

Aug. 25, 1936.

H. C. JOHANSEN

2,052,301

ADJUSTABLE SUPPORT

Filed Sept. 30, 1935

5 Sheets-Sheet 1

Fig. 1.

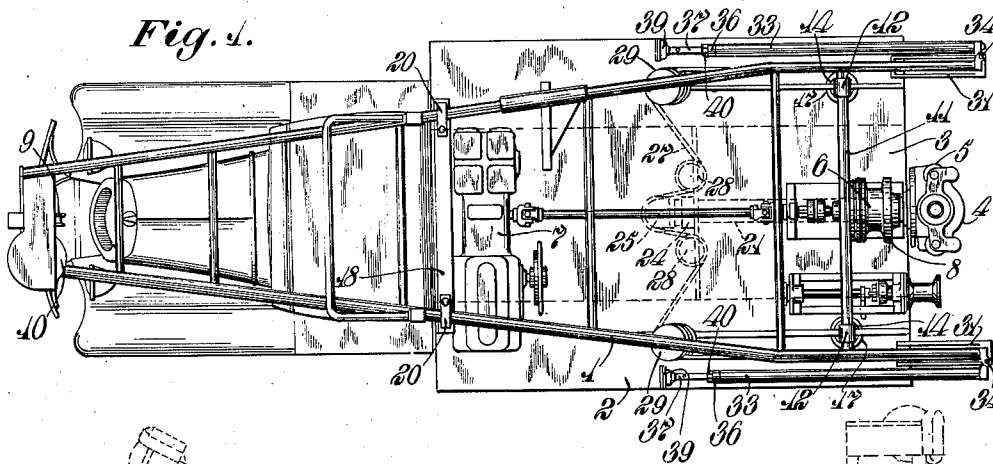
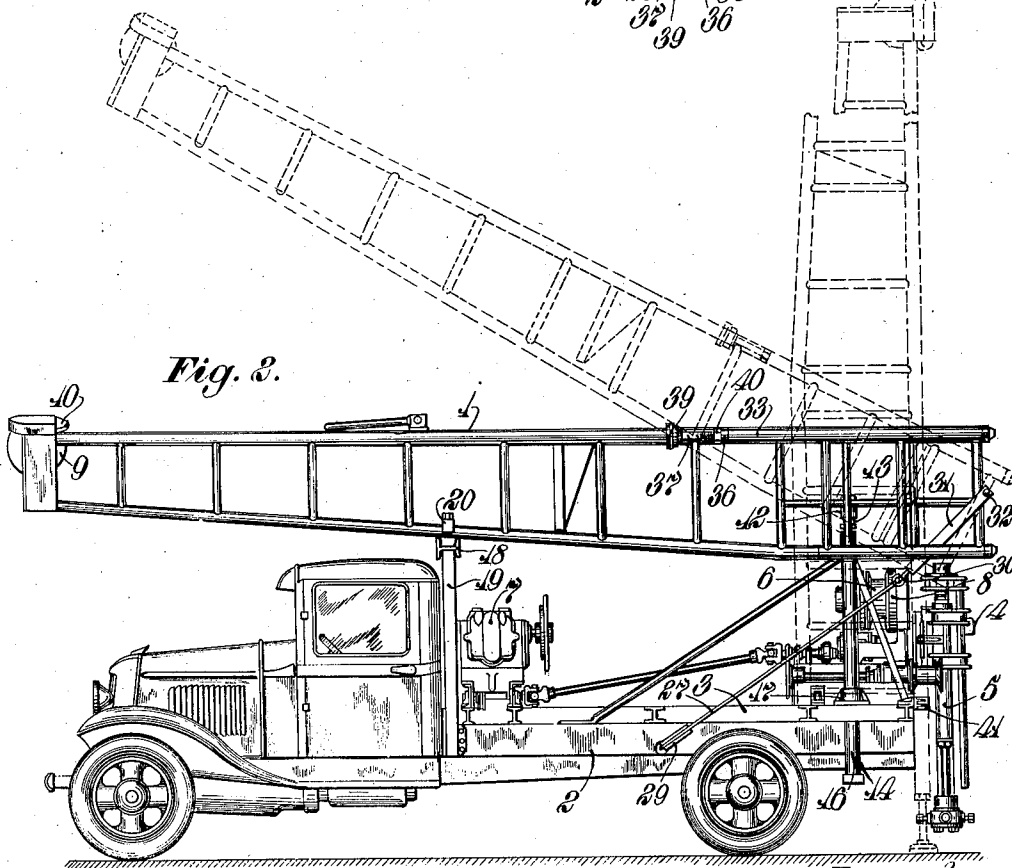


Fig. 2.



