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Council

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[54] **MOUNTING FOR DRILL RIG MAST**

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[73] Assignee: **Gardner-Denver Company,** Dallas, Tex.

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[52] **U.S. Cl.** **173/43;** 173/28; 173/DIG. 3

[51] **Int. Cl.**[2] **E21C 5/11**

[58] **Field of Search** 173/43, 28; 248/2; 52/116

[56] **References Cited**

UNITED STATES PATENTS

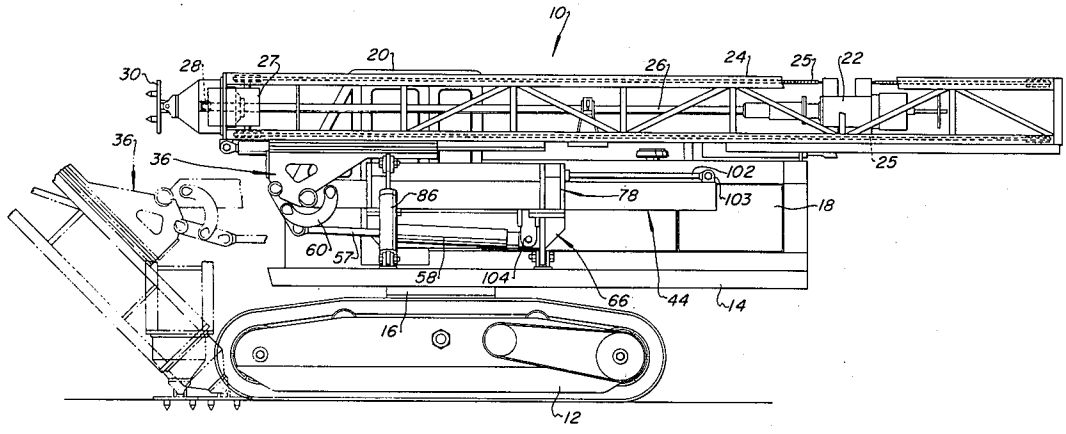
2,703,222	3/1955	Feucht	173/43 X
3,374,975	3/1968	Bronder	173/43 X
3,511,320	5/1970	Miller	52/116 X
3,724,559	4/1973	Stromnes	173/43 X
3,746,104	7/1973	McIntosh	173/43

Primary Examiner—Ernest R. Purser
Assistant Examiner—William F. Pate, III
Attorney, Agent, or Firm—M. E. Martin

[57] **ABSTRACT**

A blast hole drill rig has a main frame turnably mounted on a mobile undercarriage and includes a mast support member mounted on the frame for limited pivotal movement about a horizontal axis. A horizontally displaceable boom formed as a massive beam is slidably supported on the support member and is reversibly displaceable with respect to the support member by a hydraulic piston and cylinder type actuator. An elongated mast is mounted on a support bracket which in turn is pivotally connected to one end of the boom and is pivotable by a pair of side-by-side hydraulic cylinder actuators interconnecting the boom and the support bracket.

