

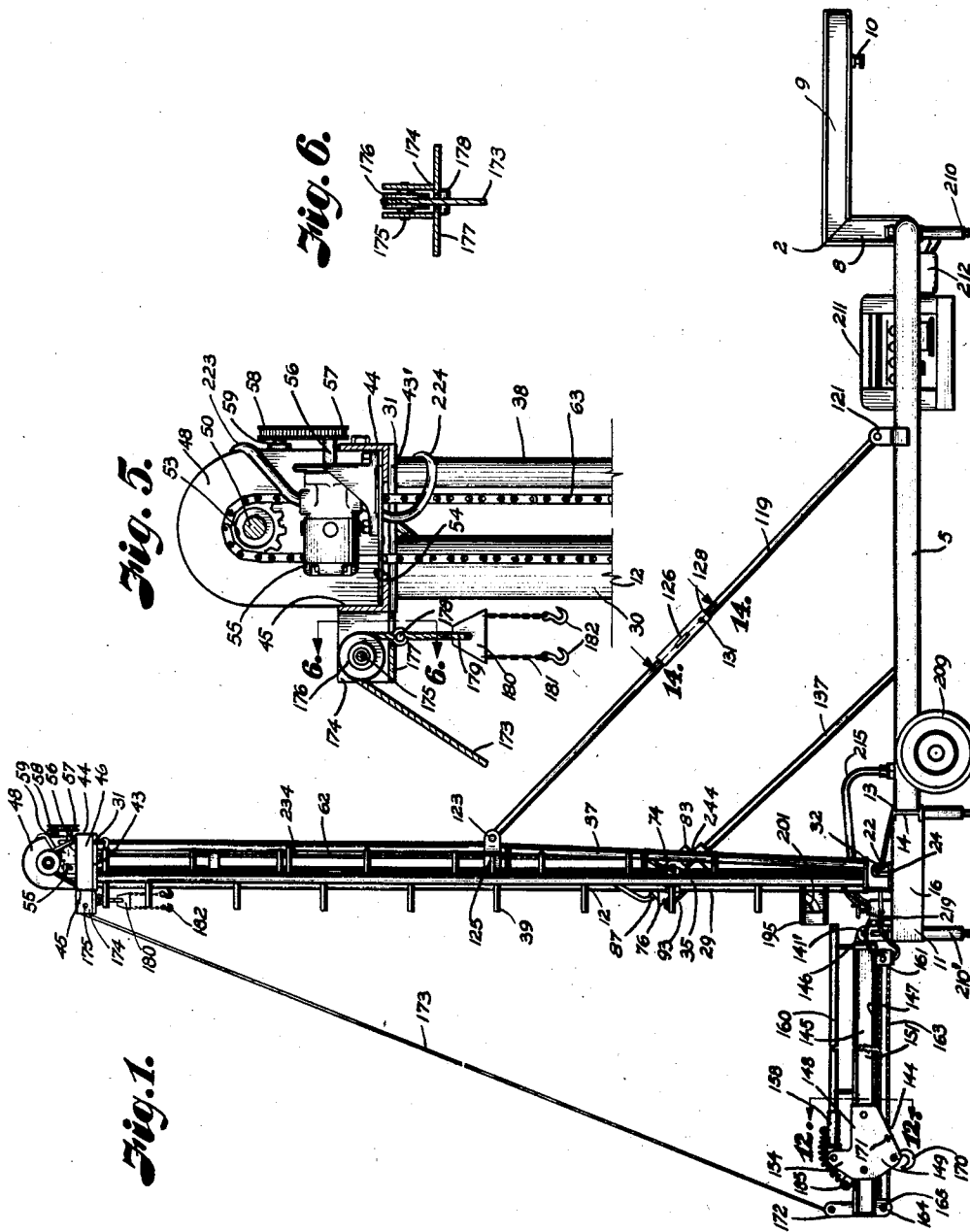
Aug. 19, 1958

W. W. SIMMONDS
PORTABLE DRILLING RIG

2,848,196

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6 Sheets-Sheet 1



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6 Sheets-Sheet 2

Fig. 2.

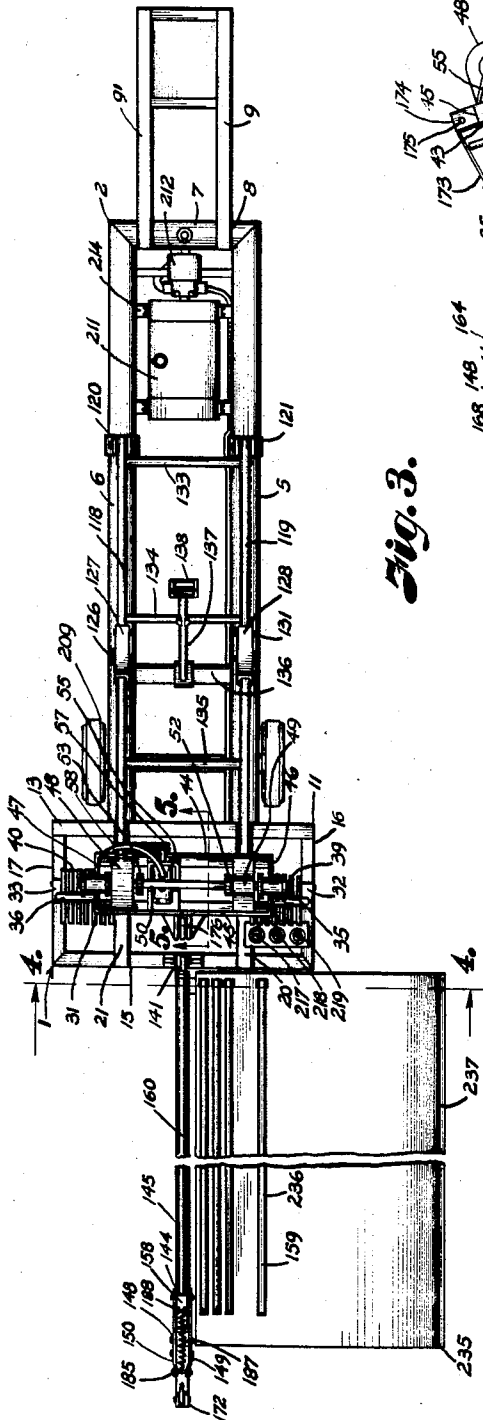
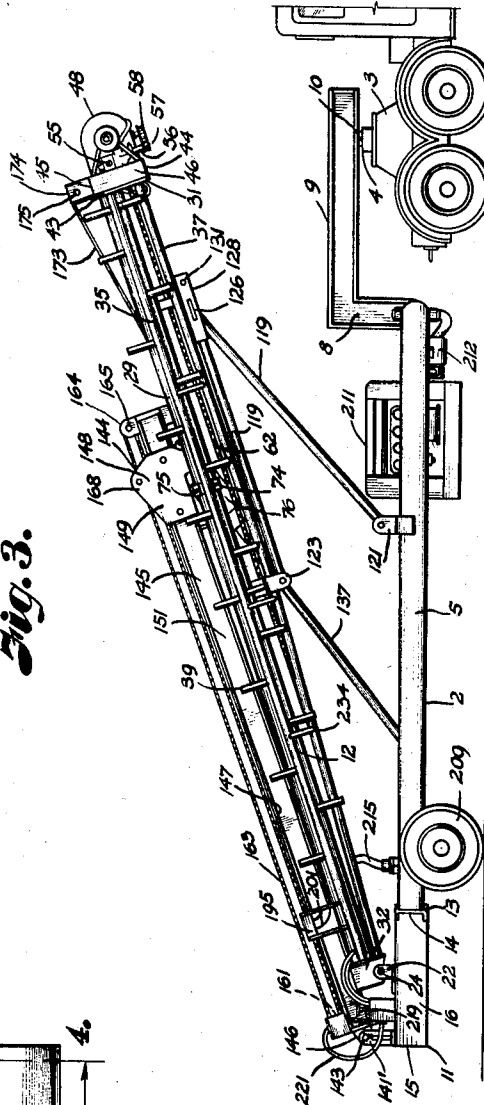