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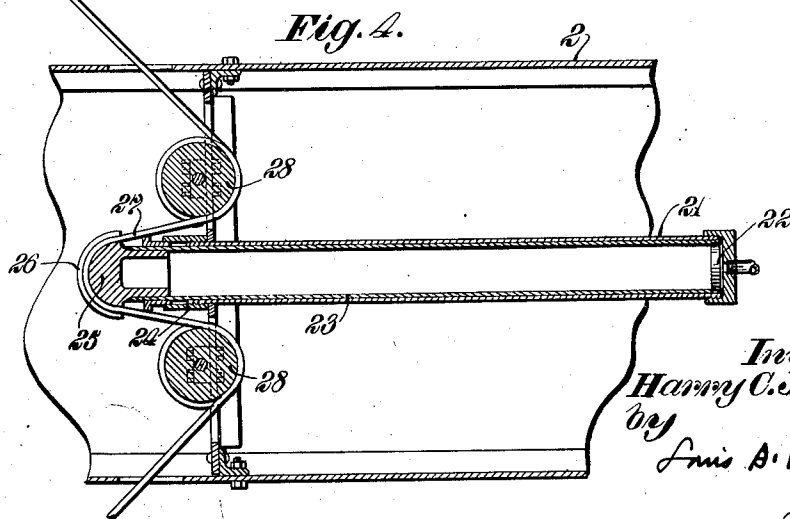
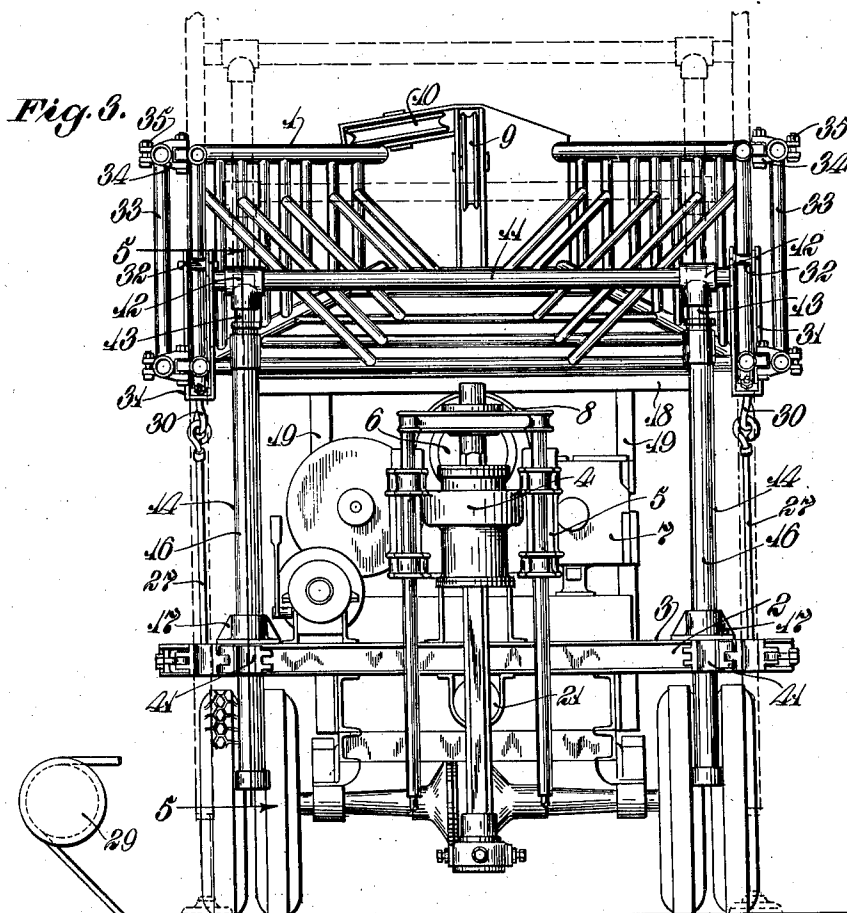
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5 Sheets-Sheet 2



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Fig. 5.