4 Claims, 8 Drawing Figures



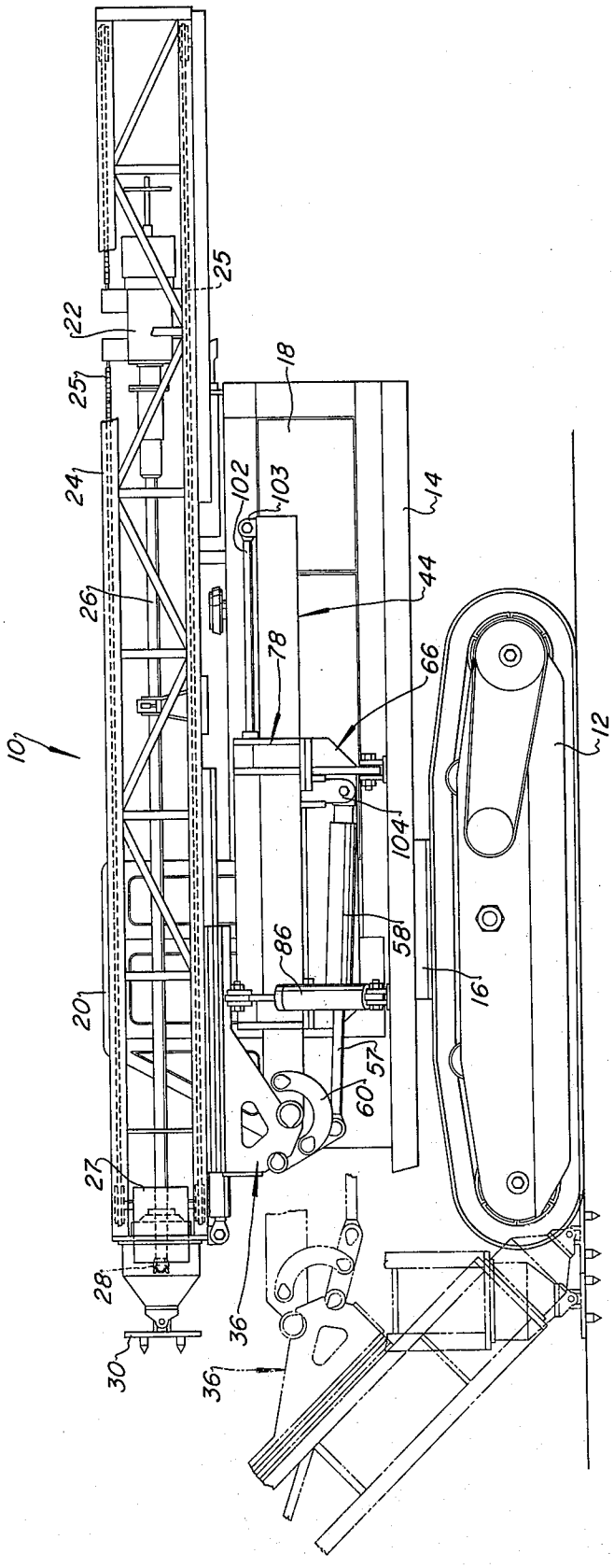

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Fig 1

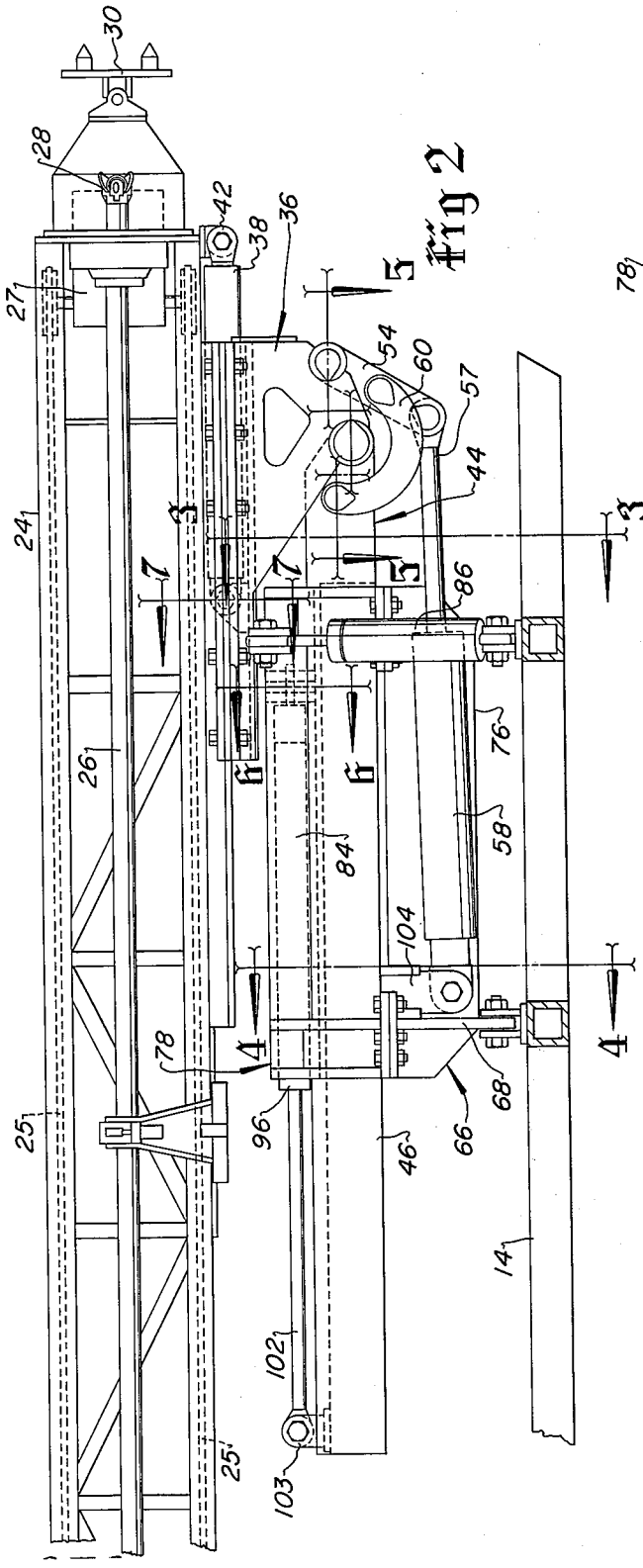


