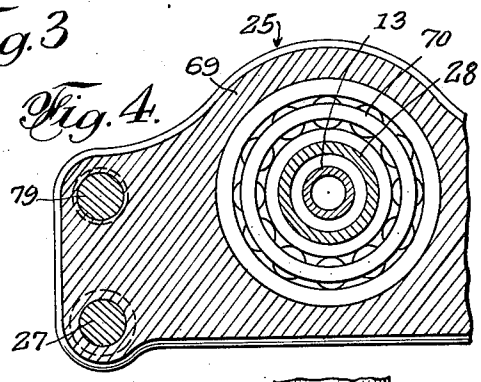


Fig. 4.

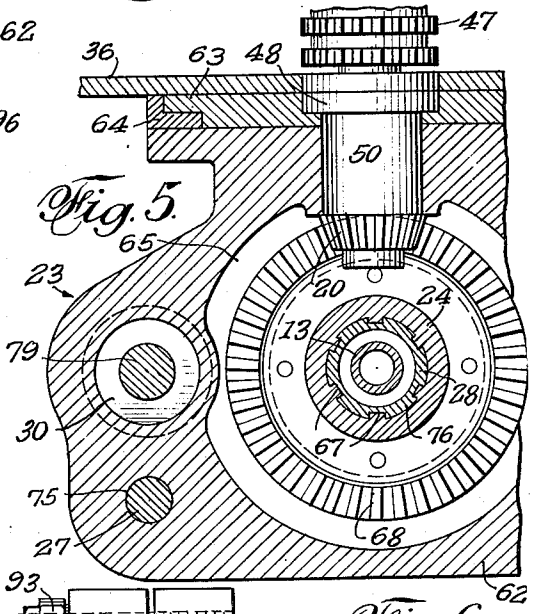


Fig. 5.

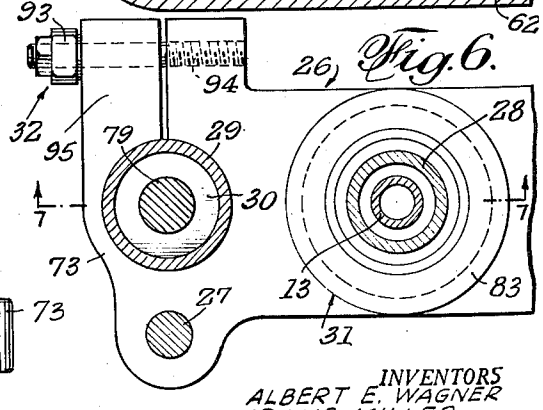


Fig. 6.

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DRILLING RIG

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Application April 2, 1956, Serial No. 575,575

8 Claims. (Cl. 255—19)

This invention relates to drilling apparatus and deals more particularly with a light weight and mobile drilling rig.

An object of the present invention is to provide a light weight drilling rig that may operate not only to drill downwardly but in any direction including, if necessary, drilling upwardly into a formation.

Another object of the invention is to provide drilling apparatus that embodies novel and simplified power transmission means, whereby drill pipe may be rotated at different speeds according to particular conditions.

A further object of the invention is to provide a drilling means of the character referred to that is provided with hydraulic power for advancing hte drill pipe, the advance being through the medium of chuck means that may be released at the end of the power stroke so that recovery movement of the drill-advancing means may be effected.

A still further object of the invention is to provide a novel form of automatic chuck which may be manually conditioned for release but is released by application of power.

The invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the following description merely describes, embodiments of the present invention, which are given by way of illustration or example only.

In the drawings, like reference characters designate similar parts in the several views.

Fig. 1 is a front elevational view of a drill rig according to the present invention, the same, in full lines, being arranged to drill horizontally, and in dot-dash lines to drill at a downward angle.

Fig. 2 is an enlarged vertical sectional view of said rig arranged to drill vertically downwardly.

Fig. 3 is a front elevational view of said rig arranged as in Fig. 2.

Figs. 4, 5 and 6 are further enlarged cross-sectional views as taken on the respective lines 4—4, 5—5 and 6—6 of Fig. 3.

Fig. 7 is a vertical sectional view as taken on the line 7—7 of Fig. 6 and showing the chuck of said apparatus in released position.

Fig. 8 is a plan sectional view as taken on line 8—8 of Fig. 7.

Fig. 9 is a fragmentary vertical sectional view of a modification.

