June 1, 1954

D. R. MOORE

2,679,910

PORTABLE DERRICK

Filed Nov. 2, 1948

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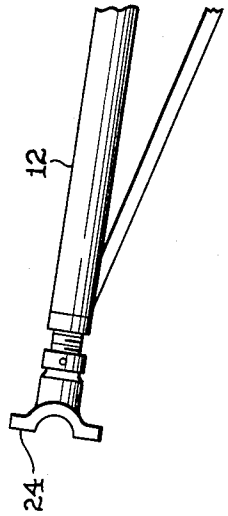
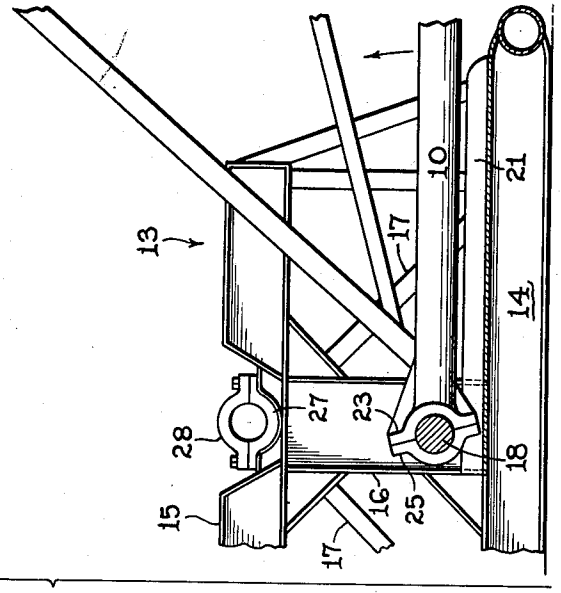


FIG. 2



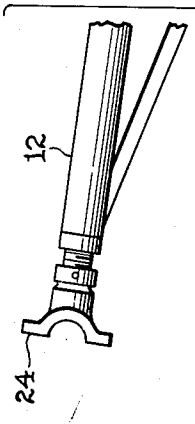
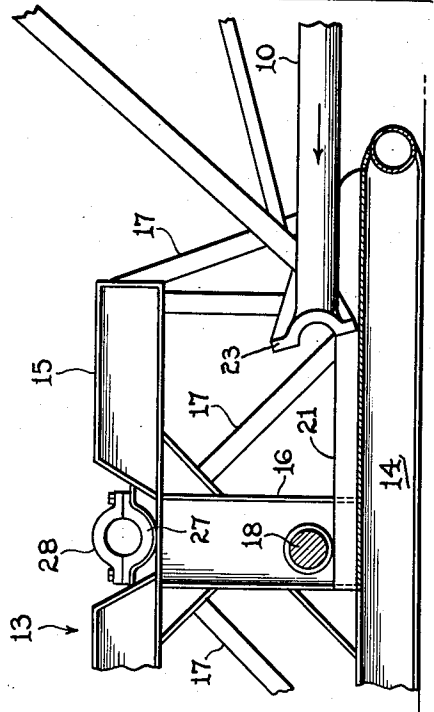