Fig 2

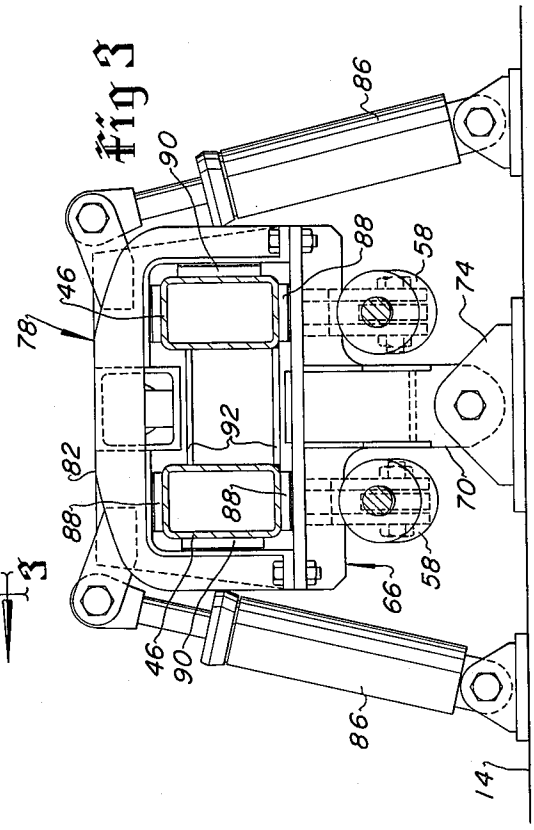


Fig 3

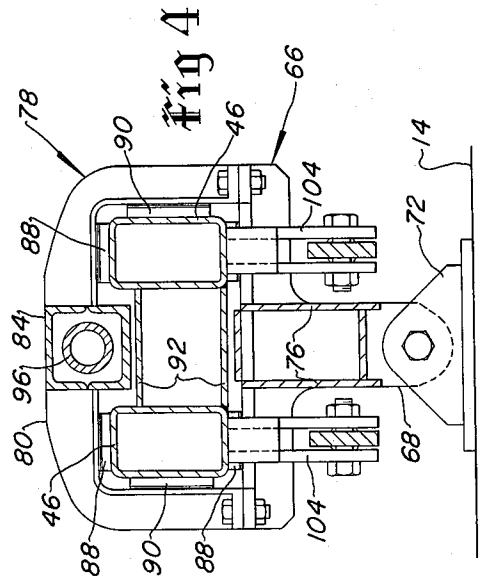
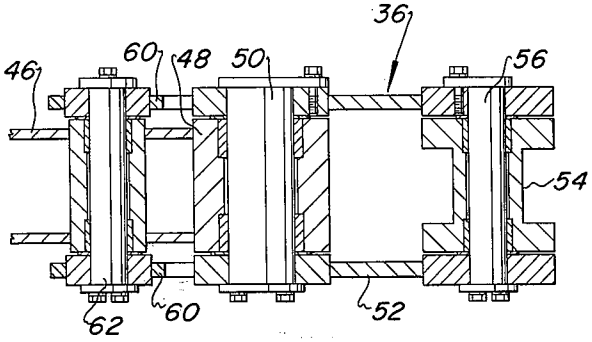


