Oct. 8, 1957 A. R. McLERRAN 2,808,911

COMBINED BRACE AND HOIST

Filed Aug. 19, 1954 5 Sheets-Sheet 1

Fig. 1

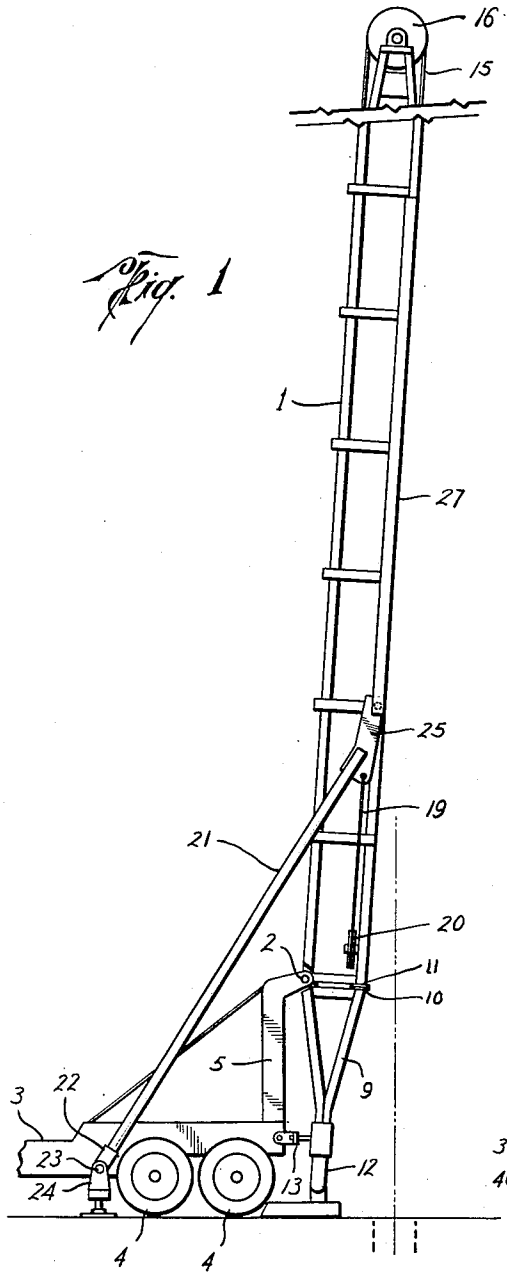


Fig. 2

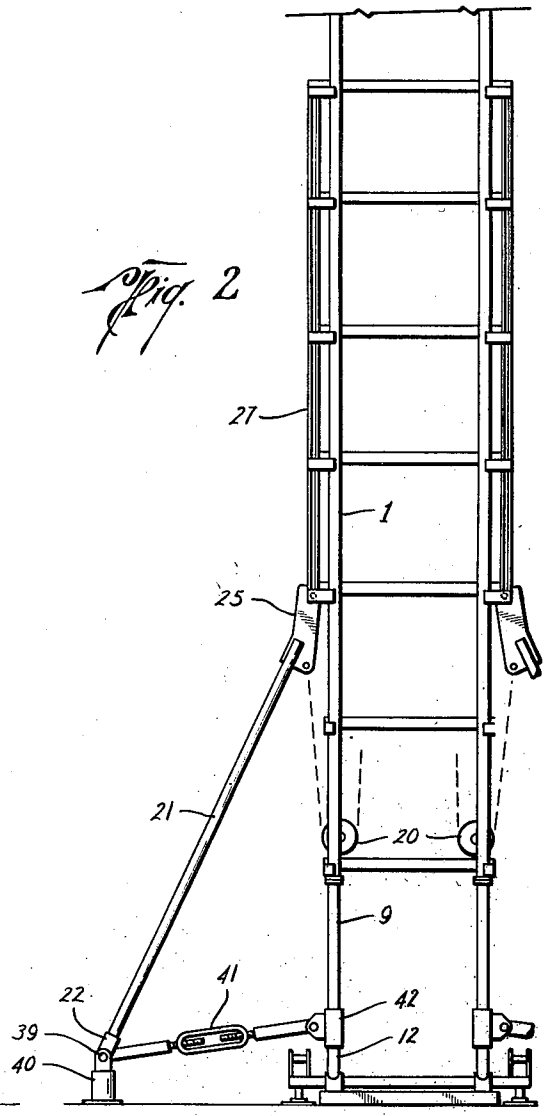
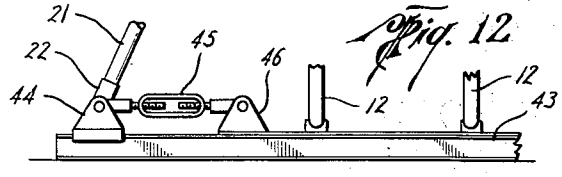


Fig. 12



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Oct. 8, 1957 A. R. McLERRAN 2,808,911