FIG. 1



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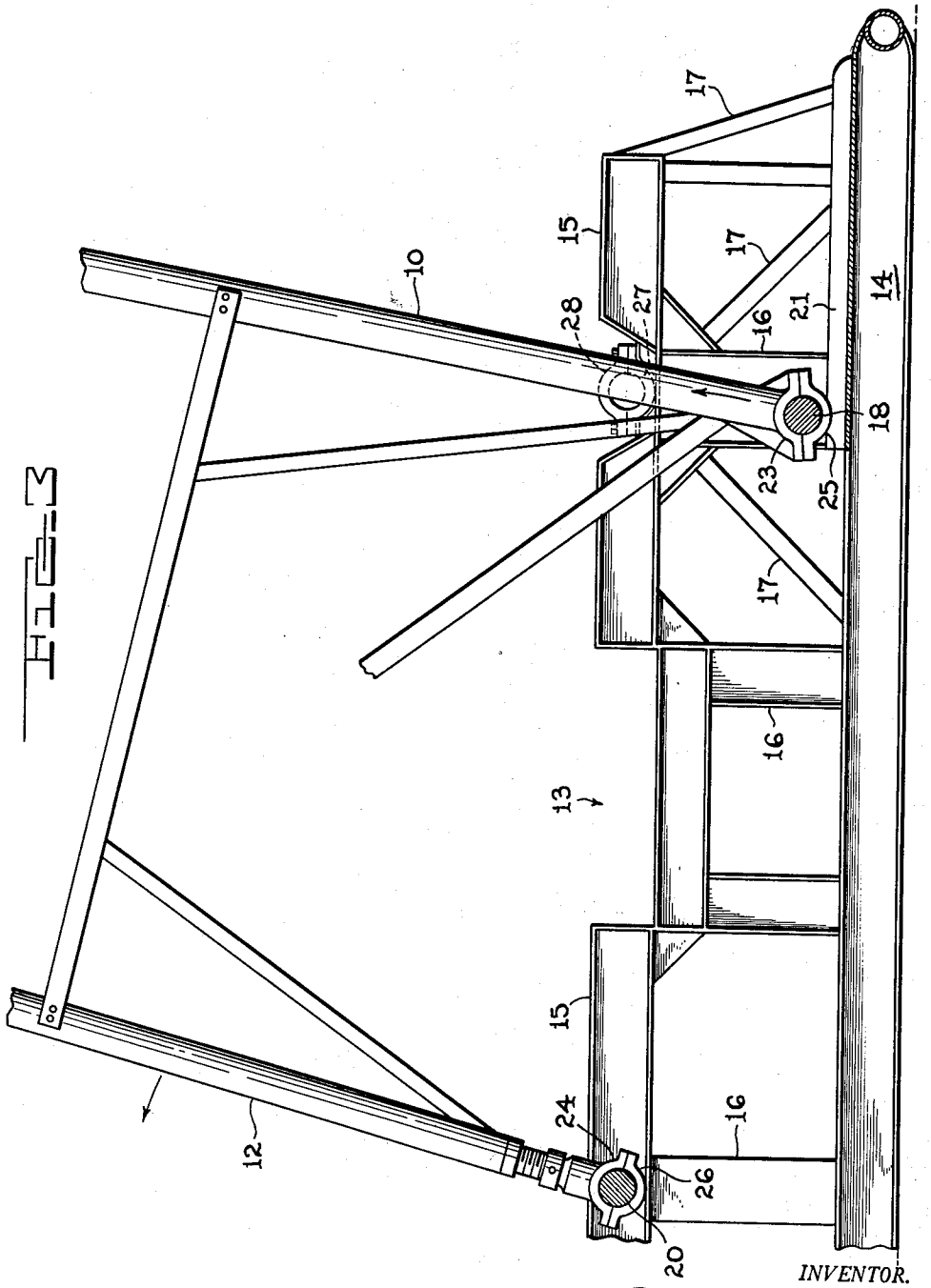
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4 Sheets-Sheet 2