Fig. 3.



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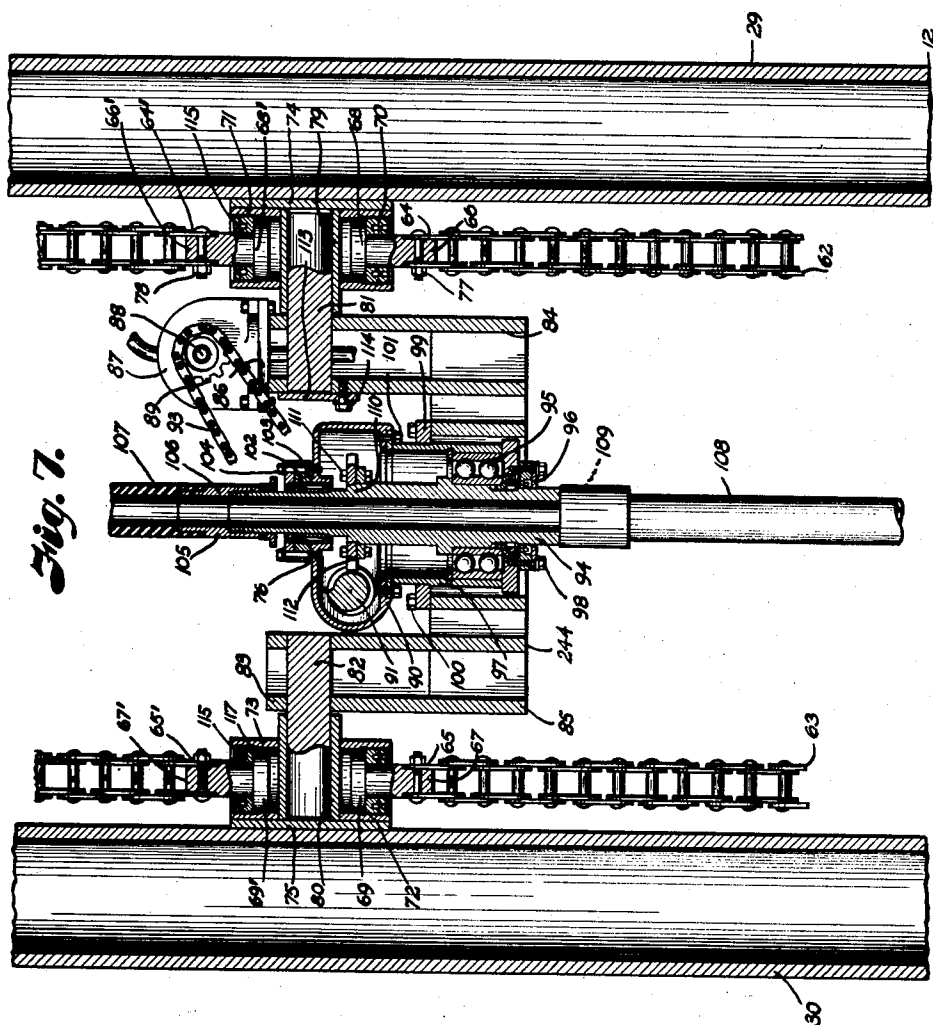
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6 Sheets-Sheet 3