COMBINED BRACE AND HOIST

Filed Aug. 19, 1954 5 Sheets-Sheet 2

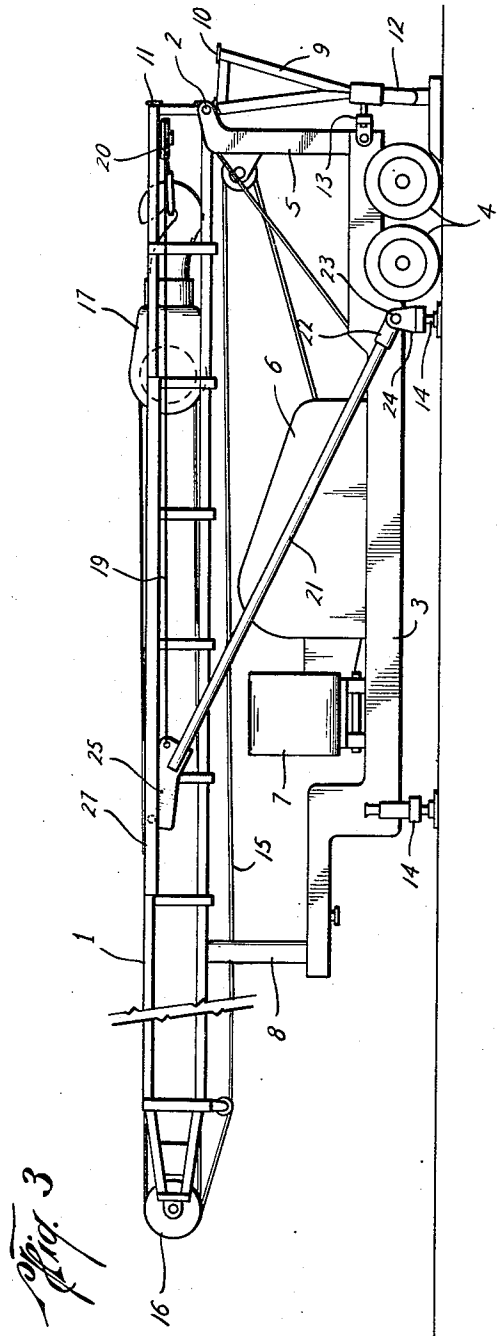


Fig. 3

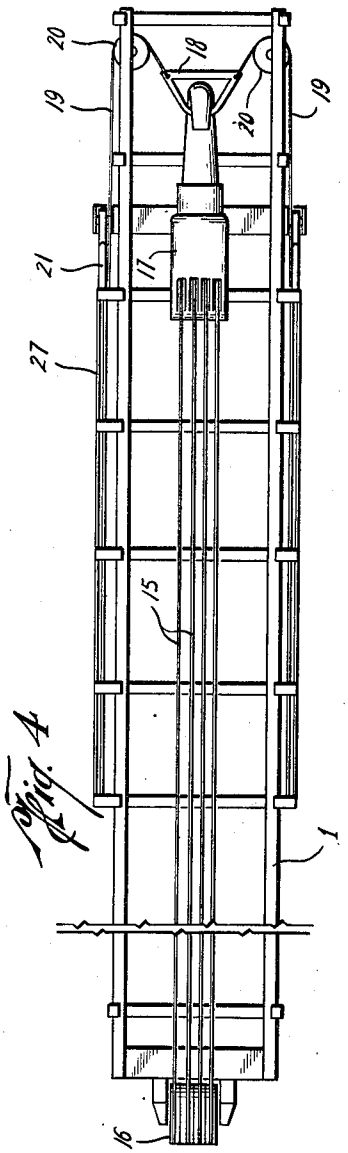


Fig. 4

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Oct. 8, 1957 A. R. McLERRAN 2,808,911

COMBINED BRACE AND HOIST

Filed Aug. 19, 1954 5 Sheets-Sheet 3

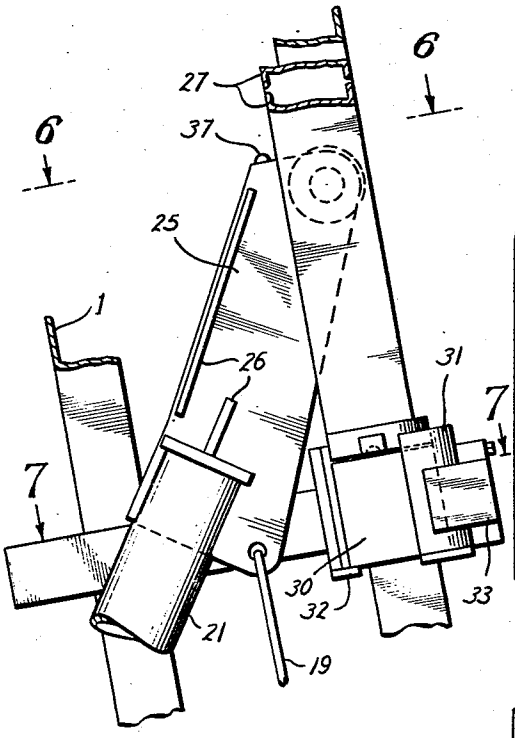


Fig. 5

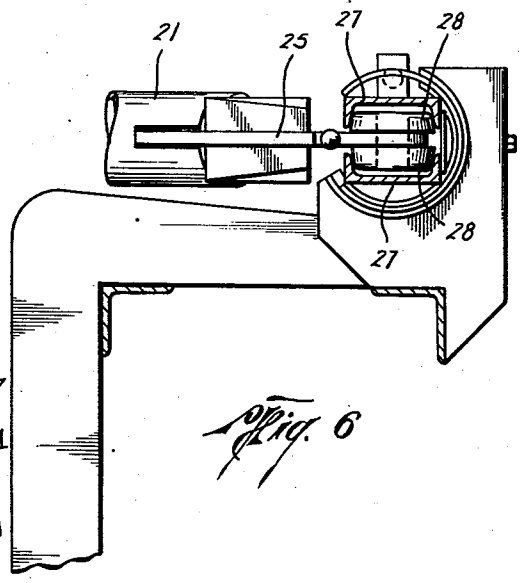


Fig. 6

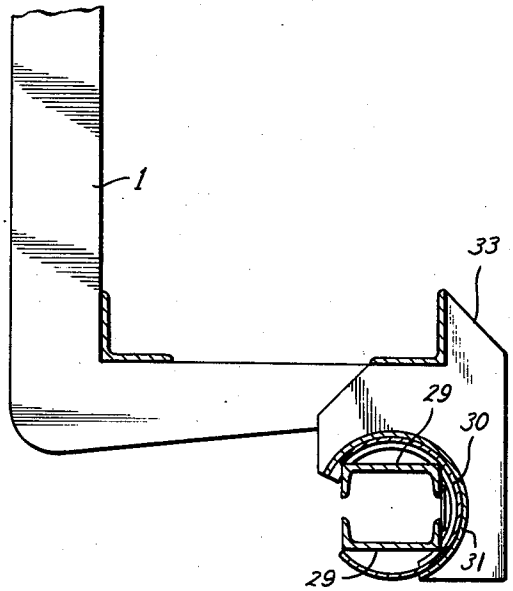


Fig. 7

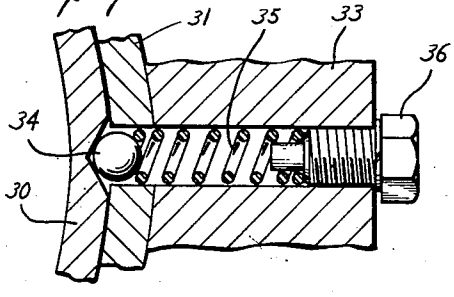


Fig. 8

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Oct. 8, 1957 A. R. McLERRAN 2,808,911