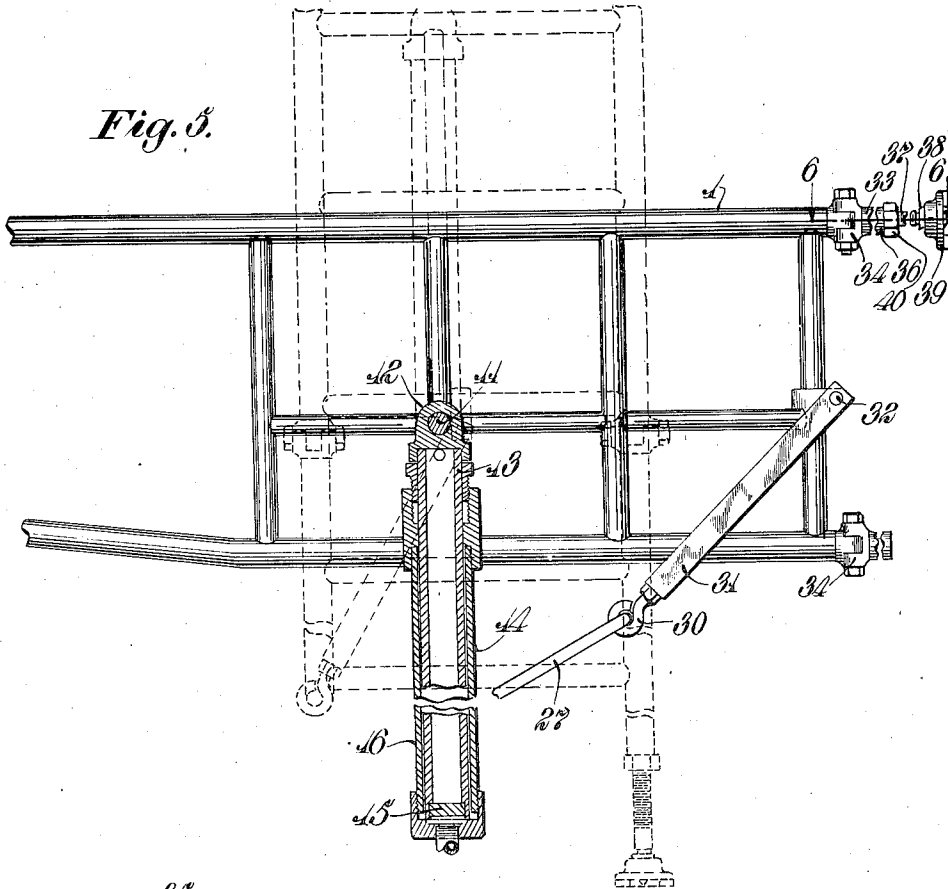


Fig. 6.

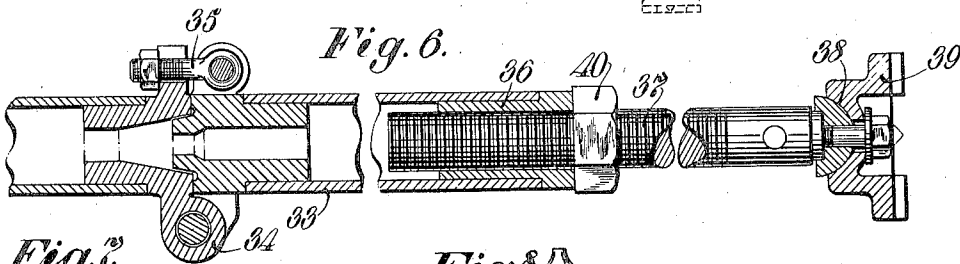


Fig. 7.

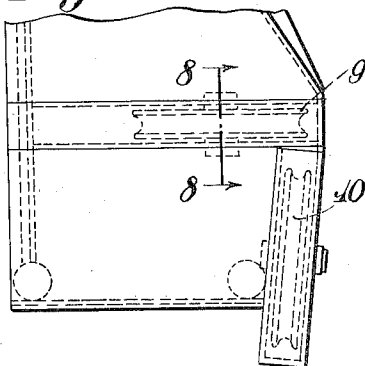
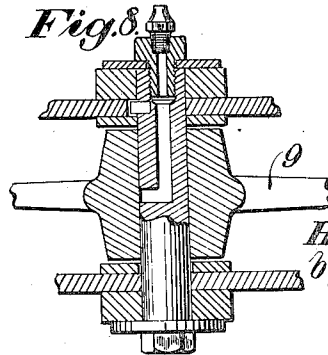


Fig. 8.