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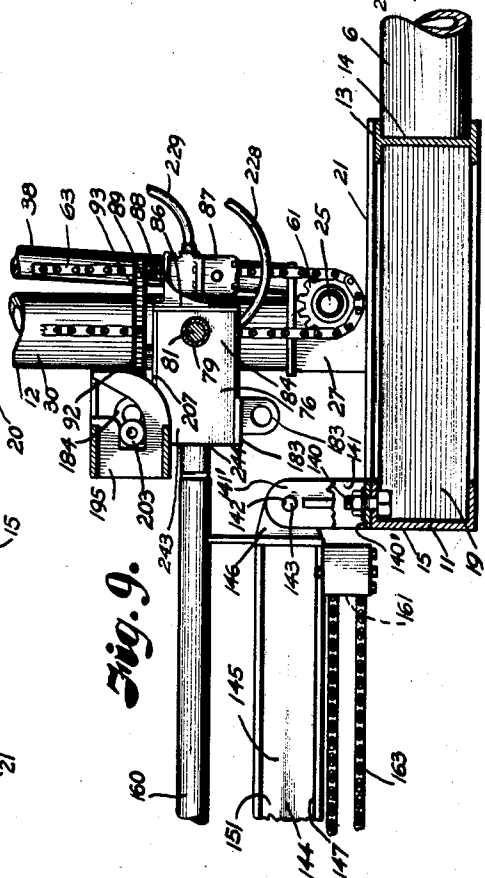
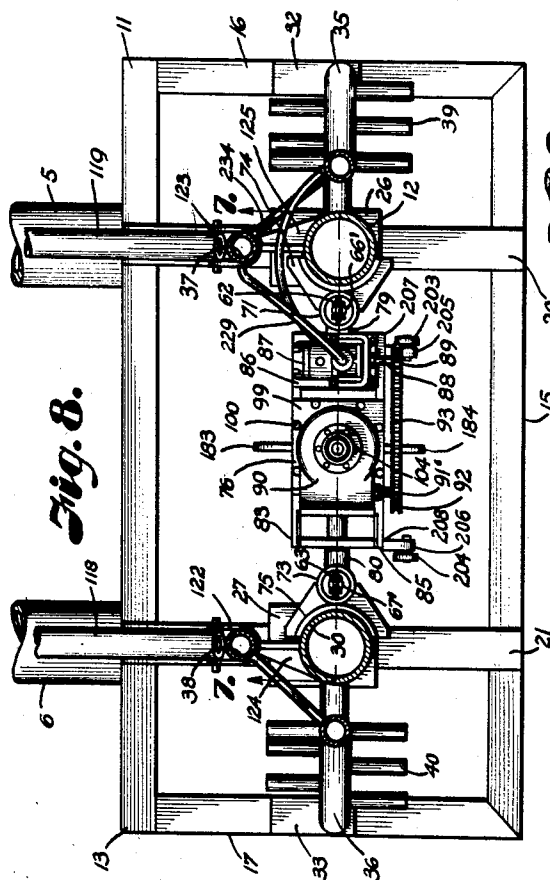
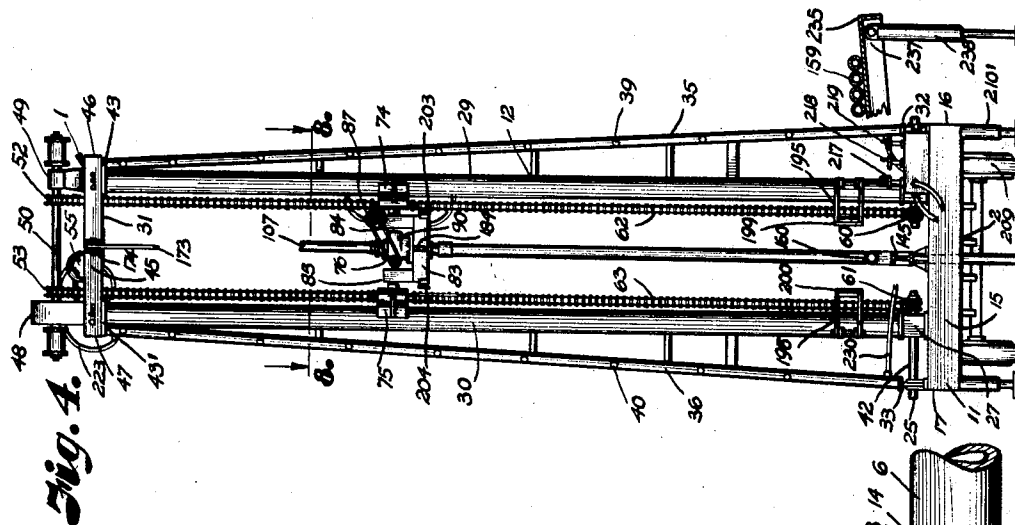
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W. W. SIMMONDS
PORTABLE DRILLING RIG

2,848,196

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6 Sheets-Sheet 4



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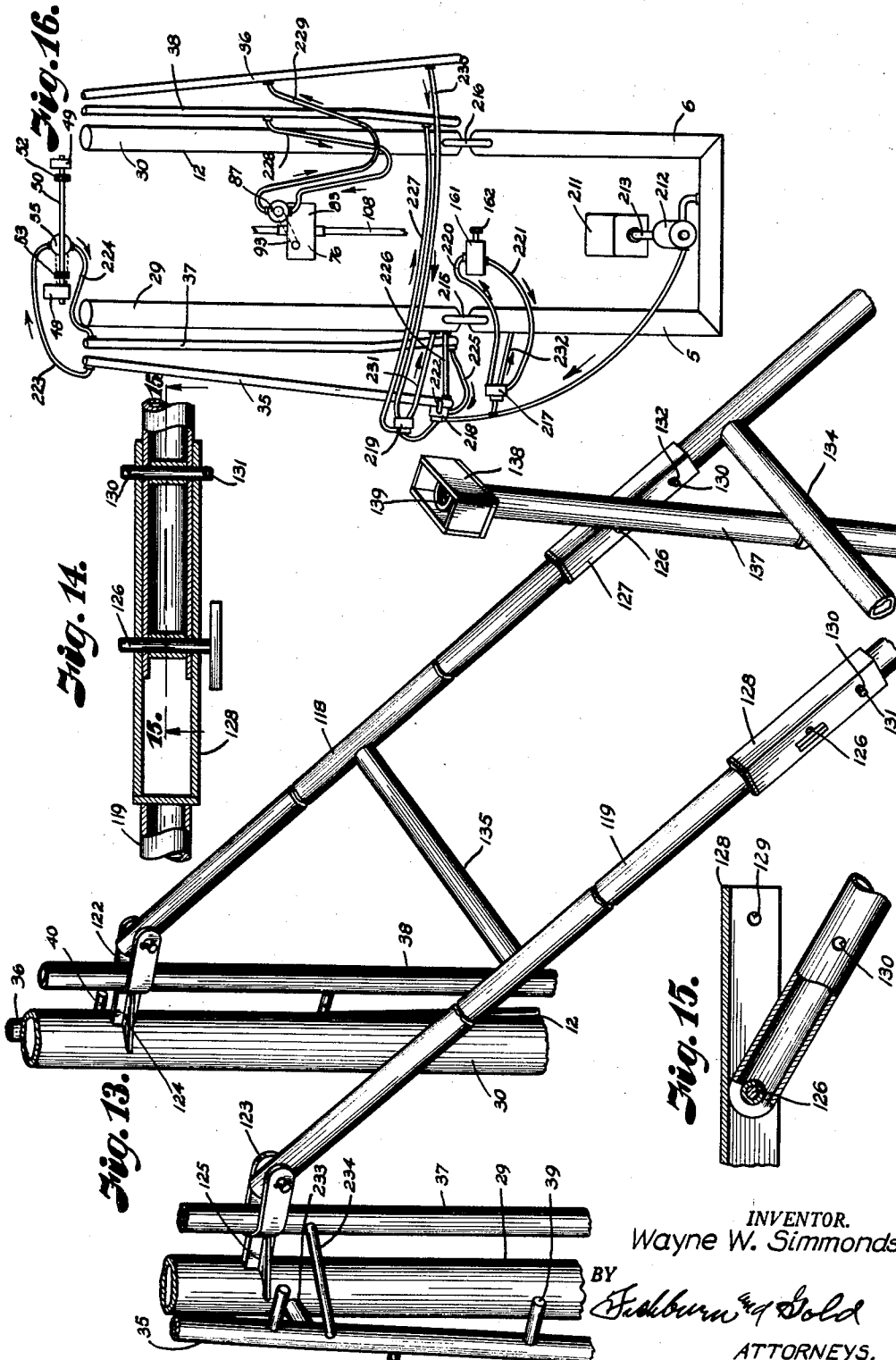
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6 Sheets-Sheet 6