COMBINED BRACE AND HOIST

Filed Aug. 19, 1954 5 Sheets-Sheet 4

Fig. 9

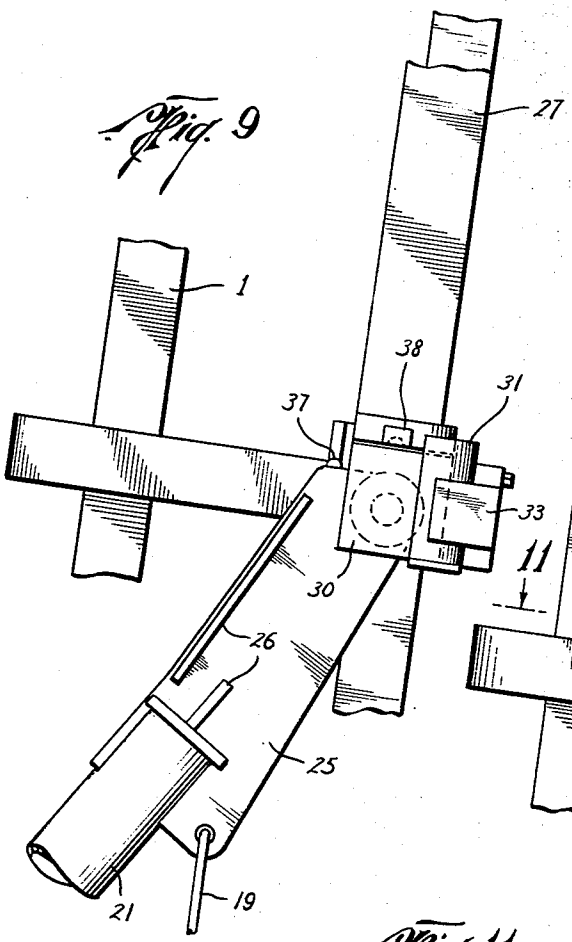


Fig. 10

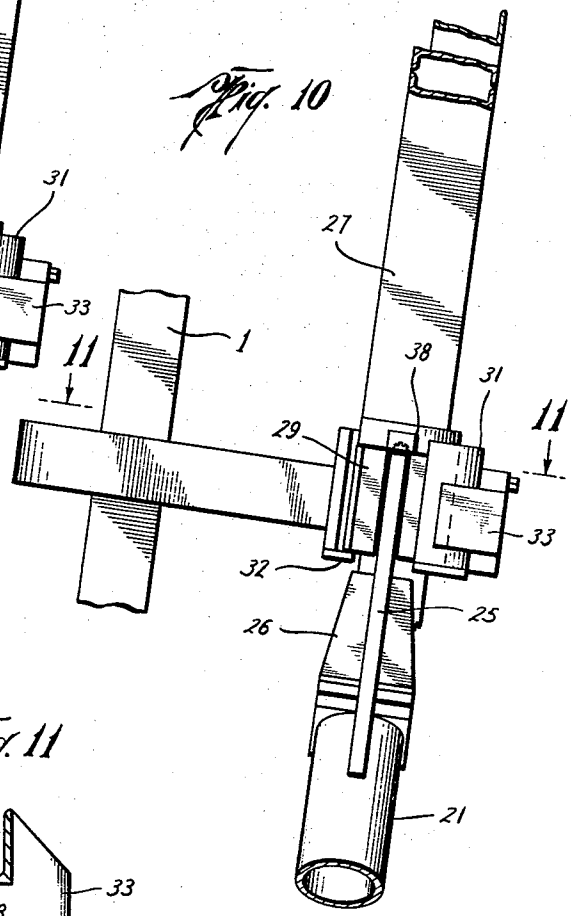
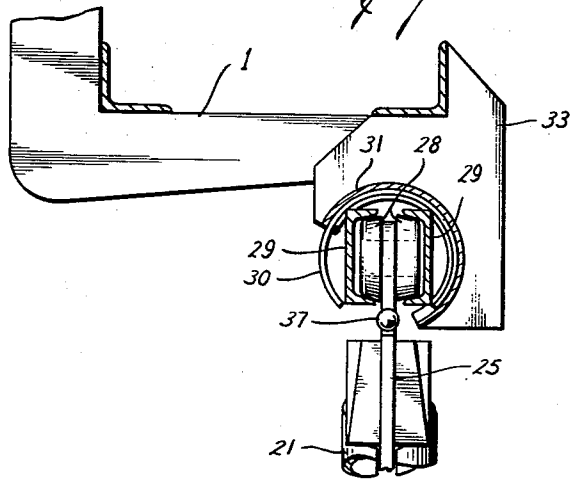


Fig. 11



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Oct. 8, 1957 A. R. McLERRAN 2,808,911