The drilling rig that is illustrated comprises, generally, a transporting vehicle 10, a derrick frame 11 carried by the vehicle, and the present novel drilling apparatus 12, also carried by the vehicle. No novelty is

claimed for the vehicle and derrick frame, the same comprising the usual means of such nature and being subject to considerable leeway of design and application. In this instance, the derrick has the function of supporting a drill rod 13 from above and while the same is being lifted or moved in a non-drilling or recovery direction.

The drilling apparatus 12 comprises, generally, a stationary frame 15 that is mounted on the vehicle 10 and includes a hydraulic fluid reservoir 16 and is provided with a prime mover in the form of an engine 17, a change-speed transmission 18 connected to said engine and mounted in said frame 15, a primary drive 19 from the output of the transmission 18 and terminating in a driven bevel pinion gear 20, a secondary drive 21 from the drive 19, a winch mechanism 22 receiving its power from the drive 21, an indexing head 23 carried by the frame 15 and overhanging the adjacent end of the vehicle 10, a drive sleeve 24 rotationally carried by said indexing head and connected to be rotated by the mentioned pinion gear 20, an upper cross head 25 on one side of the indexing head, a lower cross head 26 on the opposite side of said indexing head, guide rods 27 connected to the upper cross head and extending through the indexing head and in guiding engagement with cross head 26, a quill 28 extending between the cross heads and driven by the mentioned drive sleeve 24, a pair of hydraulic cylinders 29 carried by the indexing head on either side of the quill and parallel to said quill, a pair of pistons 30 carried by the upper cross head and operable in said cylinders, an automatic clutch 31 to connect to and release the drill pipe as desired, and means 32 to releasably affix the lower cross head to one or both of the cylinders 29 to cause operation of said clutch.

The frame 15 is shown as comprising a base plate 35 disposed upon or above the reservoir 16, a set of vertical walls 36, 37 and 38, a housing wall 39 spanning between walls 36 and 37 and forming a drive enclosure 40, a housing wall 41 spanning between walls 37 and 38 and forming a transmission enclosure 42, and a vertical partition 43 within the enclosure 42. Said enclosures 40 and 42 may be used to contain suitable lubricants for drive 19 and transmission 18. In this instance, a welded structure is shown, although the frame 15 may be formed in various other ways.

It will be noted that the reservoir 16 is of flattened form and constitutes a support base for the frame 15 and also for the engine 17. The latter, of course, may be of any desired type and has a connection 44 to the transmission 18. Although not shown, said engine may be utilized to place the hydraulic fluid used in this apparatus under suitable pressure. Accordingly, said engine may be used to operate a compressor, pump, or other fluid-compressing machine.

The transmission 18 is shown as of the three-speed forward and one-speed reverse type that is much used in automotive installations. Its controls are not shown since the same may be generally as conventional as the transmission itself. In any case, the output shaft 45 of the transmission may be driven fast or slow, as desired, or in reverse.

The primary drive 19 is shown as comprising a sprocket wheel 46 on the output shaft 45, a sprocket wheel 47 journalled at 48 in the frame wall 36, a chain or the like 49 connecting said sprocket wheels, and a shaft 50 carrying both the pinion gear 20 and the sprocket 47 and rotational in said journal 48. In the above manner, the power of the engine 17 is translated, in speed and direction of rotation, into driving rotation of pinion gear 20.

The secondary drive 21 is shown as a sprocket wheel 51 on a shaft 52 carried by the frame walls 36 and 37,

said wheel being in meshing engagement with chain 49, a sprocket wheel 53 on said shaft 52 and disposed on the side of wall 37 that is outward of enclosure 40, a sprocket wheel 54 offset from the center of shaft 52, and a chain 55 trained over and operatively connecting wheels 53 and 54. The center of wheel 54 coincides with the axis of the winch mechanism 22. The latter is disposed between and carried by the frame walls 37 and 38 above the transmission 18.

The winch mechanism 22 may vary. Essentially, the same comprises a drum 56 provided with an enlarged cylindrical end 57 that is engaged by a brake band 58, a flange 59 cooperating with the end 57 to form a cable- or rope-housing groove in said drum, a clutch 60, when coupled, connecting the drum to the drive 21, and control means shown in the form of a lever 61 that may be manually operated to couple or uncouple clutch 60, as desired, and release or tighten the band 58, as desired.