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2,848,196

PORTABLE DRILLING RIG

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Application October 17, 1955, Serial No. 540,821

13 Claims. (Cl. 255—19)

This invention relates to earth drilling machines, and more particularly to a portable apparatus for rotary drilling wherein the derrick or mast is mounted on the chassis of a vehicle so that the rig may be transported from one drilling site to another.

The principal objects of the present invention are to provide a mast having a slidably mounted rotatable drilling head mounted therein for raising and lowering the mast; to provide such apparatus for lifting additional pipe from a pipe handling device for lowering the same into the well hole and removing the same therefrom; to provide such apparatus for raising and lowering the pipe handling device, and to provide such apparatus for the drilling of a well hole wherein additional pressure may be imposed on the drill bit during the drilling operation.

Other objects of the invention are to provide a mast or derrick having means on the lower portion thereof for turning the rotating head in horizontal position to pick up pipe from a pipe handling apparatus associated with the drilling equipment and inserting the same into the well hole or removing the same therefrom; to provide hydraulically operated chain mechanism for raising and lowering the rotary head on the mast; to provide a pipe handling apparatus hingedly mounted on the framework supporting the mast; to provide means pivotally mounting the mast on the vehicle for transporting the same; to provide brace means on the vehicle for supporting the mast in vertical position; to provide means on the pipe handling device having connection with the upper part of the mast and adapted to be attached to the rotary head for raising and lowering the pipe handling mechanism to fold the same against the mast; to provide brace beams on the mast supported on the base on the frame of the vehicle; to provide the mast braces and vehicle of tubular form for housing the hydraulic fluid for operating the apparatus; to provide fluid connections for operating the apparatus and to provide a device of this character simple and economical to manufacture.

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

Fig. 1 is a side view of the drilling rig embodying the features of my invention.

Fig. 2 is a top plan view of my apparatus.

Fig. 3 is a side view showing the mast in lowered position for transportation of the apparatus.

Fig. 4 is an end view partly in cross section taken on a line 4—4, Fig. 2.

Fig. 5 is a cross-sectional view showing the chain driving apparatus on top of the mast taken on a line 5—5, Fig. 2.

Fig. 6 is a cross-sectional view taken on a line 6—6, Fig. 5.

Fig. 7 is an enlarged sectional view particularly illustrating the rotary drilling head taken on a line 7—7, Fig. 8.

Fig. 8 is a top plan view taken on a line 8—8, Fig. 4.

Fig. 9 is a fragmentary cross-sectional view particular-

ly illustrating the head in position for attaching to a pipe on the pipe handling apparatus.

Fig. 10 is an enlarged perspective view of the lower portion of the frame particularly illustrating the swingable guide members for the rotary drilling head.

Fig. 11 is an enlarged sectional view of parts of the automatic pipe handling apparatus taken on a line 11—11, Fig. 12.

Fig. 12 is a cross-sectional view taken on a line 12—12, Fig. 1.

Fig. 13 is an enlarged perspective view of parts of the mast particularly illustrating the mounting of the braces.

Fig. 14 is a sectional view through the braces taken on a line 14—14, Fig. 1.

Fig. 15 is a sectional view taken on a line 15—15, Fig. 14.

Fig. 16 is a diagrammatic view of the fluid lines connecting the motors, valves and reservoirs.

Referring more in detail to the drawings:

1 designates a drilling rig embodying the features of my invention mounted on a trailer vehicle 2 of a truck or the like 3 as shown in Figs. 2 and 3. The truck may be of any suitable form having a pin or the like 4 for connection by the forward end of the trailer vehicle. The frame of the vehicle comprises longitudinal parallel members 5 and 6 preferably of hollow form for containing a supply of fluid for a purpose later described. The longitudinal members 5 and 6 are connected at their forward ends as indicated at 7 and secured thereto are upstanding arms 8 and from which are extended forwardly a pair of arms 9 and 9' having a connection 10 for securing the trailer vehicle to the pin 4 of the truck.

Connected to the rear ends of the tubular members 5 and 6 is a frame 11 upon which the mast or derrick 12 is supported as shown in Fig. 10. The framework 11 may be of any suitable form but I have here shown a cross member as an I-beam 13 of which the web 14 thereof forms an end for the tubular members 5 and 6 for closing the same. The rear side 15 of the framework 11 and the ends 16 and 17 are of channel formation and are secured to the I-beam 13 by welding or other suitable means. Cross beams 18 and 19 are provided on the framework 11 and are here shown to be of I-beam construction. The plates 20 and 21 are provided on the I-beams and extend over the top sides 13 and 15 as best illustrated in Fig. 2.