COMBINED BRACE AND HOIST

Filed Aug. 19, 1954 5 Sheets-Sheet 5

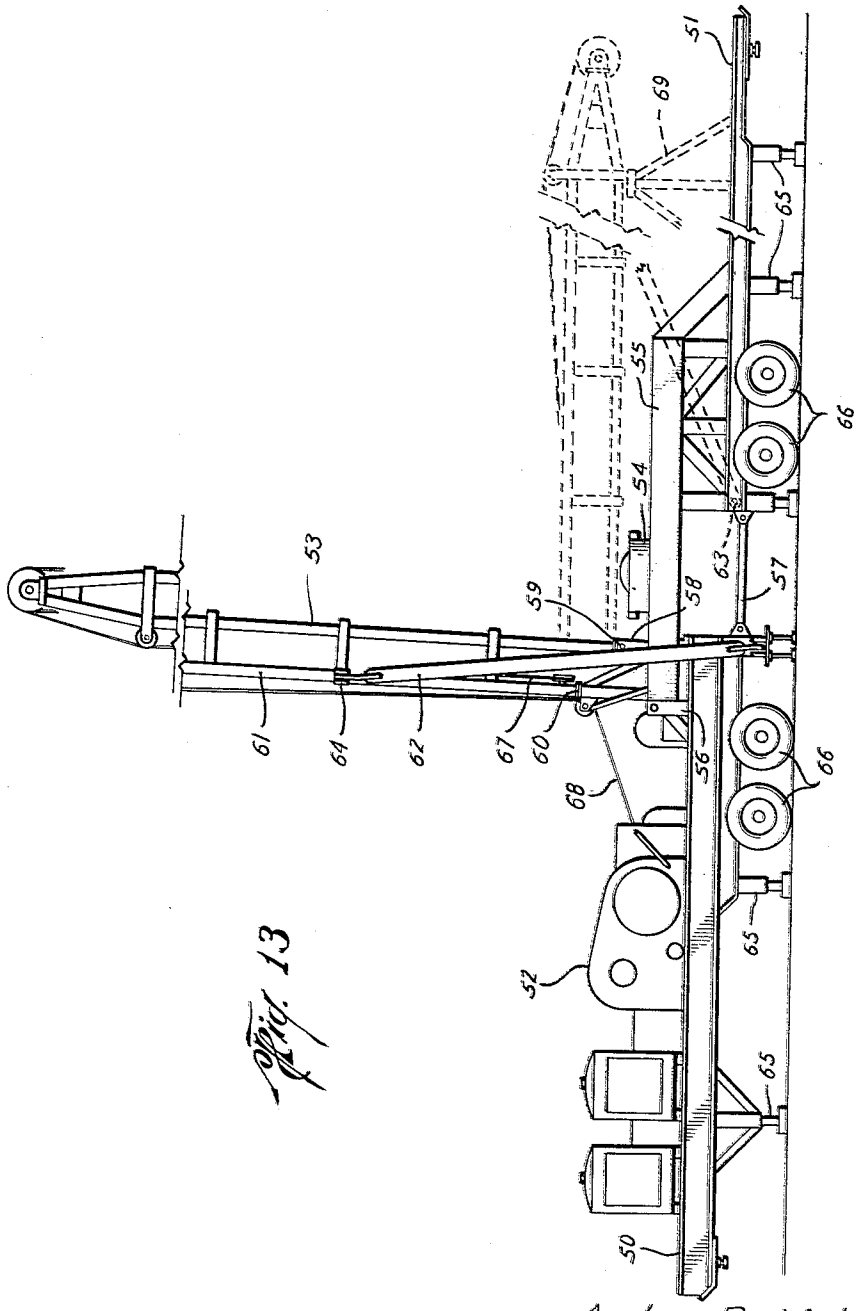


Fig. 13

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United States Patent Office 2,808,911
Patented Oct. 8, 1957

2,808,911

COMBINED BRACE AND HOIST

Archie R. McLerran, Beaumont, Tex., assignor to Dresser Equipment Company, Beaumont, Tex., a corporation of Ohio

Application August 19, 1954, Serial No. 450,841

16 Claims. (Cl. 189—11)

This invention relates to a portable rig of the type used for drilling and other well working operations, and more particularly to an improved folding mast structure. For the operations of drilling and reworking oil wells there is often used a folding mast or derrick mounted on a road vehicle for portability and which is erected at the well site and braced in upright position by a number of guy wires running in several directions to ground level.

Among the objects of this invention is the provision of an improved folding mast which eliminates the need for awkward guy wires, even though the mast is for heavy duty work and extends above the ground to great height, as is required for deep well operations, and which improved mast structure embodies, as a self contained assembly, a simple and inexpensive arrangement of adjustable legs whose adjustment and co-operative relation enables their use both as lateral braces at both sides of the upright mast and as force transmitting connections for raising and lowering the mast. The arrangement affords compactness and neatness, with the bracing legs out of the way, without interference to the other ground and platform working regions, and the leg connections at their opposite ends are purposely designed for quick and easy change of leg position and their dual use in bracing an erect mast and in transferring folding force.

Another object of the invention is to provide an improved folding, hinged mast and leg assembly utilizing a pivot connection between the mast and the upper end of the leg and whose pivot axis extends longitudinally of the mast, whereby during a folding operation the leg can be projected between the mast and its base support in a plane generally transverse to the axis of the mast hinge support and longitudinally of the mast with one end mounted on a fixed pivot whose axis is parallel to the hinge axis of the mast and with its opposite end longitudinally slidable on a track in load transferring relation for leverage force transmitted through the leg and whereby for mast erect bracing relation the leg can be swung angularly about its upper pivotal connection to project downwardly and upwardly from the mast to a side anchor and in which position thrust transmitting abutments between the top of the leg and the mast come into action to maintain a positive bracing relation.

A further object of the invention is to provide a leg upper end connection with the mast embodying a trackway fixed to the mast in the longitudinal direction of its extent for travel of the leg end bearing coincident to mast swinging travel, together with a short length trackway extension journaled to the lower end and on an axis longitudinally of the fixed trackway for reception within the rotary extension of the leg end bearing at its lower limit of travel when the mast is fully erected, whereby to accommodate angular movement of the leg about the journal axis between the angularly spaced lateral leg bracing position and longitudinal leg mast swinging position. Thus with the leg in mast raising position, the rotary extension is in aligned relation with the fixed trackway as a continuation of the guide surface thereof for

travel of the leg end bearing whereas with the leg in bracing position the extension has been rocked out of alignment with the fixed track to bring an abutment on the upper end of the leg into mating contact with a fixed abutment on the mast for the transmission of bracing thrust.

