TELESCOPING SUBSTRUCTURE FOR DRILLING RIGS

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4 Sheets-Sheet 2

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Fig. 5.

Fig. 6.

Fig. 7.

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This invention relates to improvements in substructures for rotary drilling rigs and more particularly to substructures which may be elevated to various heights by the use of the hoisting equipment of the rotary drilling rig. Various substructures have been proposed heretofore, both substructures of a fixed height and substructures of variable height, but substructures which can be elevated, for the most part, require complicated mechanism for the elevation thereof, such as hydraulic jacks, pumps, and the like.

The present device enables the hoisting equipment of the drilling rig, such as the hoisting drum, drilling rig mast, and traveling block and cable, to be utilized to raise and lower the substructure, as well as to perform other functions of assembly and disassembly.

The present substructure is so constructed that it can be raised or lowered to any desired position, within a matter of minutes, by the hoisting equipment of the drilling rig, and secured in the desired elevated position by passing pins through the upper support members so the pins will rest on the top of the lower support members, to sustain the weight placed on the substructure.

The present substructure is so constructed that it can be seated on the terrain and secured to a base structure on which the drilling rig is positioned so that the base structure on which the drilling rig is mounted will maintain the substructure in rigid relation with respect to the terrain.

An object of this invention is to provide a substructure which may be raised to the desired elevation by the hoisting equipment of a rotary drilling rig.

Another object of this invention is to provide a substructure of a size which, when in collapsed condition and with the outstanding platforms folded down and with the hand rails removed, may be loaded onto a vehicle, moved over the terrain or over highways with little difficulty, and be within the legal width and height limits of most States.

Another object of the invention is to provide a substructure which may be removed from over a well, when the well has been completed, and which well has upwardly extending pipes or a "Christmas tree" extending upward into the substructure in such manner that the substructure could not be ordinarily removed therefrom without the substructure having to be dismantled.

Still another object of the invention is to provide a telescoping substructure for rotary well drilling rigs which is of tubular construction and wherein the larger tubes telescope downward over smaller tubes, thereby preventing mud and foreign particles from passing downward between the tubular members.

Still another object of the invention is to provide a telescoping substructure for use with rotary well drilling rigs wherein side sections and cross members may be removed to enable the substructure to be removed from the well either laterally or longitudinally.

A final object of the invention is to provide a substructure, the height of which is adjustable, which is easy to erect and to dismantle, which is sturdy in construction, and relatively low in the cost of manufacture.

With these objects in mind and others which will become manifest as the description proceeds, reference is to be had to the accompanying drawings in which like reference characters designate like parts in the several views thereof, in which:

Fig. 1 is a perspective view of the telescoping substructure for rotary drilling rigs in upwardly extended position, showing the outwardly extending platforms thereof supported in position by braces, so as to give the maximum working area, and showing a regular base secured thereto with parts broken away and with parts projected therefrom.

Fig. 2 is a view similar to Fig. 1 taken from the same side, but showing another corner thereof from that shown in Fig. 1;

Fig. 3 is a side elevational view of the telescoping substructure shown in raised position, but with the outwardly extending platforms removed therefrom;

Fig. 4 is a top plan view of the telescoping substructure, as shown in Fig. 3, and showing portions thereof broken away and portions thereof being shown in section to bring out the details of construction;

Fig. 5 is an enlarged perspective view of the substructure in telescoped or collapsed position, showing portions of the platform hinged down in side-by-side relation with the substructure supports, but with the hand rails removed from the outwardly extending platform of the substructure;

Fig. 6 is a fragmentary elevational view of a portion of the substructure showing outwardly extending braces connected thereto;

Fig. 7 is a fragmentary elevational view of a portion of the base, showing a portion of the derrick mounted thereon with a brace interposed between the derrick and the base;

Fig. 8 is an enlarged elevational view of a support pin;

Fig. 9 is an elevational, exploded view of a portion of the substructure showing the manner of attaching hinged members thereto;

Fig. 10 is a greatly enlarged elevational view of the joint of the tubular telescoping members, with parts broken away, and parts shown in section to bring out the details of construction; and

Fig. 11 is a greatly enlarged elevational view of a portion of one of the cross members, showing portions thereof in section to show the construction of the joint for joining the removable cross members.