Fig 4



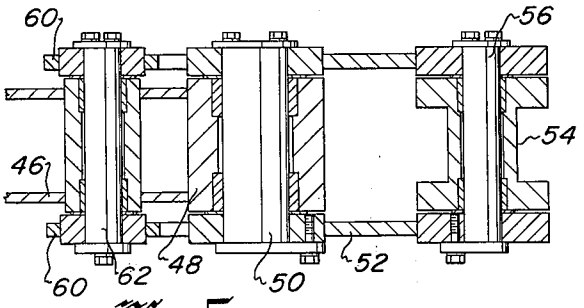


Fig 5

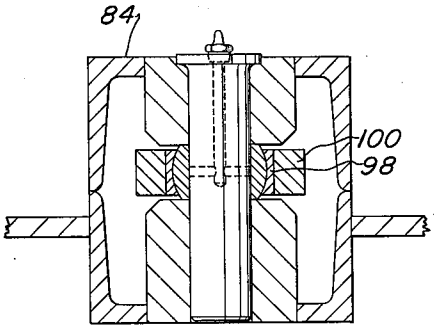


Fig 6

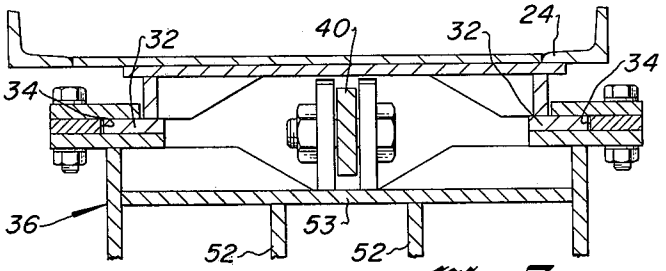


Fig 7

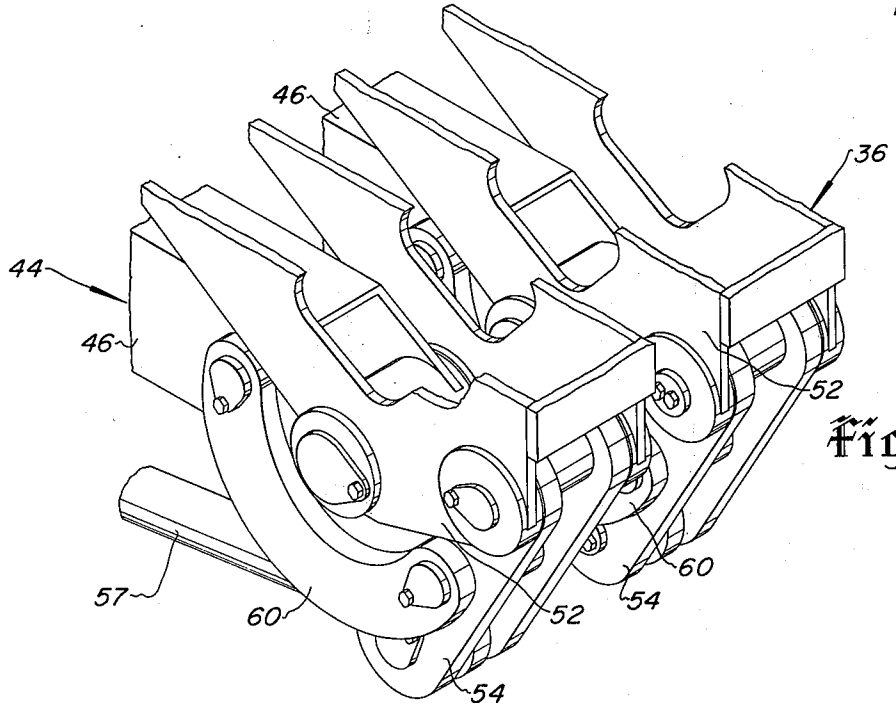


Fig 8

MOUNTING FOR DRILL RIG MAST

BACKGROUND OF THE INVENTION

Heavy drill rigs for drilling blast holes for quarries, surface mines, and other excavation work must be adaptable for drilling holes at various angles with respect to the ground surface upon which the rig is located. Furthermore, in many work applications of heavy drill rigs it is necessary to drill holes near a precipice or steep bank. Therefore, versatile positioning of the rig mast is desirable to provide for drilling holes in the required locations and direction.

In heavy drill rigs of the rotary type substantial thrust forces must be exerted on the drill stem which forces are usually obtained by utilizing at least part of the weight of the rig itself. These thrust load requirements pose special problems in the design of the mast support structure particularly when as mentioned herein it is also required that the mast be mounted for versatile movement with respect to the main frame of the rig. The present invention is directed to the solution of these problems in the art of heavy blast hole drill rigs and provides an improved mounting arrangement for a drill rig mast or rotary head support for a mobile blast hole drill. Mounting arrangements of various types for percussion type drill rigs are disclosed in U.S. Pats. Nos. 3,682,253 and 3,746,104 to I. A. McIntosh et al. and in U.S. Pat. No. 3,729,056 to F. W. Paurat. However, the mounting arrangements disclosed in these patents are not suitable for rotary type drill rigs or rigs in which substantial thrust forces must be transmitted from the main frame to the rig mast.

SUMMARY OF THE INVENTION

The present invention provides for an improved mounting arrangement for the rotary head support structure or mast of a heavy blast hole drill rig wherein the mast itself is positionable with respect to the main frame of the drill rig for drilling holes in a wide range of directions with respect to said main frame.

In accordance with the mounting arrangement of the present invention an elongated mast structure is pivotally connected to the distal end of a horizontally displaceable boom and is positionable with respect to the boom by a pair of side-by-side pressure fluid cylinder type actuators. The boom itself is mounted for limited movement about a horizontal pivot axis and is formed as a massive beam whereby suitable support of the mast with respect to the main frame of the rig is assured and heavy downthrust forces may be exerted on the drill stem by utilizing at least part of the weight of the drill rig itself.