Other objects and advantages will become apparent during the course of the following specification having reference to the accompanying drawing, wherein Fig. 1 is a side elevation of a mast in erect position on a supporting base with the mast raising legs at their upper limit of travel; Fig. 2 is an end elevation showing a raised mast with the legs in side bracing relation; Fig. 3 is a side elevation of a portable vehicle rig with the mast in folded down position overlapping the longitudinal extent of the vehicle frame; Fig. 4 is a top plan view of the folded down mast showing the raising harness associated with the conventional traveling block; Fig. 5 is a fragmentary side elevation of the mast and leg connecting parts in a relative position during swinging travel of the mast in slightly spaced relation from fully erect position; Fig. 6 is a transverse section as on line 6—6 of Fig. 5 and showing the leg connection at the far side of the mast; Fig. 7 is a transverse section on line 7—7 of Fig. 5 at the journaled part of the trackway on the near side of the mast as viewed in Fig. 5; Fig. 8 is a detail transverse section showing a releasable latch for holding the journaled guideway part in alignment with the fixed guideway part; Fig. 9 is a fragmentary side elevation of the interconnected parts of the mast and the upper end of the raising leg when the leg is in fully erected mast relation; Fig. 10 corresponds to Fig. 9 except that the leg has been swung to a side bracing position approximately 90° from the raising position shown in Fig. 9; Fig. 11 is a transverse section as on line 11—11 of Fig. 10; Fig. 12 is a fragmentary elevation showing a modified ground anchor for the bracing leg; and Fig 13 is a side elevation of a two-vehicle rig embodying the invention.

As shown in the drawings, the swinging mast 1, customarily comprised of structural metal parts welded or bolted together, is hinged forwardly of its longitudinal center line and on both sides at its lower end by trunnion pins 2 on an axis transverse to the longitudinal extent of the mast and its supporting base 3, which may consist of the chassis frame of a semitrailer type of road vehicle having suitable running gear, such as a tandem axle suspension for ground wheels 4. At the rearward end of the base frame a pair of transversely spaced upright posts or standards 5 receive the mast therebetween and mount the hinge pins 2 at a raised level above the ground sufficiently high so that when the mast is folded, as shown in Fig. 3, it overlies or bridges the frame supported drawworks 6 and drive engine 7 and bears on a steady rest or upright chair 8 at the front of the frame. Co-operating with the hinge supporting posts 5, a rearwardly disposed V-shaped frame or upright 9 is hung at its upper end on the hinge pins 2 and has a top pad 10 to be engaged by a mating seating pad 11 on the foot of the mast 1 in radially spaced relation to the pivot pin 2 and rearwardly of the mast longitudinal center line. The bottom of the mast support 9 has a pair of transversely spaced adjustable jacks 12 for bearing abutment with a ground plate or bolster rail. An adjustable threaded connection 13 near the bottom of the support 9 joins it to the chassis frame 3 and along with the jacks 12 enables a variation in the relative angular positioning of the mast support 9 and its pad 10 about the trunnion 2 for controlling the tilt angle of the mast in erect position. As will be evident in Fig. 1, the center of gravity of a rearwardly tilted mast is rearwardly of the hinge axis 2 and the overcenter weight is transmitted through the pads 10 and 11 with the mast

load to the ground being primarily through the support frame 9. This overcenter relation can be relied upon to maintain the mast erect, and additionally the pads 10 and 11 can be detachably bolted together. Additional adjustable ground engaging and load transmitting jacks 14 may be employed between the ground and the chassis frame to take weight off of the road wheels and for leveling the base support and rig assembly in compensation for ground irregularities.

The usual pulley cable 15 from the drawworks 6 passes around a sheave carried by the standards 5 and is entrained over a crown block 16 at the top of the derrick and a traveling block 17 as customary equipment for a drilling operation. In this case a harness or bridle 18 secures to the traveling block a pair of raising lines 19 which extend around pulleys 20 near the bottom and on both sides of the mast, and the free ends of the raising lines are for detachable connection to a pair of raising posts 21 at points intermediate opposite ends of the posts and preferably closely adjacent the post upper ends. Each post preferably consists of a long tube terminating at its lower end in an apertured head 22. When the post is in mast raising relation and in a plane extending transversely to the hinge axis of the mast and generally longitudinally of the vehicle frame and the mast, the head 22 is hingedly secured on a fixed axis parallel to the axis of the pin 2 by means of a detachable pin 23 and a frame carried bracket 24.

At its upper end the post 21 is bifurcated, and fitted between the forks and welded thereto is a flat terminal plate 25 having one or more transversely extending reinforcement plates 26 for imparting transverse stiffness, and containing an opening near its lower end to receive the raising line 19. Its upper end extends slidably through a longitudinal slot or opening provided between the flange edges of a pair of channels 27 which are fixed at each side of the mast and form guideways or tracks for a pair of rollers 28 rotatably mounted on the opposite ends of a support pin which is welded to and projects through and on both sides of plate 25. The rollers ride in the guideways to transmit lifting force to the derrick applied to the raising legs 21 by the raising line 19 which swings the raising legs about their fixed pivots 23, and the guideways must be of sufficient length to accommodate the relative downward movement on the mast of the rollers from the folded position shown in Fig. 3 to the erect position shown in Fig. 1. Just above the lower limit of travel of the rollers, the fixed trackways 27 terminate, but the track is continued or extended by means of a pair of short length oppositely facing channels 29 which during the mast swinging operation are in track aligned relation to the fixed channels 27. These lower channels, instead of being fixed to the mast, are secured to the mast for a slight rocking through an angle of about 90° about the longitudinal axis of the trackway. For that purpose, the outer corners of the spaced channels are welded to a parti-cylindrical sleeve 30 whose opposite ends are spaced apart for a short distance sufficient to allow the end plate 25 to pass through the space between the channels. The cylindrical surface of the bearing sleeve 30 is journaled for oscillation within an outer parti-cylindrical sleeve 31 whose circular bearing surface extends through an arc in excess of 180° for retaining the inner member therein, and opposite side edges are spaced apart a distance somewhat in excess of the angle through which the combined raising and bracing leg is to be swung. To retain the inner subassembly of sleeve 30 and channel extensions 29 in end to end continuity with the lower ends of the fixed channels 27, an inwardly extending closure flange or ring 32 is welded or formed integrally with the bottom of the outer bearing sleeve 31 and extends under the bottom edge of the inner sleeve 30. For locating the outer sleeve 31, a supporting block or plate 33 has the outer sleeve 31 welded to it, and in turn is welded to one of the adjacent mast components. As shown in Fig. 8, this supporting block 33 has an aperture or pocket housing a poppet or detent 34 resiliently urged outwardly by a coil spring 35 into a depressed seat in the inner sleeve 30 to yieldably latch or resist rocking movement of the inner sleeve away from the position in which the channels 29 are in guide alignment relation with the fixed channels 27. A closure plug 36 is threaded in the outer end of the aperature and forms a seat for the outer end of the coil spring 35.