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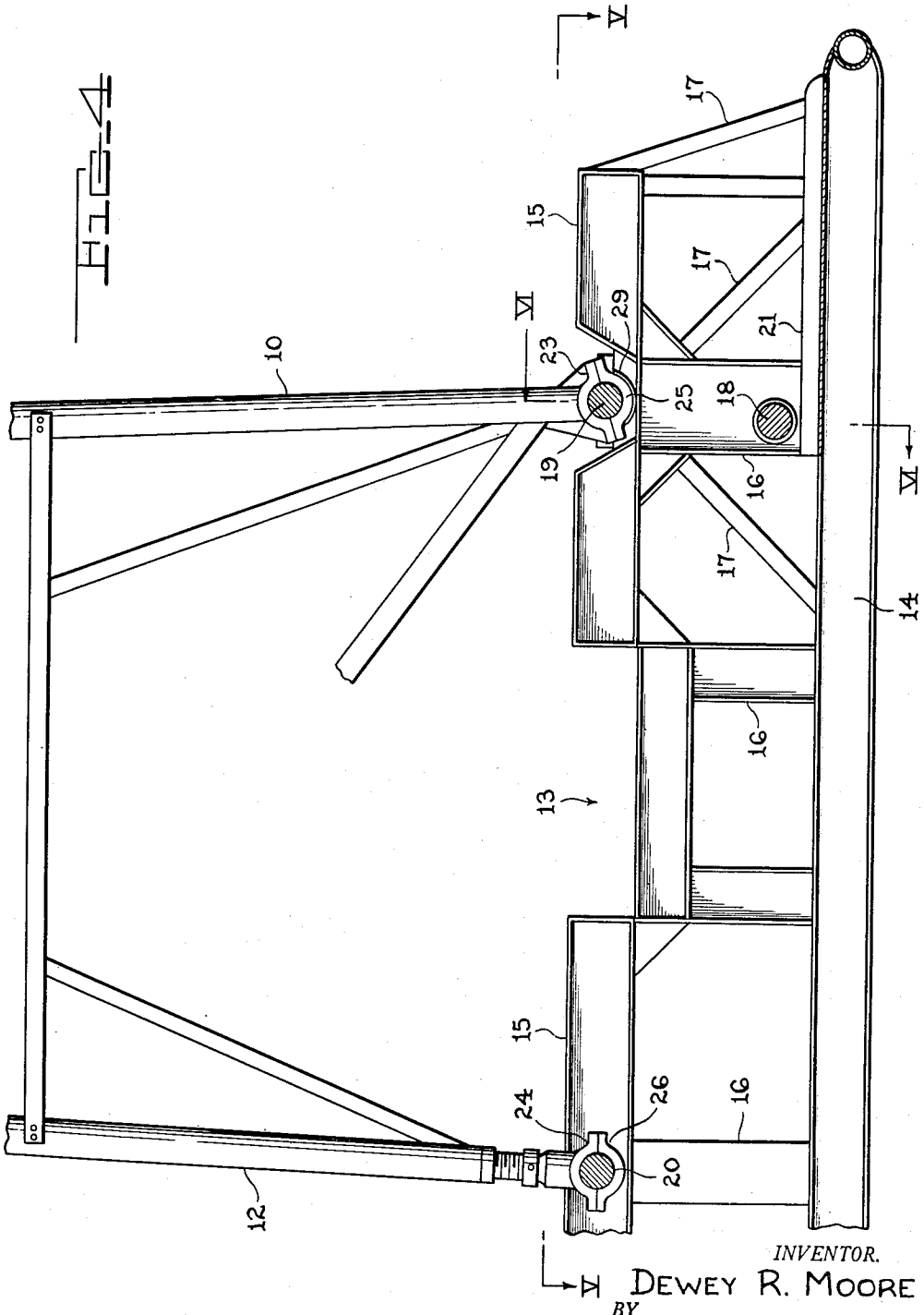
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FIG. 4



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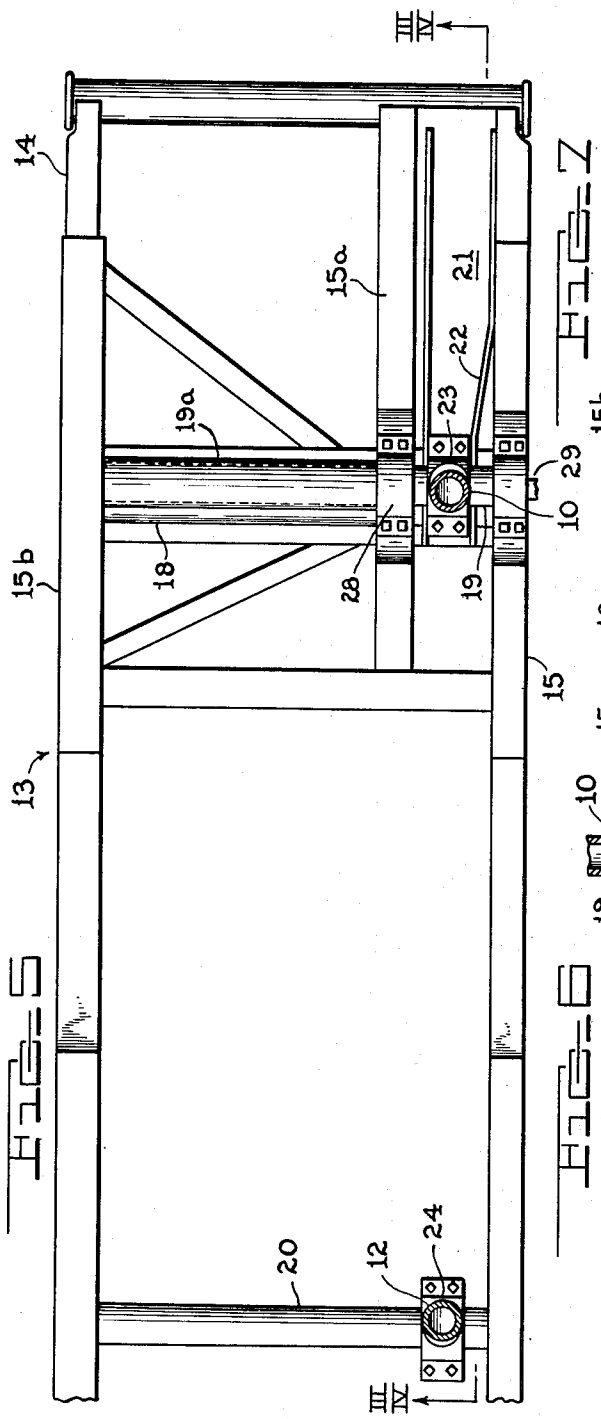