Further in accordance with the present invention there is provided a heavy blast hole drill rig which is particularly adapted for drilling blast holes in a wide range of directions from a specific location of the drill rig itself without movement thereof thanks to the mounting arrangement of the drill rig mast.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal side elevation of a heavy blast hole drill rig in accordance with the present invention;

FIG. 2 is a longitudinal side elevation of the mast mounting arrangement of the drill rig of FIG. 1 taken from the opposite longitudinal side;

FIG. 3 is a section taken along the line 3—3 of FIG. 2;

FIG. 4 is a section taken along the line 4—4 of FIG. 2;

FIG. 5 is a section taken along the line 5—5 of FIG. 2;

FIG. 6 is a section taken along the line 6—6 of FIG. 2;

FIG. 7 is a section taken along the line 7—7 of FIG. 2; and,

FIG. 8 is an isometric view of the pivotal connection between the boom and the mast positioner bracket.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 the mast mounting arrangement of the present invention is illustrated in combination with a mobile self-propelled blast hole drill rig generally designated by the numeral **10.** The drill rig **10** is characterized by a crawler type undercarriage **12** upon which is disposed a main frame **14** suitably mounted on a turntable **16** for turning movement with respect to the undercarriage **12.** The drill rig **10** also includes a suitable prime mover such as an internal combustion engine mounted on the main frame **14** and disposed within a shroud **18.** An operator's enclosure **20** is further provided on the frame **14.** The drill rig **10** may be of the so-called rotary type in which a rotary head **22** is disposed for longitudinal movement along an elongated mast **24.** The rotary head **22** is connected to a pair of elongated flexible chains **25.** The chains **25** are trained around suitable sprockets disposed at opposite ends of the mast **24** in a conventional manner. A motor **27** is drivably connected to the chains **25** for causing pulldown and hoisting movements of the rotary head **22.** The rotary head **22** comprises rotary motor means for rotating a drill stem **26** having a bit portion **28** attached to one end. A ground engaging member **30** is pivotally connected to the lower end of the mast **24** for aiding in stabilizing the rig **10** when the mast is in a working position.