At its upper end the flat terminal plate 25 carries an upwardly extending boss or half-ball extension 37, and when the end bearing rollers have been pocketed or received within the rockable lower track extension and the whole leg has been oscillated to a position in which it projects outwardly and downwardly, the boss 37 can be brought to seat within a co-operating socket in a fixed abutment seat 38 upon a slight upward movement of the rollers from their lower extreme position. This seating abutment can be best seen in Fig. 10, and it serves to maintain the brace and the mast in tight thrust transmitting relation to one another.

With the bracing legs 21 extending outwardly and downwardly from a point above the mast pivot 2, the apertured head 23 on each leg may be connected by a detachable pin 39 to a ground anchor post 40 and to the outer end of an adjustable strut or turnbuckle 41 whose inner end is pivotally connected to a suitable bracket 42 on the supplemental support assembly 9. Adjustment of the turnbuckle 41 will draw the ground support 40 inwardly and tend to raise the upper end of the brace arm 21 for seating the boss 37 in the socket 38, as aforesaid, and at the same time will push the ground post 40 toward the ground for eliminating all slack and insuring a tight lateral bracing relation and complete stabilization.

In the event the ground is too soft to receive the concentrated load on the post 40, then the arrangement shown in Fig. 12 may be employed, wherein an extended I-beam 43 will have its central region positioned under the mast jacks 12, and its outer ends can then support the adjustable braces 21 for a much wider distribution of the force into the ground. In this case the lower post head 22 will be pinned to a shoe 44, which will have a sliding engagement with the upper flange of the I-beam 43, and the adjustable turnbuckle 45 is connected at its outer end to the slide shoe 44 and at its inner end to a fixed anchor bracket 46.

With the use of the mechanism described, the vehicle load with the folded mast can be driven to location and after the jacks 12 and 14 have been adjusted the engine power can be employed to draw the traveling block 17 toward the crown block 16, and the force transmitted through the raising lines 19 will swing the posts 21 about their anchor pivots 23, sliding their upper ends downwardly against the mast until it rises to the fully erect position. Thereupon removal of the anchor pins 23 will enable the brace bars to be swung laterally by reason of the trunnion mounting of the guideway extensions 29 in which the upper ends of the bars are pocketed. After the lower ends of the brace bars are secured in position, the turnbuckle adjustment will draw them inwardly and move the upper end of the legs into tight abutment with the mast bearing surfaces for resisting sidewise tilt of the frame in a direction transverse to the longitudinal center line of the base support. Tilt of the erected mast in other directions will, of course, be resisted by the jack supports and the bearing of the base support itself on a long leverage arm extending away from the mast. For lowering the mast, the procedure will be reversed. For some purposes, the slide connection may be associated with the lower end of the raising leg and the supporting base, in which case the upper end of the leg would be pivoted for movement about an axis in spaced parallelism with the mast hinge, as well as about an axis extending longitudinally of the mast.

The arrangement described for slidably and rockably

mounting the upper ends of the stabilizing legs and enabling their lower ends to be swung between bracing and raising relations with the folding mast can be readily incorporated in a variety of rig assemblies, such as a two-vehicle unit shown in Fig. 13 and which will ideally satisfy requirements for larger equipment and greater power output. In this case the substructure is constituted by separable vehicles **50** and **51** for transit individually as a divided load and for tied together end to end relation as a single co-operative unit at a well location. The vehicle **50** is shown as including multiple power plants for compounding drive to a drawworks **52**, and the vehicle **51** carries the folding mast **53** and the rotary machine **54**, to be drive connected as usual from the power unit, with both vehicles having some free loading space for transporting auxiliary equipment.

The chassis of the mast carrying vehicle **51** includes a rearwardly disposed raised level deck or working platform **55** mounting a rotary machine **54** to be positioned over the well hole location. At its rear end the raised deck **55** overlies the abutting rear end of the drawworks vehicle **50** and is detachably coupled to a supporting stand **56** on the vehicle **50**. Additionally, the two vehicle ends are detachably joined to opposite ends of distance rods **57**. Rising upwardly from the deck **55** is a supporting chair assembly **58** which constitutes a fixed portion of the mast at the bottom of the folding portion of the mast. The two mast portions are hingedly joined together by a transversely extending pin **59** located forward of the mast center line when the folding portion is erected. Co-operating with the hinge pin **59** in the mast erect position are a pair of mating bearing pads indicated at **60** on the upper end of the chair **58** and the bottom of the mast, respectively, and rearwardly of the mast center line. The erect mast is tilted slightly, and its crown block suspended traveling block moves in a vertical path aligned with the rotary **54**.

Fixed longitudinally at both sides of the mast are channeled guides **61** for slidably receiving the upper ends of a pair of stabilizer legs **62** which during mast raising and lowering operations are detachably secured at their lower ends by transverse hinge pins **63** on the frame of the vehicle **51** at a point intermediate the longitudinally spaced limits of the arcuate swing of the upper ends of the raising legs. As previously described in detail, the fixed channels **61** each co-operates at its lower end with a short length extension or channel guide **64** journaled on the mast for rocking adjustment about the longitudinal axis into and out of alignment with the fixed channel guide. Such adjustment enables each leg at its lower limit of longitudinal travel to be swung between its raising position and its lateral bracing position. In lateral bracing position the lower ends of the legs **62** are anchored in transversely spaced relation with the mast, as are the bracing legs **21** in their side bracing positions previously described, and the upper ends of the legs **62** are brought into fixed abutment with stop seats in the manner of Fig. 10.

In setting up this rig, the mast vehicle is first driven to location and the power plant vehicle is then maneuvered back to back with the mast vehicle so that the two vehicles can be tied together and leveled in co-operative horizontal planes by a group of adjustable jacks or ground supporting legs **65** which lift the road gear **66** above the ground surface. Raising lines **67** extend from the raising legs **62** near their swinging upper ends and around pulleys at the bottom of the mast to a bridle on the traveling block, as heretofore described, and power applied through the traveling block suspension cable **68** from the drawworks will swing the raising legs **62** about their fixed pivots **63** and thereby push on the mast as the upper ends of the legs slide in their guideways for swinging a mast about the hinge trunnion **59**. On reaching fully erect mast position, the upper ends of the raising legs will have been received within the journaled guide extensions **64**, and their lower ends can be detached from the pivot pin **63** and swung outwardly for anchorage laterally of the substructure. The mast is, therefore, adequately braced in all directions. Reversal of the raising procedure is followed for lowering the mast to the dotted line transit position, in which it extends substantially horizontally and longitudinally forward above the substructure **51** with its forward end resting on a supporting cradle **69** so that the over-all height is within the usual clearance ranges for passage under bridges and other overpasses during highway travel.

