This invention relates generally to well drilling equipment and is more particularly directed to improvements in the construction of derricks employed in the drilling of wells.

In most instances when wells are to be drilled, derricks are first constructed over the locations for the wells and these derricks include foundation members which are usually of concrete or other suitable material having the requisite strength and wear-resisting qualities. Upon the foundation, a four-sided pyramidal derrick structure is erected, usually from timbers or structural steel beams and angles. At the lower end of the derrick and over the foundation, a substructure is provided for supporting the floor and the mechanism used in drilling the well. The actual drilling mechanism may be of various types, each of which possesses considerable weight and imposes a great load on the substructure when the well casing is suspended therefrom.

Also, in the drilling operations, large quantities of drill pipe are employed, this being stored within the derrick, until used, by being placed on end on the derrick floor and extended upwardly into the derrick. After the well has been "brought in," part of the mechanism is removed and pumping apparatus, which is comparatively light in weight, is provided in place thereof. It is necessary at the time the substructure is built to make the same sufficiently strong to support the great weight of the drilling apparatus, but when the relatively lighter weight pumping mechanism is substituted for the other apparatus, the substructure has many times the strength needed.

It is, therefore, the primary object of the present invention to provide a substructure having a plurality of independent parts, all of which may be constructed with the requisite strength to perform their intended functions and certain of which may be removed and transferred to the location of new wells upon the completion of the drilling operation.

It is also an object of the invention to provide a derrick substructure formed from a plurality of structural beams and girders upon which the derrick floor and other well-drilling and elevating mechanisms may be supported, the portions of the substructure provided for the reception of the drilling apparatus and casing holding means being constructed from members having strength in proportion to the weight of the drilling apparatus and the loads incident to the operation of such apparatus, the latter portions of the substructure being relatively independent from the balance thereof in order that it may be readily removed at the time the drilling table is removed, that is, after the drilling operation has been completed.

A further object resides in providing novel reinforced pedestal means for carrying the relatively heavy girders which furnish the support for the rotary table or other drilling mechanism and the well casing, the girder supporting means providing for the transmission of vibratory forces, created during the drilling operation, directly to the foundation without requiring such forces to pass through the derrick legs and into the footings provided at the lower ends thereof.

Other objects will be apparent from the following description and the accompanying drawings in which a substructure embodying the features of the present invention has been illustrated in detail.

In the drawings:

Fig. 1 is a plan view of the substructure forming the present invention;

Fig. 2 is a vertical transverse sectional view taken on the plane indicated by the line II—II of Fig. 1;

Fig. 3 is a vertical longitudinal sectional view taken on the plane indicated by the line III—III of Fig. 1;

Fig. 4 is a side elevational view looking in the direction indicated by the arrow IV in Fig. 1;

Fig. 5 is a front elevational view of the substructure;

Fig. 6 is a plan view of the substructure after the casing support has been removed therefrom;

Fig. 7 is a front elevational view of a modified form of casing support;

Fig. 8 is a side elevational view of the form of casing support shown in Fig. 7.

Referring more particularly to the drawings, the numeral 1 designates the substructure in its entirety. This substructure is mounted on a concrete foundation including a plurality of blocks 2 provided on the ground adjacent the location for the well bore. The foundation also includes a plurality of relatively large piers 3 which are arranged at the corners of the substructure and are formed for the reception of the corner legs of the derrick. The substructure is substantially square when viewed in plan but, for purposes of description, the axis running vertically in Fig. 1 will be termed the length of the substructure; the transverse axis being termed the width.

Adjacent the center of the substructure, a plurality of relatively large concrete blocks 4 are
provided for the reception of casing supporting mechanism to be hereinafter described. The substructure generally includes a plurality of longitudinally extending beams \( b \) and a second group of beams \( 6 \) located beneath the beams \( 5 \) and serving as a support for the latter beams. The beams \( 6 \) are held in an elevated position above the foundation by a plurality of columns \( w \) which, in this instance, are formed from structural members having angular cross section. The lower ends of the columns are provided with foundation engaging plates \( 8 \) through which securing elements \( 9 \) pass to hold the plates and the columns rigidly in place on the foundation. Diagonal braces \( 19 \) extend between certain of the columns and serve to reinforce the columns and prevent lateral movement at the upper ends thereof.