With more detailed reference to the drawings, the numeral 1 designates generally the base of a drilling rig which is secured to a transverse outrigger member 2, as will best be seen in Fig. 1. A telescoping substructure is designated generally by the numeral 4, which substructure has pairs of spaced apart sills 6 on the ends of each pair of sills, adjacent the end of the base, is an upstanding bracket 8, which brackets 8 are each apertured to complementarily receive a bolt therethrough and through outrigger member 2 to attachably secure the outrigger member thereto and to the adjacent end of the base 1 of the drilling rig.

The sills 6 have spaced apart cross members 10 therebetween which cross members 10 are movably secured to stub members 12 on the respective sills 6 by pin and lug connections 14 and 16, respectively, which pins 14 pass through apertures in lugs 16 and through holes in stub members 12, as will best be seen in Fig. 11, which arrangement enables any cross member to be readily removed and replaced while moving the substructure onto or of about a location, thereby enabling the substructure to be normally held in braced relation by cross members 10, yet these may be readily removed to enable the passage of the substructure from over a well which has pipes or valves extending upward into the substructure.

Each of the sills 6 has removable sections 18 fitted therein and secured in place by pins 20 which pass through lugs 22 and 24 on the respective sills 6 and sections 18, as will best be seen in Fig. 4, so as to enable the substructure to be removed transversely from around an up-
standing pipe, Christmas tree or the like which extends from the top of a completed well, or conversely to the substructure to be moved therewith, should it be desired to do so. Each of the sills 6 has upstanding tubular members 28 secured to the upper face thereof which extends upwardly, and each has a support cap 30, FIG. 10, on the upper end thereof, the purpose of which will be brought out more fully hereinafter. A tubular member 32, of larger diameter, is telescoped downward over each tubular member 28 and each has a guide ring 34 fitted therein at the lower end thereof to be in snug sliding relation with the respective upstanding tubular member 28. A bolt 36 passes through each outer tubular member 32 and into the respective rings 34 so as to secure the respective rings in place, each which ring is of sufficient length that, when abutted with the lower shoulder 38 of support cap 30, will limit the upward movement of the outer tubular member 32, a sufficient distance below the top of tubular member 28, to prevent the outer tubular member 32 from being lifted to such height that it could protrude through the aperture 44. A threaded bolt 40 passes through each upstanding tubular member 28 and into support cap 30 thereof to prevent upward movement of support cap 30 when ring 34 abuts with the lower face 38 of the support cap. A dust and mud seal 42 is secured on the lower end of each outer tubular member 32 and has a downwardly extending scraping edge so as to wipe mud and dust from the outer diameter of the respective upstanding tubular members 28 when the outer tubular member 32 is being lowered downwardly therewith.

Each of the outer tubular members 32 has apertures 44, 46, and 48 formed transversely therethrough at spaced intervals along the length thereof for passage of support pins 50 therethrough, as will best be seen in FIGS. 2 and 3. The support cap 30 has an elongated groove 52 formed in the upper surface thereof, across the entire face, so as to form a seat for pin 50 when the pin 50 is passed through one of the apertures 44, 46, or 48 of the respective outer tubular members 32. By having the apertures arranged in the manner described, the respective pins 50 may be placed in the desired apertures before lowering the upper portion of the platform, generally designated by the numeral 54, to the desired working level.