While the foregoing specification has been limited to what has been illustrated in the drawings, it is to be understood that such modifications may be made as come within the scope of the appended claims.

What is claimed is:

1. In a portable drilling rig of the character described, a longitudinal frame, a folding mast hinged on the frame for swinging travel between an erect position and a folded position extending longitudinally of the frame, a pair of combined raising and bracing legs connected at their upper ends to opposite sides of the mast and arranged to extend divergently outwardly from the erect mast and transversely of the longitudinal frame when in bracing relation and to extend in the longitudinal direction of the frame and the folded mast and to the same side of the mast hinge axis when in raising position, the upper leg end connections including longitudinal trackways to slidably receive the leg ends and constituted by upper and lower parts, means fixedly fastening the upper trackway parts to the mast for the reception of said leg upper ends in all but their lowermost position, means swivelly fastening the lower trackway parts in end to end succession with the fixed parts for reception of said leg upper ends in their lowermost position and for swinging about the longitudinal axes of fixed parts when said leg ends are received within said lower trackway parts, and means operating when the lower trackway parts are swung to outwardly divergent leg position for bracing thrust transmission between the mast and the legs.

2. In a portable drilling rig, a frame, a mast hinged to the frame on an axis transverse to the frame for swinging between upright drilling position and folded transit position, a pair of legs extended from opposite sides of the mast and arranged to project transversely of the frame and in downwardly and outwardly inclined relation from the upright mast to widely spaced apart grounded bearing when the mast is upright and to project longitudinally downwardly from the mast to fixed pivot connection with the frame when the mast is being swung about its hinged connection, said pivot connection including hinge pins joining the lower ends of the legs with the frame on axes in spaced parallelism with the hinge axis of the mast, the upper ends of said legs having slide thrust bearing with the mast in the longitudinal direction thereof under power applied through the legs for swinging the mast, and the connections between the mast and the upper ends of the legs each including at the lower limit of slide bearing a swivel joint whose axis extends longitudinally of the mast to accommodate leg movement between its transverse projection and its longitudinal projection.

3. In a portable drilling rig, a frame, a mast hinged to the frame on an axis transverse to the frame for swinging between upright drilling position and folded transit position, a pair of legs extended from opposite sides of the mast and arranged to project in divergent relation with one another and downwardly and outwardly from the mast to widely spaced apart grounded bearing when the mast is upright and to project in the longitudinal direction of the frame and downwardly from the mast to fixed pivot connection with the frame when the mast is being swung about its hinged connection, the upper ends of said legs having slide thrust bearing with the mast in the longitudinal direction thereof under power applied through the

legs for swinging the mast, and the connections between the mast and the upper ends of the legs each including at the lower limit of slide bearing a swivel joint whose axis extends longitudinally of the mast to accommodate leg movement about said longitudinal axis, and co-operating abutments on the leg and the mast for thrust bearing engagement when the leg is projected downwardly and outwardly from the mast, to constrain the upper end of the leg against relative slide travel from said lower limit.

4. In a portable drilling rig, a frame, a mast hinged to the frame on an axis transverse to the frame for swinging between upright drilling position and folded transit position, a pair of legs extended from opposite sides of the mast and arranged to project in directions transveresly of the frame and downwardly and outwardly of the mast to widely spaced apart grounded bearing when the mast is upright and to project in directions longitudinally of the frame and downwardly from the mast and to fixed pivot connection with the frame when the mast is being swung about its hinged connection, the upper ends of said legs having slide thrust bearing with the mast in the longitudinal direction thereof under power applied through the legs for swinging the mast, and the connections between the mast and the upper ends of the legs each including a slide trackway fixed to the mast and extended longitudinally thereof, a slide member on the end of the leg to engage the trackway, and a trackway extension journaled at the bottom of the fixed trackway to receive said end slide member at its lower limit and enable the leg to be swung about an axis extending longitudinally of the mast.

5. In a portable rig of the character described, a hingedly mounted folding mast, a combined raising and bracing leg arranged to be positioned alternately in either of two positions angularly related to one another about the longitudinal axis of the mast and in one of said positions to extend longitudinally of the folded mast when it is being swung about its pivot mounting under control of power applied to said leg and in the other of said positions to extend transversely of the aforementioned longitudinally extended position for bracing the erect mast in the direction laterally of the folding path of the mast, a trackway fixed with the mast for longitudinal travel thereof of a power thrust transmitting bearing at the upper end of the leg, a trackway extension to receive said bearing at the lower limit of its travel, a journal mounting for said extension accommodating rotary movement of the extension into and out of trackway alignment with the fixed trackway, and a releasable connection between said journal mounting and said extension to resist rotary movement of the extension from its said trackway alignment.

6. A folding rig of the character described, including a mast pivoted to swing between raised and lowered positions, a power transmitting leg having a mast swinging position in which the leg extends in a plane transverse to the mast pivot, a mast bracing position in which the leg extends in a plane transverse to the first mentioned plane, means pivotally securing the lower end of the leg on a fixed axis parallel to the mast pivot, means guiding the upper end of the leg for travel longitudinally of the mast and comprising a leg end retaining guide on the mast, means pivotally mounting at least a portion of the guide on an axis longitudinally of the mast and enabling said leg to be swung about said longitudinal axis laterally outwardly from its mast swinging position to its mast bracing position angularly related about said longitudinal axis to its mast swinging position, means for detachably anchoring said lower end of the leg in said bracing position, and means for fixedly securing the upper end of the leg against longitudinal displacement when the leg is in its mast bracing position.