The mast **24** is mounted on the drill rig **10** for movement between a substantially horizontal transport position as shown in FIGS. **1** and **2** to various working positions, including those indicated by the dashed lines of FIG. **1,** by means of an improved mounting arrangement disclosed herein. Referring to FIGS. **2** and **7** the mast **24** includes a pair of spaced apart parallel flanges **32** which are slidably disposed in channels **34** formed on a mast positioner bracket **36.** The mast may be supported with respect to the bracket **36** in various longitudinally displaced positions by means of an extensible hydraulic cylinder and piston actuator **38** having one end **40** connected to the bracket **36** and the opposite and piston rod end **42** connected to the mast.

Referring to FIGS. **5** and **8** also, the positioner bracket **36** is disposed on an elongated boom, generally designated by the numeral **44,** which is disposed on the drill rig **10** and is linearly movable with respect to the main frame **14.** The boom **44** comprises a pair of side-by-side rectangular tubular beam members **46** upon which the positioner bracket is pivotally mounted. As shown in FIG. **5** the members **46** include bearing supports **48** which journal pivot pins **50.** The positioner bracket **36** comprises a pair of yokelike members **52** fixed to a transverse plate **53.** Each member **52** is pivotally connected to a member **46** of the boom **44** by a pin **50.** The positioner bracket **36** is pivotally displaced on the distal end of the boom **44** by suitable mechanism

including two links 54 respectively connected at their opposite ends to the yoke members 52 by pivot pins 56 and to the piston rods 57 of a pair of extensible hydraulic cylinder actuators 58. Additionally, two pairs of link elements 60 are pivotally connected to the members 46 by pins 62. The ends of the link elements 60 opposite the end connected to the boom 44 are pivotally connected to the links 54 intermediate the ends thereof. The positioning mechanism comprising the bracket 36 and the links 54 and 60 provide for pivotal movement of the mast 24 with respect to the boom 44 through a substantial arc.

As shown in FIGS. 2 through 4 the boom 44 is supported on the main frame 14 for limited pivotal movement about a horizontal axis substantially parallel to the direction of longitudinal movement of the boom with respect to the frame. This pivotal movement of the boom 44 is provided for by a boom support which includes a cradle member 66 formed in part by a pair of upstanding legs 68 and 70. The legs 68 and 70 are respectively pivotally mounted on the main frame 14 by a pair of brackets 72 and 74 attached to the frame. The legs 68 and 70 are joined together by two spaced apart longitudinal webs 76. The pivot axis of the cradle member 66 is perpendicular to the pivot axis of the mast 24 with respect to the boom 44 which axis is formed by the pins 50.

The boom support is further characterized by a member 78 which is removably fastened to the cradle member 66. The member 78 includes a pair of spaced apart yokes 80 and 82 which are interconnected by a tubular beam 84 formed by a pair of inwardly facing channel members. As shown in FIG. 3 the member 78 is disposed between and connected to a pair of generally upstanding hydraulic cylinder actuators 86 which are mounted on the frame 14 and are operable to be suitably extended and retracted for moving the boom support about the pivot axis formed by the brackets 72 and 74 to position the boom 44 and the mast 24 in accordance with a desired directional attitude for a drill hole. The members 66 and 78 comprising the boom support are provided with a plurality of bearing blocks 88 and 90 which are disposed on the members for slidably supporting the boom 44. The bearing blocks 88 and 90 are formed of a suitable low friction material desirably having self-lubricating properties. A preferred material for the bearing blocks 88 and 90 comprises a nylon and molybdenum disulphide composition manufactured under the U.S. Trademark Nylatron. As shown in FIGS. 3 and 4 the bearing blocks 88 and 90 are disposed on the yokes 80 and 82 and on the legs 68 and 70 of the cradle member 66 thereby being suitably spaced apart to provide adequate support for the boom 44.