The working platform 54 is mounted on the upper end of outer tubular members 32 and is braced with respect thereto by braces 26. Further braces 58, 60, and 62 are positioned intermediate the outer tubular members to form a rigid structure, which platform and rigid structure is raised by lines 64 attached thereto, and to the hoist line of the hoisting equipment of the drilling rig. The platform 54 has outwardly extending portions 66 attachably connected thereto by pin connections 68 engaging apertures 70 secured therewith. Furthermore, these outwardly extending portions 66 are hingely mounted on respective bars 72 secured on the inner side of the outwardly extending portions 66 so they may be moved from the position shown in FIGS. 1 and 2 to the position shown in FIG. 5, or the outwardly extending portion may be readily removed by removal of the pins 68 from sockets 70, as will be evident in FIGS. 3 and 9. The upper portion of the substructure, which is moveable with respect to inner tubular members 28, has a transverse member 74 on which a shaft 76, having a sprocket thereon, is mounted in journaled relation so as to enable power from a prime mover to be transferred through a roller chain from a lower position to a rotary table mounted on sills 78 on platform 54.

The substructure normally extends to approximately sixteen feet in height, which normally cannot be legally transported over highways, as the floor of the trailer is usually approximately four feet from the ground level. The present substructure, when in telescoped relation, is less than nine feet in height, and since most States have a maximum height limit law of thirteen feet, six inches, the unit may be legally transported over highways without special permit.

To move the substructure, removable braces 10 may be removed from between sills 6, which will enable the substructure to be moved either way longitudinally as a "Christmas tree," upwardly extending pipes, blow-out preventers or the like, or, by removing a removable section 18 from either side of the structure, it is possible to move the substructure transversely from around such elements.

Operation

Normally for the base 1 to support the drilling rig, transverse brace or outrigger 2 and sills 6 of substructure 4 are positioned together as shown in FIG. 1 and secured together by bolts or the like, and with the well drilling rig, such as a mobile unit with a mast mounted thereon, is moved up a ramp 80 until the wheels rest on upper face 82 of base 1, and with the mast raised and properly secured in place by bracing 84, as shown in FIG. 7, and with the substructure in position as shown in FIG. 1, with outwardly extending braces 86 attached thereto as shown in FIG. 6, further braces 88 are connected between the elevated platform portion 54 of the substructure and the outwardly extending brace 86 so as to form a rigid unit. The platform 54 is then ready to be raised by swing lines 64, whereupon the traveling block (not shown) is attached to the swing lines 64, whereby the platform 54, including the outer tubular members 32, is raised to the desired height, whereupon, pins 50 are fitted into the correct apertures 44, 46, or 48. The traveling block then lower the hoist lines 64 until the support pins 50 support the platform 54 at the desired height, whereupon the outwardly extending portions 66 are raised from the position as shown in FIG. 5 to the position as shown in FIGS. 1 and 2, and if desired to 89 is positioned thereunder so that the braces will engage sockets 90 to support the outwardly extending portions 66 in an outwardly extending position. The hand rail posts 92 are then positioned in sockets 94 in platform 65 to support the hand rails 96 therearound, whereupon the substructure is in a position ready for use.

In order to lower the platform 54 from the position as shown in FIG. 2 to the position as shown in FIG. 5, the braces 26, which extend between the sills 6 and the lower portion of the outer tubular members 32, are removed by removing the braces and the outwardly extending braces 86, by removing the apertured ends thereof and through the apertured lugs on the lower ends of the respective tubular members. The swing lines 64 are then attached to the longitudinal sills 79 of platform 54, and the line of the hoisting equipment is attached to the swing lines 64 so as to raise the platform 54 and the further tubular members 32 until the weight is relieved from pins 50, whereupon, the platform 54 and tubular members 32 are lowered until the tubular members 32 are in their lowestmost position. The hand rail posts 92 are positioned in sockets 94, and with the hand rails 96 attached to the posts, the removal of the hand rails in units may be accomplished by lifting the posts 92 upward from sockets 94, then, by hoisting the respective outer longitudinal edges of outwardly extending portions 66 upwardly to a unit position, the outwardly extending portions 66 to be lowered, one at a time, from the position as shown in FIGS. 1 and 2 to that shown in FIG. 5, whereupon, the unit may be readily loaded onto a semi-trailer for transportation over the terrain.