7. A folding rig of the character described, including a mast pivoted to swing between raised and lowered positions, a power transmitting leg having a mast swinging

position in which the leg extends in a plane transverse to the mast pivot, means detachably pivotally securing the lower end of the leg on a fixed axis parallel to the mast pivot, a retaining guide on the mast slidably receiving the upper end of the leg for travel longitudinally of the mast and comprising a fixed upper part and a rotary lower part, means mounting said rotary lower part for oscillation into and out of guide alignment wih the fixed upper part and a resiliently urged detent lock co-operating with said lower part and yieldably retaining the same in guided alignment with the fixed part.

8. In a folding mast structure, a supporting base, a mast pivotally mounted on the base for swinging travel between an erect position and a folded position longitudinally overlying the base, a combined mast raising and bracing leg arranged with one end permanently connected to the mast and spaced longitudinally of the mast mounting pivot and with its opposite end for alternate detachable connection with fastenings angularly spaced from one another about the longitudinal axis of the mast and one of said fastenings being located on the supporting base in spaced relation longitudinally of the supporting base from said mounting pivot and the other of said fastenings being spaced transversely of the mast path of swinging travel to locate the leg downwardly and outwardly of the mast in inclined lateral bracing relation with the mast, one of the end connections of the leg with the mast and the support being longitudinally slidable for mast raising and lowering operations, and power applying means to effect sliding of the last mentioned connection.

9. The structure of claim 8 wherein said permanently connected end includes a swivel joint accommodating swinging of the leg about an axis extending longitudinally of the mast.

10. The structure of claim 8 wherein said permanently connected end is the slidable end of the leg and includes a swivel joint operative at the mast erect limit of the slide range to accommodate outward swinging of the leg to brace position and a stop abutment to preclude slide retraction of the end connection with the leg in brace position.

11. The structure of claim 8 wherein the slide end connection is with the mast and includes a bottoming abutment against slide retraction when the leg is in transversely extended anchor connected brace position.

12. In a folding mast structure, a mast, a hinge support on which the mast may be swung between lowered and erect positions, a combined mast raising and bracing leg shiftable about a vertical axis when the mast is erect between alternate positions, one of which is a mast raising position in which the leg extends in a plane substantially parallel with the path through which the mast is swung and the other of which positions is a mast bracing position in which the leg extends diagonally of the erect mast and in a vertical plane transverse to said path, means for detachably hingedly connecting one end of the leg on a fixed axis parallel to and radially spaced from the axis of the mast hinge support in said mast raising position, other means horizontally spaced approximately ninety degrees about said vertical axis from said detachable connecting means for detachably anchoring said end of the leg in said alternate bracing position for the erect mast, means joining the other end of said leg to the mast for relative travel in the direction of longitudinal extent of the mast during mast lowering and raising operations and for swinging travel about a substantially vertical axis between said connecting means and said anchoring means when the mast is erect, and a power receiving connection on said leg through which mast raising and lowering forces are transmitted when said leg is in its raising position.

13. In a folding rig of the character described, a base, a mast pivotally supported on the base for swinging travel between erect and lowered positions, a leg connected at its upper end to the mast by a pivot connec-

tion whose axis extends longitudinally of the mast and which enables the leg to be swung about said longitudinal axis between a mast bracing position extending transversely to the path of mast swinging travel when the mast is erect and a mast swinging position extending longitudinally of the mast, bracing thrust abutments on the mast and the upper end of the leg for co-operation in transferring thrust between the erect mast and the upper end of the leg in its lateral bracing position, a connection joining the lower end of the leg with the base when the leg is in its mast swinging position, one of said leg connections including a track for guiding the connected leg end in a longitudinal path coincident with swinging travel of the mast, and force transmitting means operable on said leg to control mast swinging travel.

14. In a folding rig of the character described, a pivotally mounted mast swingable between folded and erect positions, a leg co-operating with the mast both in its erect position and during its swinging travel and having its upper end joined to the mast by a hinge and slide connection, whose hinge axis and slide direction both extend longitudinally of the mast and whose hinge axis accommodates angular adjustment thereabout of the leg to alternate positions in one of which the leg extends substantially parallel to the path of mast swinging travel and in the other of which positions the leg extends in a direction transverse to the mast swinging path, a pair of anchor connections angularly spaced from one another in relation to said hinge axis for alternate connection with the lower end of said leg and arranged to locate said leg selectively by its connection with one of said anchoring connections in a vertical plane transverse to the path of swinging travel of the mast for bracing the mast when erect and by the leg connection with the other of said anchoring connections in longitudinally extending and slide relation to the mast during its swinging travel, means to preclude slide action of the leg relative to the mast when the leg is in said transverse vertical plane, and force transmitting means to control swinging travel of the mast and operable on the leg when the leg is in slide relation.

15. In a folding rig of the character described, a pivotally mounted mast swingable between folded and erect positions, a leg co-operating with the mast both in its erect position and during its swinging travel and having its upper end joined to the mast by a hinge and slide connection, whose hinge axis and slide direction extend longitudinally of the mast, a pair of anchor connections angularly spaced from one another in relation to said hinge axis for alternate connection with the lower end of said leg and arranged to locate said leg selectively in longitudinally extending and slide relation to the mast during its swinging travel and in a vertical plane substantially normal to the path of mast swinging travel when the mast is in its erect position, a stop abutment on the mast engageable by the upper end of said leg after the leg has been swung on said hinge axis to said transverse vertical plane, and adjustable leg setting means operable for shifting the lower end of the bracing leg inwardly toward the mast and thereby raising its upper slidable end into engagement with said stop abutment.

16. In a portable rig assembly of the character described, a supporting base structure, a folding mast trunnioned on the base structure for swinging travel between an erect operating position and a lowered transit position overlying the base structure, a combined stabilizing and mast raising leg pivotally joined at its upper end to the mast on an axis extending longitudinally of the mast for swinging of the leg between a stabilizing position in which the leg extends transversely to the path of mast swinging travel and a raising position projecting longitudinally of the mast and in which latter position the leg is mounted to swing in a vertical arc with the mast, co-operating stop abutments on the leg and the mast arranged to be brought into and out of stabilizing thrust transmitting alignment upon swinging of the leg about said longitudinal pivot axis between lateral stabilizing position and said raising position, and force transmitting means for connection with the leg to swing the same in said vertical arc when in raising position for controlling swinging travel of the mast.

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