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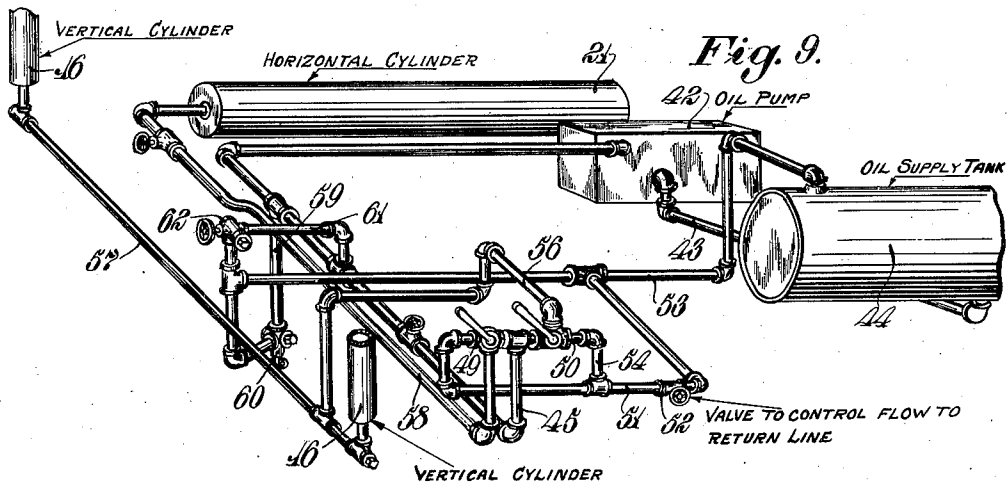
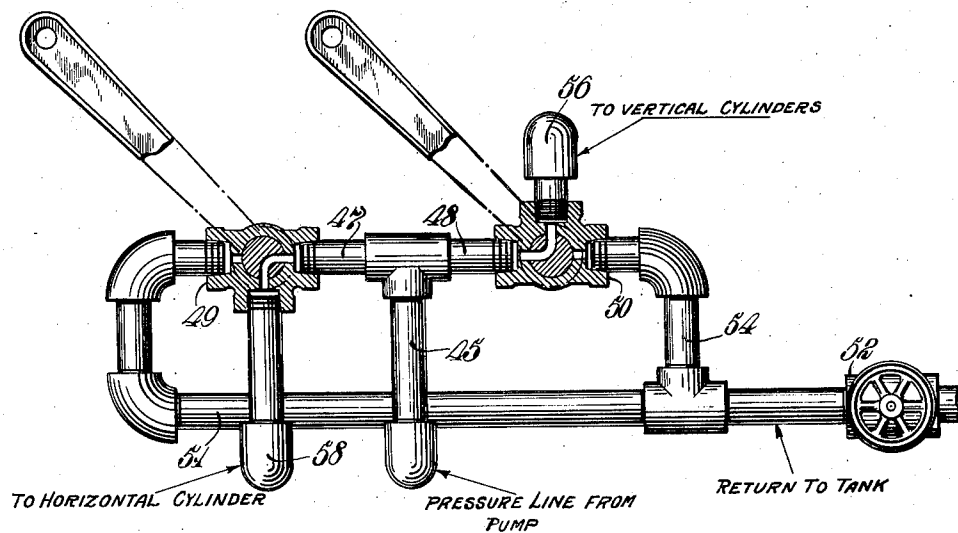


Fig. 10.