Mounted upon each of the ends 16 and 17 of the framework 11 are ears or brackets 22 and also mounted upon the plates 20 and 21 are ears or brackets 23 having bearing openings for shafts 24 and 25 upon which is pivotally mounted the mast 12 and bracing therefor now to be described.

Boxes or brackets 26 and 27 are seated on the plates 20 and 21 respectively. The respective sides thereof are provided with openings as indicated at 28 (Fig. 10) through which the shafts 24 and 25 extend. Rigidly mounted upon the boxlike members 26 and 27 by welding or other suitable means are tubular mast members 29 and 30 forming the main support for the mast 12, connected at their upper ends by a head 31 which closes the open ends of the tubular members. Short T-beams 32 and 33 are adapted to seat on the ends 16 and 17 of the frame 11 and are provided with openings through which the shafts 24 and 25 also extend. The forward lower ends of the vertical web portion of the T-beams 32 and 33 are cut away as best shown in Fig. 3 to permit the T-beams to rotate on the shafts 24 and 25. Rigidly secured on the top of the T-beams 32 and 33 are tubular side brace members 35 and 36 which also extend to the top of the mast alongside the tubular members 29 and 30 and are also secured to and closed by the head 31. Mounted on the top of the box members 26 and 27 and forwardly of the tubular members 29 and 30 are tubular

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braced members 37 and 38 which also extend to the top of the mast and are secured to and closed by the head 31 (Fig. 5). The brace members 35, 36, 37 and 38 are all adapted for housing the hydraulic fluid as will hereinafter be more clearly set forth. The brace members 35 and 36 are provided with step members 39 and 40 for mounting the mast as desired. Brace members 41 and 42 are provided between the boxes 26 and 27 and the T-beams 32 and 33 to lend rigidity to the mast structure, and the entire mast structure including the boxes 26 and 27 and the short T-beams 32 and 33 are rotated with the shafts 24 and 25 in the bracket bearings 22 and 23.

The head 31 on top of the mast, particularly that part for closing the tops of the tubular members 29, 30, 35, 36, 37 and 38, comprise plates 43 and 43' (Fig. 5). Mounted on the plates 43 and 43' and forming sides 44 and 45 and ends 46 and 47 are angle members rigidly secured by welding or other suitable means to the plates 43 and 43'. Mounted on the horizontal portion of the angle members is a gear box 48. Mounted on the opposite end of the head is a bearing member 49 for a shaft 50 which extends through the gear box 48. Spaced sprockets 52 and 53 are mounted on the shaft 50 (Fig. 4). Substantially near the center of the head is a plate 54 on which is mounted a motor 55 having a shaft 56 and a sprocket 57 thereon for accommodating a chain running over a sprocket 58. The sprocket 58 (Fig. 3) is mounted on a shaft 59 extending into the gear box 48 upon which is carried a worm (not shown) meshing with a worm wheel (also not shown) in the gear box on the shaft 50 for driving the said shaft and rotating the sprockets 52 and 53.

The shafts 24 and 25 upon which the mast is pivotally mounted as illustrated in Fig. 10 extend outwardly from the box-like members 26 and 27 and mounted thereon are sprockets 60 and 61 for accommodating chains 62 and 63 running over the sprockets 52 and 53 on the shaft 50 at the top of the mast and as shown in Fig. 7 having their free ends 64 and 64' and 65 and 65' respectively attached to rods 66 and 66' and 67 and 67' respectively of pistons 68 and 68' and 69 and 69' in cylinders 70 and 71 and 72 and 73 respectively forming a part of guides 74 and 75 for the rotatable head 76 which is slidable vertically on the inside of the tubular members 29 and 30 which form trackways for said guides as will later be shown. The ends of the chains are attached to the piston rods by bolts or the like as indicated at 77 and 78.

The guides 74 and 75 are semi-circular in cross section as illustrated in Fig. 4 so that they will provide traction on the tubular members 29 and 30. The guides 74 and 75 are provided between the cylinders 70, 71, 72 and 73 respectively with transversely extending bearings 79 and 80 for accommodating short shafts 81 and 82 on which is mounted a swing or framework structure 83 comprising side members 84 and 85 having a cross plate 86 upon which is mounted a motor 87 carrying a shaft 88 upon which is mounted a sprocket 89. 90 designates a gear box for housing a worm 91 having a shaft 91' with one end of said shaft 91' extending outwardly from the box and upon which is mounted a sprocket 92 aligning with the sprocket 89 over which runs an endless chain 93. A drive rod or spindle 94 extends through the head and is of tubular form, and includes a ball bearing 95 and a sealing and packing member 96 below the bearing, secured to a sleeve 97 by studs or bolts 98. The sleeve 97 has flanges 99 and is secured in the head by stud bolts 100. The upper end of the sleeve is also flanged and secured to the gear box by studs 101. The drive spindle 94 is reduced towards its upper end and a bearing 102 engages a sleeve 103 which is secured to the gear box by bolts 104. The upper end of the spindle is externally threaded and adapted to receive an internally threaded member 105 as indicated at 106 and secured to the outer end of the spindle is a resilient tubular member 107 for furnishing a drilling fluid or mud to the well hole through

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the head. A drill pipe 108 having a tapered end 109 engages the lower end of the drive spindle as is the usual practice.

The drive spindle 94 is offset forming a shoulder 110 to which is attached by bolts 111 a worm ring gear 112, which engages the worm 91 for rotating the drive rod through operation of the motor 87 (Fig. 7). The chain 93 and sprocket arrangement will thus provide rotation of the hollow spindle 94 circumferentially in the framework structure 83 and said framework structure will swing on the short shafts 81 and 82 for lateral movement of the hollow spindle 94 relative the mast. A plate 113 is provided to retain the short shaft 81 in place by a set screw or the like 114.

The piston rods 66, 66', 67 and 67' extend through openings in threaded plates 115 respectively. The threaded plates engage internal threads 117 on the cylinders to allow for adjustment of the chains 62 and 63 as desired also as illustrated in Fig. 7.