If it is desired to further extend the respective outwardly extending portions 66 may be raised at their respective inner sides so as to move pins 68 upward out of sockets 70, which will enable each of the outwardly extending portions 66 to be readily removed, substantially as shown in FIG. 3.

Having thus clearly shown and described this inven-
tion, what is claimed as new and desired to be secured by Letters Patent is:

1. A substructure for drilling rigs comprising; a pair of sills forming a base, members mounted on and secured to said sills in spaced apart relation longitudinally thereof and extending upward therefrom, further members telescoped over said respective upstanding members, said further members having a platform secured to the upper ends thereof, bracing secured intermediate said further members and said platform to hold said platform in rigid relation with respect thereto, abutment means on said respective further members to engage said upstanding members to support said platform a selected spaced distance above said sills, hoisting means to raise said platform, each of said upstanding members having an abutment mounted thereon, on the upper end thereof, which abutment is larger in diameter than said upstanding member, means securing said respective abutments against longitudinal movement with respect to said respective upstanding members, which abutments are of a size to fit in sliding relation within the inside of said respective further members, a sleeve fitted within the inner diameter of each further member and being secured thereto near the lower end thereof, each said sleeve being engageable with said respective abutment secured on the respective upper ends of said upstanding members when said further members are in one position.

2. A substructure for drilling rigs comprising; a pair of sills forming a base, tubular members mounted on and secured to said sills in spaced apart, parallel relation longitudinally thereof and upstanding therefrom, further tubular members telescoped down over said respective upstanding members, said further tubular members having a platform secured to the upper ends thereof, bracing secured intermediate said further tubular members and said platform to hold said platform in rigid relation with respect thereto, each of said first mentioned tubular members being closed at its opposite ends and with its tubular wall free of openings to prevent the passage of moisture and foreign matter through said first mentioned members and between said first mentioned members and their respective associated further tubular members, seal means secured to the lower ends of the respective said further tubular members and surrounding said first mentioned upstanding tubular members to exclude moisture and foreign matter from entering between said members, abutment means on said respective further members to engage said upstanding members to support said platform a selected spaced distance above said sills, and hoisting means for raising said platform.

References Cited in the file of this patent

UNITED STATES PATENTS
942,347 Pichler ---------------- Dec. 7, 1909
2,689,025 Yates ---------------- Sept. 14, 1954
2,698,673 Solomon ------------- Jan. 4, 1955
3,017,968 McMahon -------------- Jan. 23, 1962

FOREIGN PATENTS
467,273 France ----------------- Mar. 26, 1914

within the lower end of each said further tubular member to abut with each said support cap when said further tubular members are moved to the uppermost position to retain said upstanding tubular members and said further tubular members in engaged relation, and hoisting means to raise said platform.

3. A substructure for drilling rigs, as defined in claim 2; wherein said support caps each has a transverse groove formed in the top thereof to complementally receive said pins which extend transversely through said transversely aligned apertures.

4. A substructure for drilling rigs comprising; a pair of sills forming a base, tubular members mounted on and secured to said sills in spaced apart, parallel relation longitudinally thereof and upstanding therefrom, further tubular members telescoped down over said respective upstanding members, said further tubular members having a platform secured to the upper ends thereof, bracing secured intermediate said further tubular members and said platform to hold said platform in rigid relation with respect thereto, each of said first mentioned tubular members being closed at its opposite ends and with its tubular wall free of openings to prevent the passage of moisture and foreign matter through said first mentioned members and between said first mentioned members and their respective associated further tubular members, seal means secured to the lower ends of the respective said further tubular members and surrounding said first mentioned upstanding tubular members to exclude moisture and foreign matter from entering between said members, abutment means on said respective further members to engage said upstanding members to support said platform a selected spaced distance above said sills, and hoisting means for raising said platform.