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5 Sheets-Sheet 5

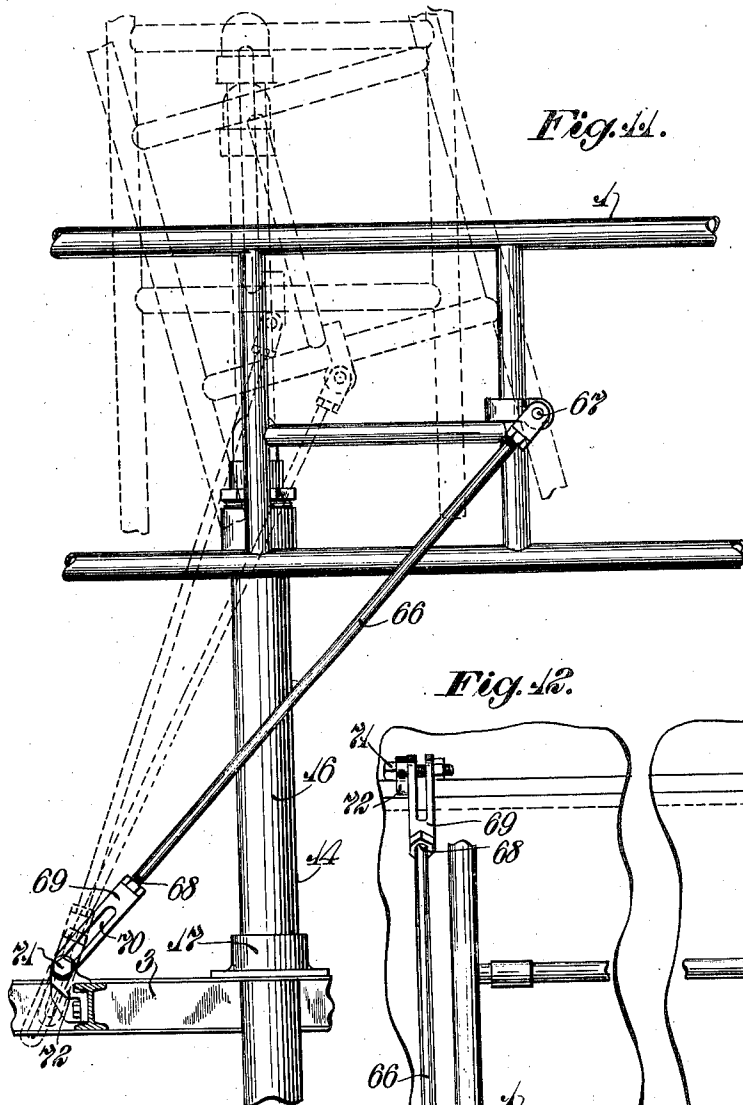
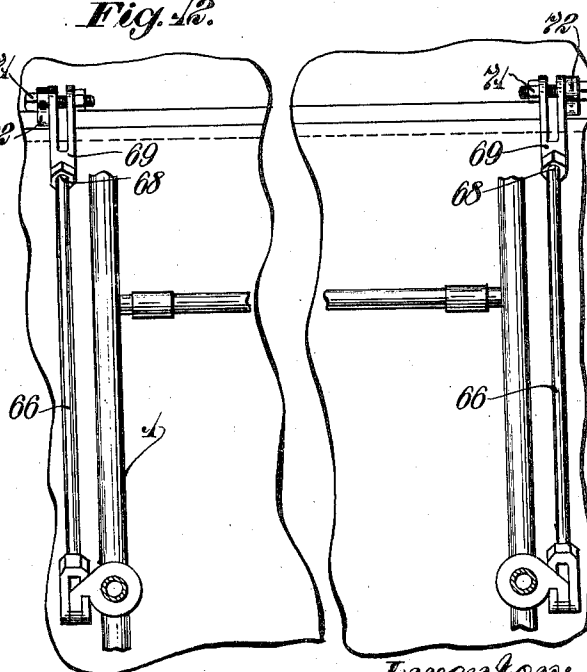


Fig. 12.



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UNITED STATES PATENT OFFICE

2,052,301

ADJUSTABLE SUPPORT

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Application September 30, 1935, Serial No. 42,898

8 Claims. (Cl. 255—51)

This invention relates to drilling apparatus, and more particularly has reference to improvements in the raising and lowering means for the derrick mast of a portable drilling apparatus especially designed for use in oil well drilling work.

An object of this invention is to provide an improved derrick mast structure for an oil well drill of the portable type having improved means for raising and lowering the mast.

Another object is to provide an improved derrick mast structure for an oil well drill having improved means for mounting the mast on the drill. A further object is to provide an improved derrick mast for an oil well drill of the automobile type having improved means for supporting the mast in transport position on the automobile and improved power operated means for raising the mast into drilling position. Still another object is to provide improved power means for varying the elevation of the mast pivot, thereby to facilitate the raising and lowering operation. These and other objects will, however, hereinafter more fully appear.

In the accompanying drawings there are shown for purposes of illustration one form and a modification thereof which the invention may assume in practice.

In these drawings,—

Fig. 1 shows in plan a portable oil well drilling apparatus of the automobile type having embodied therein one illustrative form of the improved derrick mast structure.