Adjacent the central portion of the longitudinally extending beams \( 5 \), the transversely extending lower beams include relatively short sections \( 11 \) and \( 12 \) and terminate in spaced relation from the longitudinal axis of the substructure designated by the line \( X-X \) on Fig. 1. The beams \( 12 \) are composed of structural members having greater strength than the beam sections \( 11 \) and serve to strengthen the derrick floor in their location, the floor at this point receiving the drill pipe stored in the derrick prior to being used in the operation of drilling the well. A large quantity of drill pipe is generally used and therefore the sections \( 12 \) must be of great strength to withstand the concentrated load.

The edges of the substructure are provided with channel members \( 13 \) which terminate in spaced relation from the corners to receive, and be joined with the corner legs \( 14 \) of the derrick; said legs being secured at their lower ends to the beams \( 15 \) fastened in any suitable manner to the piers \( 3 \). Brace bars \( 16 \) extend from the footing members \( 15 \) to the channel members and serve to strengthen the same and prevent relative movement during the operation of the derrick. All members \( 17 \) are provided on the upper flanges of the beams \( 5 \) and receive the transversely extending planks \( 18 \) which constitute the floor of the derrick. The marginal beams \( 18 \), as shown at the bottom of Fig. 1, are parted or formed in two sections, thus providing an aisle-way or entrance in the front of the structure for access-allowing purposes. These marginal beams may be suitably supported by resting on columns and being connected with the corner legs \( 14 \) of the associated derrick.

The structure thus far described furnishes a sufficient support for the derrick floor and the mechanism used in the operation of the well with the exception of the drilling apparatus and the casing support.

To support the drilling apparatus and the well casing, the framework indicated generally by the numeral \( 19 \) has been provided adjacent the central portion of the substructure. This framework is mounted on the piers \( 4 \) and includes a plurality of pedestal members \( 20 \) having vertically extending columns \( 21 \) provided at their lower ends with laterally extending feet \( 22 \). The upper ends of the columns \( 21 \) receive and support lateral extending beams \( 23 \) which, in turn, receive longitudinally extending girder members \( 24 \). The end portions of the girder members \( 24 \) rest on the I-beams \( 23 \) and are suitably secured thereto in spaced relation. To maintain this relation, a plurality of columns \( 25 \) are secured to inclined plates \( 26 \) carried by the webs \( 27 \) of the girders adjacent the end portions.

To prevent lateral movement of the columns \( 24 \), due to the heavy loads imposed on the girders \( 24 \), wing-like webs \( 28 \) are connected with the inner sides of the columns \( 21 \) and the feet \( 22 \). The framework thus formed is further strengthened by securing plates \( 29 \) to the feet \( 22 \) and the lower flanges of the girders \( 24 \) and connecting angle members \( 30 \) at their ends with the plates \( 29 \). By this construction a table-like support is provided for the reception of the rotary drilling apparatus and the well casing which is held by the apparatus in the operation of lowering the casing into the well bore.

It will be noted from the various figures in the drawings that the framework \( 19 \) is substantially free from engagement with the remaining portions of the substructure and may be independently removed therefrom after the drilling operations have been completed. When the framework \( 19 \) is in position adjacent the well bore, the short and demountable longitudinally extending beam sections \( 25 \) are supported thereby as after the framework or casing support \( 19 \) has been removed, suitable columns may be provided to receive the drill pipe and furnish sufficient support for the derrick floor in the vicinity of the longitudinal axis of the substructure. It will be seen that when the beam sections \( 25 \) are disconnected from the frame structure, a substantially rectangular opening is provided therein which permits of ready removal of the units of the framework or casing support \( 19 \) by lifting the same through said opening.