The tubular beam members 46 of the boom 44 are interconnected by suitable structure including two webs 92 to form a massive beam for supporting the mast. The boom 44 is horizontally movable on the support by an extensible hydraulic cylinder actuator 96. The cylinder 96 is disposed within the tubular beam 84 and is connected to the beam at one end, as shown in FIG. 6. The connection of the cylinder 96 to the beam 84 is formed by a spherical bearing 98 mounted on a bracket 100 which is fixed to the end of the cylinder 96. The piston rod 102 of the cylinder 96 has an enlarged end portion which is connected to a bracket 103 mounted on the boom 44, as shown in FIGS. 1 and 2.

The hydraulic cylinders 58 are connected to the boom 44 by depending brackets characterized as clevises 104 fixed to the tubular beams 46 between the upstanding legs 68 and 70 of the boom support. The cylinders 58 are thus movable with the boom 44 when it is displaced with respect to the frame 14. The cylinders 58 are actuated in unison to change the position of the mast with respect to the boom 44 by pivoting the mast about the axis formed by the pins 50.

With the mounting arrangement of the present invention the mast 24 may be positioned in a wide variety of directional attitudes of the drill stem 26 without movement of the undercarriage 12. With the provision of the boom 44, which is horizontally slidable on the boom support, and the pivot mounting of the mast on the boom the mast may be moved away from the undercarriage a distance suitable enough to provide for drilling under the drill rig itself. Moreover, the structural features of boom 44 and its support are particularly adapted to adequately support the mast in any position attainable with the positioning mechanism disclosed herein and to transfer heavy pulldown forces to the drill stem by utilizing at least part of the weight of the undercarriage and main frame plus the components mounted thereon. Thanks to the arrangement of the boom support and the cylinders 86 for pivoting the support about a substantially horizontal axis the directional attitude of the mast and drill stem may be further altered to compensate for the terrain upon which the drill rig is parked or to be in accordance with the desired attitude of a drill hole. Because of the heaviness of the rig 10 including the mast 24 and attendant devices mounted thereon pivotal movement about an axis which is perpendicular to the pivot axis formed by the pins 50 is preferably provided by the pivotal mounting of the boom support and the cylinders 86 rather than providing a pivotal mounting arrangement on the positioner bracket itself.

What is claimed is:

1. In a mobile drill rig including an undercarriage, a frame mounted on said undercarriage, and an elongated mast including a drill motor mounted for movement along said mast for driving a drill stem, an improved mounting for said mast comprising:

a support mounted on said frame and comprising a cradle member including a pair of spaced apart legs pivotally connected to said frame for limited movement about a horizontal pivot axis formed by said pivotal connection, said support being disposed between a pair of extensible hydraulic cylinders connected to said frame and said support for positioning said support about said horizontal pivot axis;

an elongated boom mounted on said support for linear movement substantially parallel to said horizontal pivot axis; and,

a positioner bracket pivotally mounted on one end of said boom and connected to said mast whereby said mast may be pivoted with respect to said boom.

2. The invention set forth in claim 1 wherein:

said support includes a member removably fastened to said cradle member and said support includes bearing means disposed on said member and said cradle member for slidably supporting said boom.

3. The invention set forth in claim 2 wherein:

said bearing means comprises a plurality of bearing blocks disposed on said member and said cradle

member, said bearing blocks being self-lubricating.

4. In a mobile drill rig including an undercarriage, a frame mounted on said undercarriage, and an elongated mast including a drill motor mounted for movement along said mast for driving a drill stem, an improved mounting for said mast comprising:

a support mounted on said frame for limited movement about a horizontal pivot axis;

an elongated boom comprising a pair of side-by-side elongated tubular members fixed together by webs interposed between said tubular members, and mounted on said support for linear movement substantially parallel to said horizontal pivot axis;

a positioner bracket pivotally mounted on one end of said boom and connected to said mast whereby said mast may be pivoted with respect to said boom; and,

a pair of extensible hydraulic cylinders mounted side by side, each cylinder being connected to one of said tubular members and to said positioner bracket.

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