The indexing head 23 is preferably carried by the frame wall 36. Said head is shown as a housing 62 that is provided with a circular plate 63 having a rotational interfit with a flanged ring 64 affixed to said wall 36. It will be clear that said head may be rotationally adjusted around the axis of shaft 50 that is centered on said plate and ring and that such adjustment may be locked by suitable bolts or the like. The three positions of the head shown in Figs. 1 and 2 indicate that the same may have adjustment through the full 360° of a circle. Said housing 62 is formed to have an interior space 65 in which the pinion gear 20 resides and the upper and lower walls of said housing are fitted with bearing-carrying closure plates 66.

The drive sleeve 24 extends through the space 65 and has its ends in bearing engagement with the plates 66. Thus, said sleeve is disposed on an axis intersecting the axis of shaft 50. The internal bore of said sleeve is provided with splines 67 and the same may be rotated through the medium of a bevel gear 68 affixed thereto and in mesh with the pinion gear 20.

The upper cross head 25 comprises a housing 69 that is fitted with a central bearing 70 retained in position by opposite closure plates 71.

The lower cross head 26 comprises a housing having a central bore 72 and provided with laterally extending opposite wings 73 each provided with a bore 74.

The guide rods 27 interconnect the cross heads to hold the same mutually aligned. Said rods 27 are shown as affixed to the cross head 25, extending through guide bores 75 in the indexing head 23, and in guiding and sliding engagement with the cross head 26. Said rods 27 may be affixed to cross head 26 and in guiding and sliding engagement with cross head 25. In either case, the two cross heads are adapted to have relative longitudinal movement.

The quill 28 is provided with splines 76 slidingly interfitting with the splines 67 of the sleeve 24. Said quill extends through said sleeve, is rotational therewith, and is relatively slidable thereto. The upper end 77 of the quill extends through the bearing 70 in the upper cross head and is affixed to the cross head as by means of nuts 78. Thus, the quill, while rotational, is longitudinally movable with the upper cross head and, since the two cross heads 25 and 26 may be moved longitudinally relatively, the lower end of said quill may move endwise relative to the lower cross head 26.

The cylinders 29 are carried by the indexing head 23, one on each side of the axial center of said head as represented by the quill 28. The lower cross head 26 is provided with the mentioned bores 74 into which said cylinders are slidingly fitted. This interfit of cylinders 29 and the lower cross head serves to hold the latter against turning on the axis of the quill, the guide rods 27 thereby serving to similarly orient the upper cross head.

The pistons 30 (Fig. 7) are fitted into said cylinders and are connected by means of piston rods 79 to the upper cross head 25, said rods 79 extending through the indexing head, as indicated in Fig. 5.

The automatic clutch 31 is provided with an outer housing 80 that is rotationally carried by cross head 26, said housing having an upper collar 81 that extends through the bore 72 and is engaged by suitable bearings 82 in said bore. A flange plate 83 is connected to said collar and, together with housing 81, acts to locate said housing on the cross head against endwise movement.

Housing 80 is provided with an internal bore 84 which, at the lower end of the housing, is provided with a counterbore 85, the latter being closed by a ring 86 affixed to the open end of the housing to close the end of the counterbore 85.

Said automatic clutch is provided with a core part 87 that slidingly fits the bore 84 and is provided with an extension 88 that fits within collar 81 and is threadedly connected to the lower end of the quill 28. Said core part has a central opening 89 that freely passes the drill rod 13 and the same is formed to have an interior space 90 in which is disposed a set of rod-gripping jaws 91 that are movable into and out of engagement with the drill rod 13 by clutch balls 92. When said balls are engaged with the wall of bore 84, they have an inward position that presses the jaws in rod-gripping position. When the balls are engaged with the wall of the counterbore 85, they effect release of the jaws, enabling free movement of the drill rod 13.

From Figs. 2 and 7, showing two different positions of the chuck 31, it will be evident that the chuck is released when the quill 28 and the chuck core 87 are moved downwardly relative to the indexing head 23 and the chuck housing 80, and that the chuck is actuated to grip the drill rod by an upward movement of the quill 28.

Such relative movement is effected by the means 32, which comprises a lever or arm 93 that rotates a threaded member 94 to release or draw together the clamp 95 formed in the cross head 26. Said clamp, when applied, effects gripping of one cylinder 29 by cross head 26. When said cross head is thus gripped and is unable to move endwise relative to the indexing head 23, upward movement of the cross head 25 will pull the chuck core 87 up. Reverse movement of the latter cross head will push said core down. Thus, the chuck may be operated as above outlined.