The mast is braced to the motor vehicle by rods 118 and 119 having knuckle joints at substantially their centers and having their lower ends secured to ears 120 and 121 respectively on the tubular members 5 and 6 forwardly of the base of the mast and their upper ends pivotally secured to clevises 122 and 123 secured to the braced members 37 and 38 by brackets 124 and 125 which are welded or otherwise suitably secured between the tubular mast members 29 and 30 and the braced members 37 and 38 as best illustrated in Fig. 13. The rods 118 and 119 are in two sections and have their mating ends pivotally connected by pins 126. The ends of the rods are overlapped by sleeves 127 and 128 substantially square in cross section with their lower sides open as best illustrated in Fig. 15 forming the knuckle joints. The sleeves and lower ends of the rods are provided with aligned openings 129 and 130 respectively to receive pins 131 and 132. The pins 131 and 132 are adapted to be removed when the mast is to be lowered. The rods 118 and 119 are connected by cross rods 133, 134 and 135 to lend rigidity to the structure.

The trailer vehicle is provided with a cross member 136 to which is pivotally secured a brace rod 137 having its free end provided with a box-like frame 138 as shown in Figs. 2 and 13. The brace 137 is tubular and internally threaded as indicated at 139 for a purpose later described.

Pivotally secured by a pin 140 at substantially the center of the rear side 15 of the framework on the rear end of the trailer vehicle 2 is a plate 140' provided with spaced upstanding brackets 141 and 141' (Fig. 10). The upper ends of the brackets are provided with aligned openings 142 adapted to receive a pin 143 for pivotally and swingably mounting a pipe handling device 144 which consists of an I-beam 145 having an extension or arm 146 which extends between the brackets 141 and 141' and is pivotally connected thereto by the pin 143. Mounted upon the lower flange 147 of the I-beam is a carriage 148 having sides 149 and 150 and mounted to said sides on each side of the web 151 of the I-beam 145 are pairs of spaced rollers 152 and 153 as shown in Figs. 11 and 12. The carriage includes an upstanding bracket 154 having an opening 155 adapted to receive a pin 156 for pivotally mounting the end 157 of a short sleeve 158 adapted to receive the end 159 of a section of pipe 160 for feeding to the mast as later described.

Mounted on the forward end of the I-beam 145 is a fluid operated motor 161 (Fig. 10) having a shaft provided with a sprocket 162 for an endless chain 163. The outer end of the I-beam 145 has depending brackets 164 forming bearings for a shaft 165 upon which is mounted a sprocket 166 over which the endless chain 163 also runs. The carriage 148 has depending skirts or sides 167 and 168 the lower portions of which are provided with a pin 169 upon which is pivotally mounted a hook 170 to be used as a lifting device when the automatic pipe loading apparatus may be used as a crane as later de-

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scribed. The lower portion of the chain 163 is secured to the depending skirts 167 and 168 by a pin as indicated at 171 (Fig. 11) so that when the motor 161 is operated the chain will carry the carriage along the trackway of the beam 145.

The outer end of the beam has upstanding arms or brackets 172 to which is attached a cable 173 extending upwardly to the head 31 of the mast 12 which carries outwardly extending arms 174 having bearings for a shaft 175 upon which is mounted a pulley 176 over which the cable 173 extends as shown in Fig. 5. The arms 174 are connected by a bottom plate 177 having an opening through which the cable extends and the end of the cable is provided with a stop member 178 which acts as a stop for the cable when the pipe handling device is lowered to position to prevent disengagement of the cable from the pulley. The stop member includes a loop 179 for attachment to a connecting member 180 to which are attached chains 181 having hooks 182 on their free ends which are adapted to engage outwardly extending loops 183 and 184 on the rotary drilling head for a purpose later described.

Rigidly secured to the arm 154 of the carriage 148 and extending rearwardly therefrom and slightly upwardly are arms 185 having a pin 186 in its outer end to which is attached one end of a coil spring 187 and the other end of which is attached to a pin 188 on the sleeve 158 of the pipe handling apparatus for exerting tension on the sleeve to raise it to substantially vertical position when the carriage is near the mast.

For the purpose of using the rotatable drilling head in the derrick in connection with the automatic pipe handling apparatus I have provided spaced ears 189 and 190 and 191 and 192 on each outer side of the tubular members 29 and 30, provided with pins 193 and 194 for swingably mounting brackets 195 and 196 as shown in Fig. 10. The brackets comprise spaced arms 197 and 198 having plates 199 and 200 rigidly secured to the outer ends thereof. The plates extend outwardly from the inside of the arms between the tubular members 29 and 30 as illustrated in Fig. 10, and are provided with cutout portions 201 and 202 forming guideways for rolls 203 and 204 mounted on brackets 205 and 206 extending outwardly from the corners 207 and 208 of the frame 83 of the rotatable drilling head as shown in Fig. 8. When the drilling head is lowered in the mast or derrick the rollers will contact the guideways and turn the rotatable head in a horizontal position as shown in Fig. 9 so that the pipe may be disengaged from the drive spindle or engaged thereon for raising for use.

The trailer vehicle is provided with wheels 209 near the rear end of the longitudinal tubings 5 and 6 and when the drilling rig is moved to the desired position jacks 210 are placed under the forward end. Jacks 210' are placed under the respective corners of the framework secured to the rear ends of the tubular members 5 and 6 as illustrated in Figs. 1 and 4.

The tubular members 5 and 6 of the trailer vehicle as well as the tubular mast members 29 and 30 form fluid reservoirs and the brace members 35 and 36 and 37 and 38 provide fluid lines as will presently be shown, to operate the various mechanisms.

Mounted on the vehicle trailer frame near the forward end thereof is a motor 211 and a pump 212. A drive shaft 213 connects the pump to the motor and the motor is connected to the frame cross member of vehicle frame as indicated at 214. The rear ends of the tubular members 5 and 6 of the vehicle frame are connected to the lower ends of the tubular mast 29 and 30 by fluid lines 215 and 216. Fluid lines lead from the pump 212 to valves 217, 218 and 219 for operating motors 161, 87 and 55 respectively. Fluid line 220 leads from the valve 217 to motor 161 and a return line 221 leads back to the valve 217. Valve 218 is connected to the tubular brace member 35 by line 222. A line 223

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leads from the upper end of the tubular member 35 to the motor 55 and line 224 leads to the upper end of the tubular member 37. Line 225 leads from the lower end of the tubular member 37 back to the valve 218.