Fig. 2 is a side elevational view of the apparatus shown in Fig. 1, the lowered transport position of the mast being indicated in full lines.

Fig. 3 is an end elevational view of the apparatus shown in Figs. 1 and 2.

Fig. 4 is a horizontal sectional view showing the improved mast swinging cylinder and its associated connections.

Fig. 5 is a vertical sectional view taken substantially on line 5—5 of Fig. 3 showing one of the vertical elevating cylinders for the mast pivot.

Fig. 6 is a detail sectional view taken on line 6—6 of Fig. 5.

Fig. 7 is a fragmentary elevational view showing the pulley arrangement at the top of the derrick mast.

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

Fig. 9 is a somewhat diagrammatic view showing the hydraulic fluid system for the swinging and elevating cylinders.

Fig. 10 is a detail view showing the control valve arrangement for the hydraulic cylinders.

Fig. 11 is a side elevational view generally similar to Fig. 5 showing a modified form of mast raising means.

Fig. 12 is a plan view showing details of the construction shown in Fig. 11.

In this illustrative construction, the improved derrick mast 1 is shown mounted on an oil well drilling apparatus 2 of the portable automobile type. The drill is of the type commonly known as a diamond drill, and is mounted on a conventional automobile chassis, and is supported by a platform 3 mounted on the chassis. The diamond drill comprises drill rod rotating means 4, drill rod feeding means 5 and drill rod hoisting mechanism 6, the drill rod rotating means and the hoisting mechanism being driven through suitable transmission connections from the engine of the automobile. The drill feeding means is of the hydraulic type and may be supplied with hydraulic pressure from a pump 7 mounted on the drill platform and likewise driven through suitable transmission connections from the automobile engine. The drill rod hoisting mechanism embodies a hoisting drum 8 having wound thereon a hoisting cable, and this hoisting cable is adapted to be extended upwardly from the hoisting drum around suitable guide sheaves indicated at 9 and 10 in Fig. 7 carried by a frame structure supported at the upper end of the mast. As the structure of the diamond drill per se does not enter into this invention, further detailed description thereof is considered unnecessary.

The derrick mast 1 is of fabricated tubular construction built up of tubes welded together in the desired form and rigidly braced, and has located at its lower extremity a rigid horizontal cylindrical bar 11 secured at its ends to the side frames of the mast and mounted in bearings 12, 12, and this bar in its bearings forms a horizontal pivotal support for the mast whereby the latter may be swung in a vertical direction into transport and operative drilling positions. The derrick mast pivot bearings are fixed to the upper ends of parallel piston rods 13, 13 of a pair of hydraulic elevating jacks 14, 14. The piston rods are secured at their lower ends to pistons 15 reciprocably mounted in vertical cylinders 16, 16. These cylinders are fixed within supporting brackets 17 bolted to the top of the drill platform at the opposite sides thereof in the manner shown in Fig. 3. When the derrick mast is in its lowered transport position, as indicated in full lines in Fig. 2, it rests upon a transverse support 18

mounted on a vertical framework 19 secured to the sides of the automobile chassis, and the mast is adapted to be held in position thereon by suitable bolt-held clips 20. When the holding clips are released and hydraulic pressure is supplied to the bottoms of the vertical cylinders, the pivotal axis of the derrick mast may be elevated for a purpose to be later explained.