FIG. 5

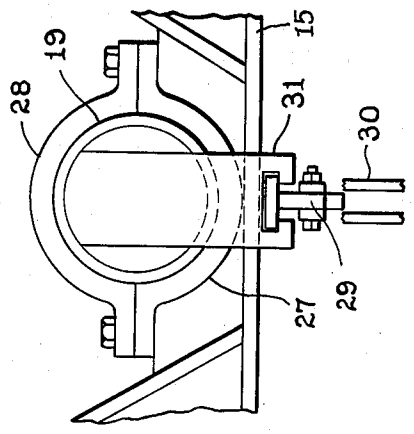


FIG. 7

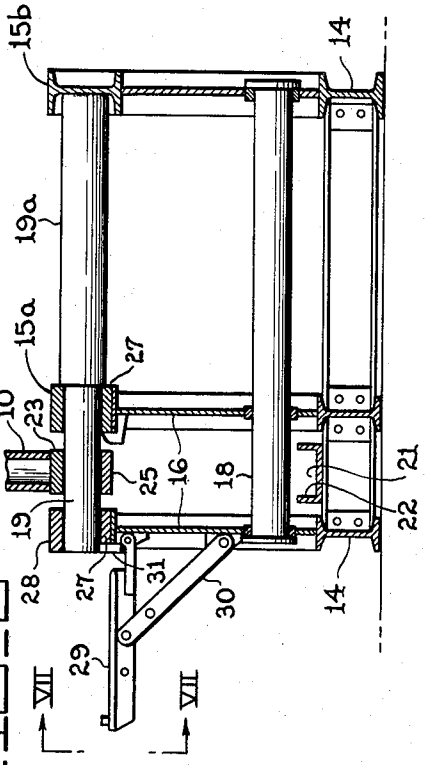


FIG. 6

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UNITED STATES PATENT OFFICE

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PORTABLE DERRICK

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Application November 2, 1948, Serial No. 57,907

4 Claims. (Cl. 189—11)

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This invention relates to portable well drilling derricks and particularly to improved means and methods for joining sub-structures and legs of such derricks.

Modern portable derricks stand on sub-structures that range in height from about five to fifteen feet above the ground to accommodate equipment such as blow-out preventers situated between the ground and the rotary table. Such derricks are assembled in prone position on the ground and then are erected about suitable fulcrum means on the sub-structure. This procedure commonly necessitates that the derrick be assembled away from the sub-structure and then its entire lower end lifted above the sub-structure and its front legs lowered accurately into position at the fulcrum means. The reverse of these operations must be performed when the derrick is lowered. Since these derricks are heavy and delicate, such operations are time consuming and difficult.

The principal object of the present invention is to provide portable derricks which have improved means for joining the sub-structure and legs without initially lifting the lower end of the derrick above the sub-structure.

A further object of the invention is to provide portable derricks which have improved means for joining the legs and sub-structures in which the need for positioning the legs accurately with respect to the sub-structure is eliminated, the legs being positioned only approximately and then guided automatically to the fulcrums.

A further object of the invention is to provide improved portable derrick sub-structures which have means for automatically guiding the derrick legs to their fulcrums, and thereby eliminate the need for lifting the lower end of the derrick or placing the legs accurately with respect to the fulcrums.

A further object of the invention is to provide improved methods for assembling and erecting portable derricks in which the derrick is assembled prone with the front legs positioned at the base of the sub-structure and then guided automatically to the fulcrums by a simple towing operation.