The lower end of the tubular member 35 is connected to the lower part of the tubular reservoir mast member by line 226. Line 227 leads from the valve 219 to the lower end of the tubular member 38 and attached to near the center of the tubular member 38 is a line 228 leading to the motor 87. A line 229 leads from the motor 87 to the tubular brace member 36. Line 230 connects the lower end of the tubular member 36 to the valve 219 and a return line from the valve 219 is connected to the lower end of the tubular mast reservoir 29 by a line 231. There is also a return line 232 from the valve 217 leading to the reservoir 5 of the trailer vehicle.

Additional bracing for the mast members 29 and 30 may be provided as indicated by the brace members 233 and 234 (Fig. 13) to lend rigidity to the mast structure.

Operation of the apparatus constructed and assembled as described is as follows:

Operation of the fluid motor 87 through control valve 219 will cause the chain 93 to rotate the worm 91 in the gear box 90 thus operating the worm gear ring 112 on the drive spindle 94 to rotate said spindle thus rotating the drilling tools in the well hole as desired. It will be obvious the drilling fluid may be supplied through the tube 107 and spindle 94 and drill pipe 108 to the well hole from a source of supply (not shown) as is the usual practice.

In order to raise or lower the rotatable drilling head in the mast, operation of the valve 218 will energize motor 55 thus rotating the sprockets 52 and 53 on top of the mast through chains 57 and 57' running over the lower sprockets 60 and 61 to move the head upwardly or downwardly as desired in the mast structure, the guides 74 and 75 engaging the inner sides of the tubular mast members 29 and 30 which act as trackways for the guides.

Operation of control valve 217 energizes the motor 161 through the fluid supply to move the carriage 148 back and forth on the automatic pipe handling apparatus through rotation of the chain 163 running over the sprocket on the motor and the sprocket 166 on the outer end of the I-beam 145. A rack 235 may be provided for the pipe as indicated at 236. The outer end 237 is provided with adjustable legs 238 so that the outer part of the platform may be slightly higher than the inside so that the pipe will move of its own volition to the automatic handling apparatus. A stop (not shown) may be provided on the lower side of the platform for manipulation by hand to feed the pipe to the device as desired.

In Fig. 10 I have illustrated in dotted lines a well hole 239 in which is inserted a casing 240 including the usual tapered end 241. 242 illustrates the usual slips or elevators.

When it is desired to add additional pipe or casing to the well the rotatable drilling head is lowered in the mast by operation of the motor 55 until the rollers 203 and 204 on the frame 83 of the head engage in the guideways 201 and 203 on the swingable brackets 195 and 196 on the lower portion of the tubular members 29 and 30, which will turn the head to assume a horizontal position as illustrated at 243 (Fig. 9).

By operation of the fluid motor 161 the carriage 148 may be moved to the outer end of the I-beam 145 and the end 159 of the pipe inserted in the sleeve 158 and then the carriage moved towards the drive spindle 94 and the pipe 160 connected to the drive spindle and then by again operating the motor 55 the rotating head will be raised from the guideways 201 and 202 to assume a vertical position so that the pipe raised may be attached to the pipe or casing in the well hole. The sleeve 158 is pivoted as indicated at 157 so that the pipe may assume the desired position for raising as the carriage 148 moves forwardly on the tracks of the I-beam 145. The pipe may be

removed from the well hole and disengaged therefrom and returned to the rack 235 by reversing the operation just above described.

When it is desired to use the pipe handling apparatus as a crane, the drive spindle 94 is disengaged from the drill pipe 108 and the hooks 182 attached to the cable 173 are engaged in the ears 183 and 184 of the rotatable head and by operation of the motor 55 on top of the mast lowering of the rotating drilling head will raise the outer end of the I-beam 145 of the pipe handling apparatus to raise the load through the cable 173.

When the hooks 182 are attached to the ears 183 and 184 of the rotating head, operation of the motor to drive the head downwardly in the mast will raise the pipe handling apparatus to lay alongside of the mast, as illustrated in Fig. 3, before the mast is lowered.

In order to lower the mast, the short brace 137 is attached to the lower end of the drive spindle 94 of the head by connecting the same to the end thereof by the threads 139. The box 138 will engage the lower edge 244 of the frame of the head so that the box will engage the head to provide stability to the connection of the brace with the head. Operation of the motor 55 to raise the head in the mast with the brace 137 thus connected to the head will cause the mast to fold forwardly towards the trailer vehicle and assume the position shown in Fig. 3 for transportation as desired. It will be obvious that the brace rods 118 and 119 will break at the knuckle joint as provided by the sleeves 127 and 128.

When the mast is lowered to the position shown in Fig. 3, the jacks 210 and 210' may be removed from under the vehicle frame for transportation of the rig.

It will be further obvious that by reversing the motor 55 to move the rotary head downwardly in the mast, the mast may be raised to vertical position after reaching a new location.

It will be obvious from the foregoing that I have provided an improved drilling rig for rotary drilling including a rotary drilling head for accomplishing the purposes herein set forth.

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

1. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a rotatable drilling head swingably mounted in said last-named frame, said drilling head including a drive spindle, means on said last-named frame for rotating said drilling head, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft, brace means pivotally connected to said mast and to the vehicle frame, said brace means being foldable upon lowering of said mast, a second brace having one end pivotally connected to the vehicle frame, means on the other end of the last-named brace for pivotally connecting same to said drive spindle on the rotatable head whereby operation of said motor on the mast head in one direction will lower said rotating head to raise said mast and operation of the motor in the opposite direction will lower said mast for transportation on said vehicle.

2. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a swingable drilling head mounted in said last-named frame, said drilling head

including a drive spindle for attachment to the drilling tools, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam connected to the vehicle frame adjacent the lower end of the mast, means connected to the lower end of said mast for swinging the drilling head to the horizontal position upon lowering said head in the mast, and means on said beam for delivering drill pipe to said drilling head for connection to said drive spindle.

3. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a rotatable drilling head swingably mounted in said last-named frame, said drilling head including a drive spindle for attachment to the drilling tools, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam swingably mounted on the vehicle frame adjacent the lower end of the mast and extending in a horizontal position outwardly therefrom, a carriage, a motor, means connecting said motor to said carriage for moving said carriage on said beam, means on the lower end of said mast for swinging said drive spindle to horizontal position upon lowering of said head in said mast, and means on said beam for engaging one end of drill pipe for delivering said pipe to said drilling head for connection to said drive spindle.

4. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a rotatable drilling head swingably mounted in said last-named frame, said drilling head including a drive spindle for attachment to the drilling tools, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam swingably mounted on the vehicle frame adjacent the lower end of the mast and extending outwardly therefrom, a carriage on said beam, a motor, means including chain and sprocket having connection with said carriage for moving said carriage longitudinally on said beam, means on the lower end of said mast for swinging said drive spindle to horizontal position upon lowering of said head in said mast, and means on said beam for engaging one end of drill pipe for delivering said pipe to said drilling head for connection to said drive spindle.

5. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a rotatable drilling head swingably mounted in said last-named frame, said drilling head including a drive spindle for attachment to the drill-

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ing tools, means on said last-named frame for rotating said drilling head, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam swingably mounted on the vehicle frame adjacent the lower end of the mast and extending outwardly therefrom, a carriage on said beam, a motor, means including chain and sprocket having connection with said carriage for moving said carriage longitudinally on said beam, means on the lower end of said mast for swinging said drive spindle to horizontal position upon lowering of said head in said mast, and means on said beam for engaging one end of drill pipe for delivering said pipe to said drilling head for connection to said drive spindle.

6. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a swingable drilling head mounted in said last-named frame, said drilling head including a drive spindle for attachment to the drilling tools, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam connected to the vehicle frame adjacent the lower end of the mast, brackets pivotally connected to the lower ends of said standards of said mast, said brackets having cut out portions forming guides, and means on said drill head engaging in said last-named guides for swinging the drill head to horizontal position upon lowering said head in the mast.

7. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a swingable drilling head mounted in said last-named frame, said drilling head including a drive spindle for attachment to the drilling tools, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam connected to the vehicle frame adjacent the lower end of the mast, a cable secured to the outer end of said beam, a pulley mounted on the mast head over which said cable is run, loop members on said drilling head frame, means on the free end of said cable for engaging said loops whereby operation of the motor on said mast to lower the drilling head in said mast will raise the outer end of said pipe handling beam to fold the same against said mast.

8. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a drilling head mounted in said last-named frame, a shaft rotatably mounted on

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said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam rotatably and swingably mounted on the vehicle frame adjacent the lower end of the mast and extending outwardly therefrom, a pulley mounted on the upper end of the mast, loops on said frame for the drilling head, a cable having one end attached to the outer end of the pipe handling beam and running over the pulley on the mast, and means on the free end of the cable for engaging said loops whereby operation of said motor will raise and lower said drilling head to raise and lower said beam when used as a crane and whereby said crane may be swung laterally of said mast.

9. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a swingable drilling head mounted in said last-named frame, said drilling head including a drive spindle for attachment to the drilling tools, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam connected to the vehicle frame adjacent the lower end of the mast, means connected to the lower end of said mast for swinging the drilling head to horizontal position upon lowering said head in the mast, means on said beam for delivering drill pipe to said drilling head for connection to said drive spindle said means including a carriage operable on said beam, means pivotally mounted on the carriage for receiving the end of a pipe to be raised, and means for moving said carriage along said beam.

10. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a swingable drilling head mounted in said last-named frame, said drilling head including a drive spindle for attachment to the drilling tools, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam connected to the vehicle frame adjacent the lower end of the mast, means connected to the lower end of said mast for swinging the drilling head to horizontal position upon lowering said head in the mast, means on said beam for delivering drill pipe to said drilling head for connection to said drive spindle said means including a carriage operable on said beam, means pivotally mounted on the carriage for receiving the end of a pipe to be raised, means for moving said carriage along said beam, and pipe racking means adjacent said beam for delivering the pipe to the pipe receiving means on said carriage.

11. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame,

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a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a swingable drilling head mounted in said last-named frame, said drilling head including a drive spindle for attachment to the drilling tools, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable shaft for raising and lowering said rotary drilling head, a drill pipe handling beam connected to the vehicle frame adjacent the lower end of the mast, means connected to the lower end of said mast for swinging the drilling head to horizontal position upon lowering said head in the mast, and means adjacent said beam for racking said pipe as it is pulled from the well and lowered to horizontal position by the drilling head.

12. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a swingable drilling head mounted in said last-named frame, said drilling head including a drive spindle for attachment to the drilling tools, a shaft rotatably mounted on said mast head, gear means including a shaft on said mast head having driving connection with one end of said shaft, chain and sprocket means mounted in spaced relation on said shaft and the lower portion of the mast and having connection with said guides, means on said motor shaft having connection with said gear means shaft for rotating said rotatable

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shaft for raising and lowering said rotary drilling head, brackets swingably mounted on the lower ends of said standards of said mast, guide members on said brackets, and rollers mounted on said drilling head for engaging said guide members on said swingable brackets for swinging the drill head to horizontal position upon lowering said head in the mast.

13. A drilling rig of the character described mounted on a vehicle having a frame and having a mast including spaced standards pivotally mounted on said vehicle frame, a head on said mast, a motor having a shaft on said head, a frame slidably mounted in said mast and having guides engaging said standards, a rotatable drilling head swingably mounted in said last-named frame, said drilling head including a drive spindle for attachment to drilling tools, means operatively connecting the shaft of the motor on the mast head with said guides for raising and lowering said rotary drilling head, a drill pipe handling beam on the vehicle frame adjacent the lower end of the mast and extending in a horizontal position outwardly therefrom, means on the lower end of said mast for swinging said drilling head to position the drive spindle therein substantially horizontally upon lowering of said drilling head in said mast, and means on said drill pipe handling beam for engaging one end of drill pipe for delivering said drill pipe to said drilling head for connection to said drive spindle.

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