The casing support is capable of considerable modification such as has been illustrated in Figs. 7 and 8 wherein the laterally extending feet have been omitted and the columns \( 21 \) are reinforced against lateral movement by X-bracing \( 31 \). In this form, the plates \( 23 \) and the brace \( 23 \) are also provided to increase the rigidity of the framework.

From the foregoing it will be apparent that a substructure has been provided which includes a plurality of independent frame units, certain of which are constructed of relatively heavy strong parts capable of withstanding severe strains during the drilling operation. These parts are removable from the balance of the substructure and may therefore be transferred to a new location, thus decreasing the initial cost of the apparatus necessary in drilling subsequent wells. Since the support for the rotary drilling apparatus is independent of the balance of the substructure, the loads and vibratory forces incident to the drilling operation will be transmitted directly to the foundation of the derrick without passing through the corner legs and the piers on which they are supported.

While the substructure may be modified in many ways, it is desired to reserve the right to all such modifications as may be embraced within the scope of the following claims:

What is claimed is:

1. A substructure for well derricks comprising a framework having a group of relatively spaced longitudinally extending beams, a second group of relatively spaced lateral extending beams which, in turn, receive longitudinally extending girder members. The end portions of said girder members rest on the lateral extending beams and are suitably secured thereto in spaced location. To maintain this relation, a plurality of columns are secured to inclined plates carried by the webs of the girders adjacent the end portions.
therein, the beams of the second group arranged adjacent to the ends of the beams of the first group extending continuously and without interruption from side to side of the framework, and well casing supporting means arranged below and in vertical registration with said opening, said means being substantially disconnected with the rest of the substructure and independently removable with respect thereto.

2. A substructure for well derricks comprising a rigid framework, the latter embodying an upper group of spaced longitudinally extending beams and a second group of spaced beams arranged immediately below the beams of the first group to support the latter and extending at right angles thereto, a foundation, spaced columns arising from said foundation for effecting the support of said beams in horizontal planes, the beams forming the central regions of said second group being of shorter length than the beams comprising the outer portions of said second group, and the beams of the upper group being spaced apart at the center of the framework, whereby to form an opening in the center of said framework, and an independently mounted removable well casing supporting means mounted on said foundation below said beams and in vertical registration with said opening.

3. A substructure for well derricks comprising a foundation, a rectangular horizontally disposed frame structure consisting of a plurality of rigidly united relatively spaced longitudinally and transversely extending beams, the transversely extending beams at the central region of said frame work being of shorter length than the transverse beams forming the outer portion of said frame work, and the longitudinally extending beams being spaced apart at the center of the frame work whereby to provide in the center of the frame work an elongated opening, spaced vertically disposed columns having their lower ends attached to said foundation and their upper ends joined with said frame work to effect the support of the latter in a horizontal plane above said foundation, and a well casing supporting frame structure mounted on said foundation independently of the aforesaid frame work below and in vertical registration with said opening, the well casing supporting frame structure being removable through said opening.

4. A substructure for well derricks comprising a foundation, a rectangular horizontally disposed frame structure consisting of a plurality of rigidly united relatively spaced longitudinally and transversely extending beams, the transversely extending beams at the central region of said frame work being of shorter length than the transverse beams forming the outer portion of said frame work, and the longitudinally extending beams being spaced apart at the center of the frame work whereby to provide in the center of the frame work an elongated opening, spaced vertically disposed columns having their lower ends attached to said foundation and their upper ends joined with said frame work to effect the support of the latter in a horizontal plane above said foundation, supplementary shorter length beams determinable joined to said outer portion of said frame work and having their innermost ends spaced apart at the region of said elongated opening, and a well casing supporting frame structure mounted on said foundation independently of the aforesaid frame work below and in vertical registration with said opening, the well casing supporting frame structure being removable through said opening, when said supplemental beams are removed.

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