In this illustrative form of the invention a horizontal hydraulic cylinder 21 is mounted beneath the drill platform 3 midway between the sides thereof, and is arranged in a longitudinally extending position, as shown in Figs. 1 and 4. This horizontal cylinder contains a reciprocable piston 22 having its piston rod 23 extending forwardly through the packed front head 24 of the cylinder. Secured to the forward end of the piston rod is a member 25 having an arcuate guiding groove 26 for a cable 27, and arranged on the drill platform at opposite sides of the forward portion of the cylinder are horizontal guide sheaves 28, 28 for guiding the cable with respect to the guiding member 25. Supported at the opposite sides of the drill platform are inclined guide sheaves 29, 29, and the cable is adapted to extend from the guide sheaves 28 laterally around the guide sheaves 29 and then rearwardly along the sides of the drill platform. The ends of the cable 27 are connected by eye members 30 to links 31, the latter in turn being pivotally connected at points below the mast pivot, as at 32, to the opposite sides of the derrick mast. It will thus be seen that when hydraulic pressure is supplied to the rear end of the horizontal cylinder 21, the piston 22 is moved forwardly to draw in the ends of the cable 27, thereby pulling downwardly on the lower end of the derrick mast to swing the upper portion of the mast in a vertical direction about its pivotal axis. Before the derrick is swung vertically, hydraulic pressure is supplied to the elevating jacks to raise the mast pivot so that the mast may clear the top of the drilling apparatus during its initial swinging movement. When the mast assumes its vertical drilling position, the mast pivot may be lowered. To obtain compactness as to length during transport of the mast structure, the lower side portions 33 of the mast are hinged at 34 so that these lower portions may be folded inwardly along the sides of the derrick during transport. When the mast is brought into its vertical operative relation, these side portions are swung outwardly in place and clamped in position by clamping bolts 35. These hinged side portions of the derrick mast have secured within the tubular portions thereof at its outer sides nut members 36 threadedly engaged with adjusting screws 37. The lower ends of these screws have connected thereto through a universal pivotal mounting 38 foot members 39. Threaded on the screw and engaging the nut is a lock nut 40 for holding the parts in adjusted position. When the hinged side frames are locked in their operative position, and the derrick mast is swung in its vertical position, the foot members 39, upon adjustment of the screws 37, are brought into engagement with the ground surface, thereby to provide stable supporting means for the mast and to remove a major portion of the weight on the hoisting cable from the automobile chassis during the hoisting operation. When the mast is in its vertical position, suitable clamps 41 engage the side frames of the mast to clamp rigidly the mast to the automobile chassis.

Now referring to the improved hydraulic fluid system and the fluid control valves, it will be

noted that in Fig. 9 there is shown a conventional oil pump 42 preferably driven from the drill driving connections, and the pump intake is connected through a pipe 43 to an oil tank 44. The pump discharge communicates with a pipe 45 connected by branched pipes 47, 48 to manual control valves 49 and 50, respectively. The valve 49 is connected by a pipe 51 under the control of a valve 52 to the oil return pipe 53 leading back to the oil tank 44, and the valve 50 is connected to a pipe 54 in turn connected to the oil return pipe 53. The valve 50 is connected by a pipe 56 to a pipe 57 connected to the lower ends of the elevating cylinders 16, 16, while the valve 49 is connected by a pipe 58 to the rear end of the horizontal cylinder 21. The oil pressure pipe 45 is connected by a pipe 59 to the oil return pipe 53 under the control of an automatic pressure release valve 60. The oil pressure pipe 45 is also connected by a pipe 61 to the oil return pipe 53 under the control of a manual by-pass valve 62. It is accordingly evident that when there is an excessive pressure built up in the oil pressure pipe, the relief valve 60 opens automatically to by-pass the oil to the oil return pipe 53 back to the oil tank. The oil pressure pipe 45 may be manually by-passed to the oil return pipe 53 under the control of the manual by-pass valve 62. When the valve 49 is in the position shown in Fig. 10, oil under pressure may flow from the supply pipe 45 through a passage in the valve to the pipe 58 leading to the rear end of the horizontal cylinder 21, while when the valve 50 is in the position shown in Fig. 10, hydraulic pressure may flow from the pressure pipe 45 to the pipe 56 and pipe 57 to the lower ends of the vertical elevating cylinders 16. When the valves 49 and 50 are turned into their opposite position, the hydraulic cylinders 16 and 21 are connected to the oil return pipe through the pipes 51, 54 and at that time the manual by-pass valve 62 is positioned to by-pass the supply of oil pressure back to the oil tank.

In the modified form of mast elevating structure shown in Figs. 11 and 12, the derrick mast structure and the hydraulic elevating cylinders for the mast pivot are similar to those above described. In this construction, however, the horizontal mast swinging cylinder is omitted and links 66 are pivotally connected at 67 to the sides of the mast. These side links have secured at 68 to their lower ends members 69 having longitudinal slots 70, and bolts 71 mounted in brackets 72 secured to the drill platform extend through these slots, thereby to provide a lost motion connection between the bolt brackets and the side links. When hydraulic pressure is supplied to the lower ends of the hydraulic cylinders 16, the mast pivot is elevated, and as the mast is elevated, the side links 66 prevent elevation of the lower end of the mast, and as a result, the upper portion of the mast is swung in a vertical direction about its pivot. As the mast passes its center of gravity it swings by its own weight into its vertical operative position, the slots 70 in the ends of the side links 66 permitting such swinging movement. It is accordingly evident that by the provision of the side links 66, it is possible to raise the mast pivot and at the same time swing the mast in a vertical direction into its operative vertical position, the elevating cylinders co-acting with the stop links to effect such swinging movement. Otherwise this form of the invention is similar to that above described.