When the chuck is released, the drill rod may be extracted from the machine, the winch and the derrick being used for this purpose. When the chuck is in gripping engagement with the rod 13 and the means 32 released to allow movement of the lower cross head relative to the indexing head, the power of the fluid supplied at ports 96 and as compressed by the power of the engine 17, is applied to the tops of pistons 30, thus forcing the quill downwardly, together with the now released lower cross head. This action is simultaneous with rotation of rod 13 when drilling is to be effected. Extraction or reverse operation is effected by fluid at ports 97.

Referring now to Fig. 9, the modification there shown embodies a dual ratio drive to the pinion shaft 50. This drive is achieved by interposing a two-speed transmission 100 between shaft 101 of sprocket wheel 47 and said shaft 50. This transmission may be controlled by a shift lever 102. By this construction, the speed of drive of the drill rod 13 may be controlled independently of the drive of the winch mechanism 22, the master drive being controlled by transmission 18 and the mentioned independent drive by the dual ratio transmission 100.

Any suitable hydraulic system and controls may be provided to regulate the rate of tool or rod feed.

While the foregoing has illustrated and described what are now contemplated to be the best modes of carrying out our invention, the constructions are, of course, subject to modification without departing from the spirit and scope of the invention. It is, therefore, not desired to restrict the invention to the particular forms of con-

struction illustrated and described, but to cover all modifications that may fall within the scope of the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A drilling apparatus comprising a frame, an indexing head carried by said frame, a rotational sleeve carried by the head, a quill extending through the sleeve and driven thereby, the hollow of the quill housing a drill rod, a first cross head on one side of the indexing head and connected to one end of the quill, hydraulically operable piston and cylinder means carried by said indexing head and cross head to effect movement of the cross head relative to the indexing head and to thereby produce longitudinal movement of the quill relative to the indexing head, a second cross head on the other side of the indexing head and engaged by the quill, a chuck comprising two relatively movable parts, one rotationally carried by the second cross head and the other carried by the end of the quill that is engaged by the second cross head, drill rod-gripping means in the latter part of the chuck, and means carried by the second cross head to releasably connect said second cross head to one of the cylinders of said piston and cylinder means to hold one clutch part longitudinally immovable during longitudinal movement of the other clutch part, as imparted by longitudinal movement of the quill, said clutch embodying means operable during such movement of the clutch parts to move the rod-gripping means between gripping and releasing positions.

2. Drilling apparatus according to claim 1: guide rods passing through the indexing head on each side of the axis of index thereof, means to affix said rods to one cross head, the other cross head having sliding engagement with said rods.

3. Drilling apparatus according to claim 1: a pair of guide rods affixed at one end to the first cross head and extending through the indexing head on each side of the axis of index of the latter head, the opposite ends of the rods having sliding engagement with the second cross head.

4. Drilling apparatus according to claim 1: the second cross head having bores on each side of the axis of the drill rod, said cylinders slidingly extending through said bores, and the mentioned releasable connecting means comprising a clamp part formed in said second cross head and releasably connected to the cylinder associated therewith.

5. In a drilling device having a rotational and longitudinally movable quill, a housing through which the quill extends and relative to which the same is longitudinally movable, a first cross head on one side of said housing and connected to one end of the quill, hydraulically operable piston and cylinder means carried by said housing and cross head to effect movement of the cross head relative to the housing and to thereby produce longitudinal movement of the quill relative to the housing, a second cross head on the other side of the housing and engaged with the quill, a chuck comprising two relatively movable parts, one rotationally carried by the second cross head and the other carried by the end of the quill that is engaged by the second cross head, drill rod-gripping means in the latter part of the chuck, and means carried by the second cross head to releasably connect said second cross head to one of the cylinders of said piston and cylinder means to hold one clutch part longitudinally immovable during longitudinal movement of the other clutch part, as imparted by longitudinal movement of the quill, said clutch embodying means operable during such movement of the clutch parts to move the rod-gripping means between gripping and releasing positions.

6. Drilling apparatus according to claim 5: guide rods passing through the mentioned housing on each side of and parallel to the quill, means to affix said rods to one cross head, the other cross head having sliding engagement with said rods.

7. Drilling apparatus according to claim 5: a pair of guide rods affixed at one end to the first cross head and extending through the housing on each side and parallel to the quill, the opposite ends of the rods having sliding engagement with the second cross head.

8. Drilling apparatus according to claim 5: the second cross head having bores on each side of the axis of the drill rod, said cylinders slidingly extending through said bores, and the mentioned releasable connecting means comprising a clamp part formed in said second cross head and releasably connected to the cylinder associated therewith.

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