A further object of the invention is to provide improved means and methods for joining derrick legs and sub-structures which have the foregoing features and are of the dual fulcrum type, that is, as the derrick is erected, it turns about the front legs as a fulcrum until its center of gravity crosses this fulcrum and then it turns about the rear legs as a fulcrum.

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

Figure 1 is a vertical sectional view of a portion of a derrick and its sub-structure embodying features of the present invention, the parts being shown in the initial position which they assume when the derrick is about to be erected;

Figures 2, 3 and 4 are vertical sectional views similar to Figure 1, but showing the parts in progressively advanced positions as the derrick is being erected, Figures 3 and 4 being taken substantially on lines III—III and IV—IV of Figure 5;

Figure 5 is a horizontal sectional view of the erected derrick and its sub-structure taken substantially on line V—V of Figure 4;

Figure 6 is a vertical sectional view of the erected derrick and its sub-structure taken substantially on line VI—VI of Figure 4; and

Figure 7 is a side elevational view of a portion of the sub-structure taken substantially on line VII—VII of Figure 6.

There are shown at 10 and 12 one of the front legs and one of the rear legs, respectively, of a portable derrick of any desired construction, such for example as that shown in my co-pending application, Serial No. 648,721, filed February 19, 1946, which issued as Patent No. 2,465,813, March 29, 1949. The derrick comprises the usual tower, which supports a crown block, a drilling line and a traveling block, not shown. There is shown at 13 a portion of a derrick sub-structure which supports the erected derrick, and also the usual rotary table, drawworks and prime mover, not shown. This sub-structure is approximately five to fifteen feet high to accommodate other mechanisms, such as blow-out preventers, between the ground and the rotary table. The sub-structure is formed of two separate frameworks, each of which supports one front leg and one rear leg of the erected derrick. Only one pair of legs and their sub-structure are illustrated, since corresponding parts on the opposite side are similar and a disclosure of one suffices for both.

Each framework of the sub-structure comprises a relatively low longitudinal base 14, longitudinal top members 15, 15a and 15b (Figure 5) and uprights and diagonal struts 16 and 17 (Figures 1 to 4), which support the top members in spaced relation above the base. An opposed pair of uprights carry a transverse axle 18 which is either fixed or rotatable about a fixed axis near

the base and is situated at a relatively low height, preferably not greater than about two feet. Axle 18 furnishes fulcrum means about which front leg 10 turns during a part of the process of erecting or lowering the derrick, as hereinafter explained. Top members 15 and 15a carry a retractable transverse axle 19, which supports the front leg when the derrick is fully erected and also is described in more detail hereinafter. Top members 15a and 15b carry a fixed extension 19a of axle 19, which extension further braces the structure (Figures 5 and 6). Top members 15 and 15b also carry a transverse axle 20 which furnishes fulcrum means about which rear leg 12 turns during the remainder of the process of erecting or lowering the derrick and also supports said rear leg when the derrick is fully erected.

Base 14 carries a longitudinal guide trough 21 which extends from adjacent the end of the base to beneath axle 18. This trough opens upwardly and one of its flanges 22 converges toward the other, thus forming a guide passage which converges toward axle 18 for guiding front leg 10 of a derrick in prone position into engagement with said axle (Figure 5).

The lower ends of legs 10 and 12 have bearing shoes 23 and 24, which have downwardly facing semi-circular recesses for receiving the respective axles. The shoes may be removably joined to the axles by complementary bearing caps 25 and 26, respectively, which are bolted or otherwise attached to said shoes.

Top members 15 and 15a have aligned cradles 27 for supporting retractable axle 19 (Figures 6 and 7). Preferably these cradles carry semi-circular guide pieces 28 and axle 19 is slidably received within the guideways formed by said cradles and guide pieces. The top member and upright of the sub-structure preferably carry a foldable bracket 29 and brace 30 for supporting axle 19 when it is retracted from the guideways. The axle carries a slotted guide piece 31 which slidably engages bracket 29, so that when the axle is retracted it remains aligned with the guideway and is easily pushed into this guideway without a separate aligning step.