As a result of this invention, it will be noted that an improved oil well drilling apparatus is

provided having an improved derrick mast structure of a compact design and improved power operated means for elevating and lowering the mast structure. It will further be noted that an improved drilling apparatus of the portable automobile type is provided having improved means for elevating the derrick mast into its operative drilling position and for rigidly holding the mast in drilling position. Other uses and advantages of the improved drilling apparatus will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form and a modification of the same which the invention may assume in practice, it will be understood that this form and modification of the same are shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

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

1. In a drilling apparatus, a mobile base, a drill on said base, a derrick mast mounted on said base and movable relative thereto, between transport and vertical operating position and having a horizontal pivotal axis about which the same is swingable in its transition between said positions, and power operated means for elevating the pivotal axis of said mast and for swinging the mast about its pivot.

2. In a drilling apparatus, a mobile base, a drill on said base, a derrick mast mounted on said base and movable relative thereto between transport and vertical operating positions and having a horizontal pivot about which the same is swingable in its transition between said positions, and power operated means for swinging said mast about its pivot during its transition from its transport position to its vertical operating position including a hydraulic cylinder on said base, a piston reciprocable in said cylinder, and operative connections between said piston and said mast.

3. In a derrick mast structure, a mast pivoted to swing about a horizontal axis during transition between transport and vertical operating positions, and power operated means for elevating the mast pivot and swinging the mast about its pivot to move said mast from its transport position to its vertical operating position.

4. In a derrick mast structure, a mast pivoted to swing about a horizontal axis during transition between transport and vertical operating positions, power operated means for elevating the mast pivot and swinging the mast about its pivot to move said mast from its transport position to its vertical operating position, and means for locking said mast in either of said positions.

5. In a drilling apparatus, a mobile base, a drill on said base, a hoisting mechanism on said base including a hoisting cable, a derrick mast mounted on said base and associated with said hoisting mechanism, said mast supporting at its

upper end a guide pulley for the hoisting cable, said mast being swingable about its pivot relative to said base and disposable selectively in a substantially horizontal transport position or in a vertical operating position, and power operated means on said base and operatively connected to said mast for elevating the mast pivot and for swinging the mast about its pivot when so elevated.

6. In a drilling apparatus, a mobile base, a drill on said base, a hoisting mechanism on said base including a hoisting cable, a derrick mast mounted on said base and associated with said hoisting mechanism, said mast supporting at its upper end a guide pulley for the hoisting cable, said mast being swingable about its pivot relative to said base and disposable selectively in a substantially horizontal transport position or in a vertical operating position, and power operated means on said base and operatively connected to said mast for elevating the mast pivot and for swinging the mast about its pivot, said elevating means being operative when the mast is swung into its vertical operating position to lower the mast pivot.

7. In a drilling apparatus, a mobile base, a drill on said base, a hoisting mechanism on said base including a hoisting cable, a derrick mast mounted on said base and associated with said hoisting mechanism, said mast supporting at its upper end a guide pulley for the hoisting cable, said mast being swingable about its pivot relative to said base and disposable selectively in a substantially horizontal transport position or in a vertical operating position, power operated means on said base and operatively connected to said mast for elevating the mast pivot and for swinging the mast about its pivot when so elevated, said elevating means being operative when the mast is swung into its vertical operating position to lower the mast pivot, and means carried by said mast and engageable with the ground surface for supporting said mast in its vertical operating position.

8. In a drilling apparatus, a mobile base, a drill on said base, a hoisting mechanism on said base including a hoisting cable, a derrick mast mounted on said base and associated with said hoisting mechanism, said mast supporting at its upper end a guide pulley for the hoisting cable, said mast being swingable about its pivot relative to said base and disposable selectively in a substantially horizontal transport position or in a vertical operating position, power operated means on said base and operatively connected to said mast for elevating the mast pivot and for swinging the mast about its pivot when so elevated, said elevating means being operative when the mast is swung into its vertical operating position to lower the mast pivot, and means on said base and engageable with said mast for locking said mast in its vertical operating position.

HARRY C. JOHANSEN.