According to the novel method of derrick erection which utilizes the construction just described, the derrick is assembled on the ground or on short blocks starting with the top section, which is most remote from the sub-structure. This section and succeeding sections are positioned only approximately with respect to the sub-structure, the only necessity being that after the lower section is assembled shoes 23 on each front leg 10 are situated forwardly of the fulcrum means and somewhere within guide troughs 20, as shown in Figure 1. The derrick thus assembled is towed back until the recesses in the shoes 23 engage axles 18, as shown in Figure 2. During this towing step troughs 21 automatically guide the shoes to the proper position with respect to the axles. Bearing caps 25 are then applied to these shoes around axles 18.

Next the derrick is erected with front legs 10 turning about axles 18 as a fulcrum. Various apparatus are known by which derricks may be erected about fulcrum means in this fashion. In general such apparatus comprises a gin pole and a hitching line which connects the traveling block and the gin pole and either the sub-structure or the derrick frame. One suitable form of such appartus is shown, for example, in my co-pending application Serial No. 697,553, filed September 17, 1946, which issued as Patent No. 2,476,210, July 12, 1949. Hence a detailed disclosure of such apparatus is deemed unnecessary here.

Just before the center of gravity of the derrick crosses axle 18, shoes 24 on rear legs 12 engage axle 20, as shown in Figure 3. Bearing caps 26 are then applied to shoes 24 around axle 20 and bearing caps 25 are removed from shoes 23. The derrick is moved on up to its fully erected position with rear legs 12 turning about axles 20 as a fulcrum. When the derrick is fully erected, retractable axles 19 are shoved into the guideways formed by cradles 27 and guide pieces 28 and thus engage shoes 23 on front legs 12. Bearing caps 25 are then re-applied to these shoes, all as shown in Figure 4.

When the derrick is lowered, the reverse of the operations just described takes place.

From the foregoing description it is seen that I have provided a means and method for assembling and erecting portable derricks without lifting their lower ends above the sub-structure nor accurately positioning the derrick legs at the fulcrum means. These steps are difficult and time consuming and by their elimination I have facilitated erection and assembly of derricks. The structure and method involve the dual fulcrum system, and thus eliminate the need for snubbing the derrick into its fully erected position after the center of gravity crosses the first fulcrum, and for initially pulling the derrick away from its fully erected position when lowering.

While I have shown and described only a single embodiment of the invention, it is apparent that modifications may arise. Therefore, I do not wish to be limited to the disclosure set forth but only by the scope of the appended claims.

I claim:

1. In a portable derrick assembly which comprises a derrick movable between upright and prone positions, a pair of cooperating substructure frames, said derrick including a pair of front legs having arcuately recessed bearing shoes on their lower ends and a pair of rear legs likewise having arcuately recessed bearing shoes on their lower ends, each of said frames including a retractable front axle and a rear axle, which axles are spaced apart longitudinally and are received in the recesses in the bearing shoes of one front leg and one rear leg respectively when the derrick is in its upright position and thus support these legs, and a third axle which is below said front axle and is received in the recess of the front bearing shoe for supporting the front leg and allowing it to pivot during part of the movement of the derrick between said positions, and bearing caps cooperable with said bearing shoes for attaching the latter to said axles, the combination with each of said frames of a device for supporting the front leg when the derrick is in its prone position before the front leg engages said third axle comprising a trough fixed to said frame and extending longitudinally from a point immediately below said third axle to a point adjacent the front of the frame, said trough being upwardly open for receiving and supporting the front leg and guiding it into engagement with said third axle.

2. A combination as defined in claim 1 in which said trough has relatively converging side walls adapted to assist in guiding the front leg into engagement with the third axle.

3. A combination as defined in claim 1 in which the vertical distance between the upper face of

said trough and the center of said third axle is slightly greater than the distance between the front edge of the bearing shoe on the front leg and the center of its recess to provide clearance for applying one of said bearing caps.

4. A substructure frame for portable derricks comprising a relatively low base, a plurality of transversely spaced longitudinally extending top members, uprights and struts supporting said top members in spaced relation above said base, transverse front and rear axles carried by said uprights and spaced above said base and adapted to support one front leg and one rear leg respectively of an upright derrick, said front axle being retractable, a third axle carried by said uprights below said front axle at a relatively low height adjacent said base, and an upwardly open trough carried by said base and extending longitudinally at a relatively low height from a point

immediately below said third axle to a point adjacent the front of the frame and adapted to support the front leg of a prone derrick and guide it into engagement with said third axle.

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