April 7, 1970 E. A. CAMPBELL ET AL 3,504,749

OIL WELL DRILLING SUBSTRUCTURE AND POWER PLANT

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Fig. 1

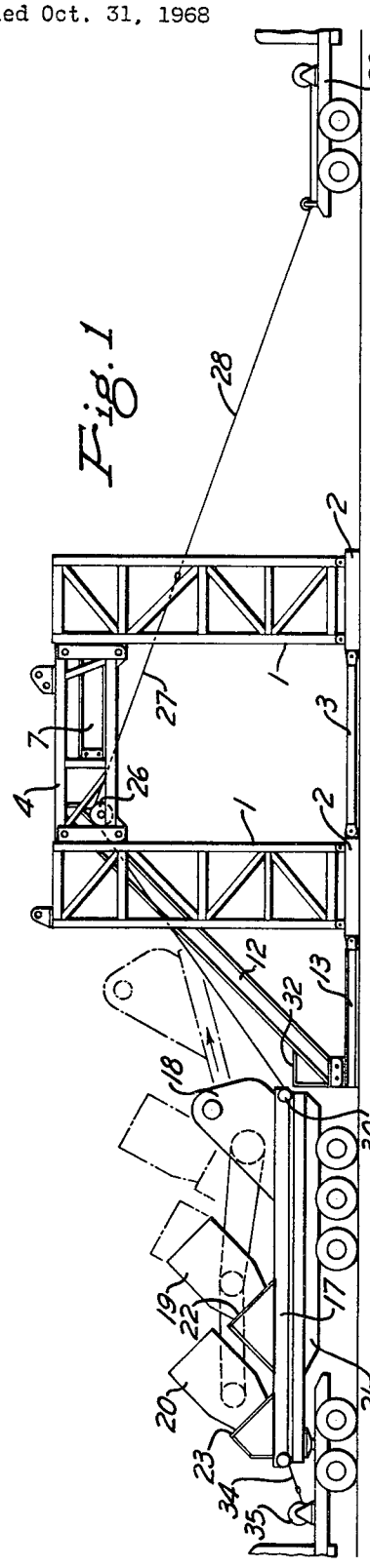

Fig. 2

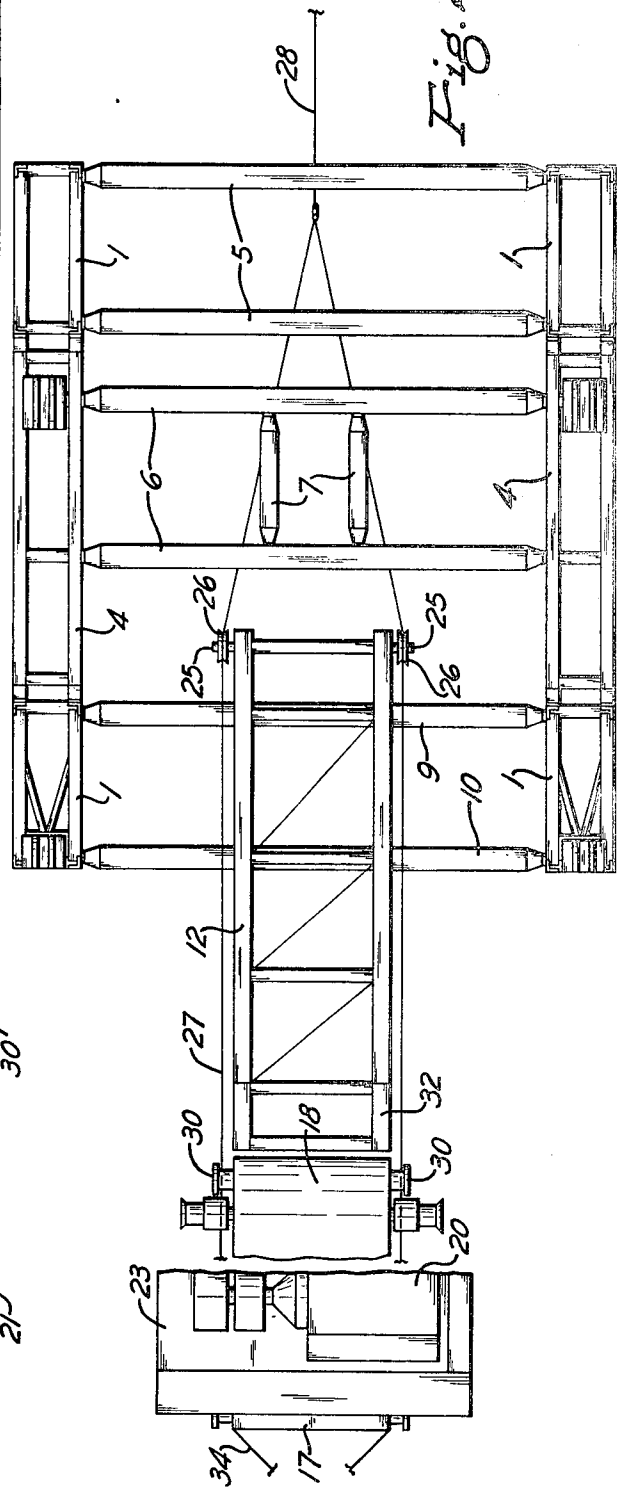

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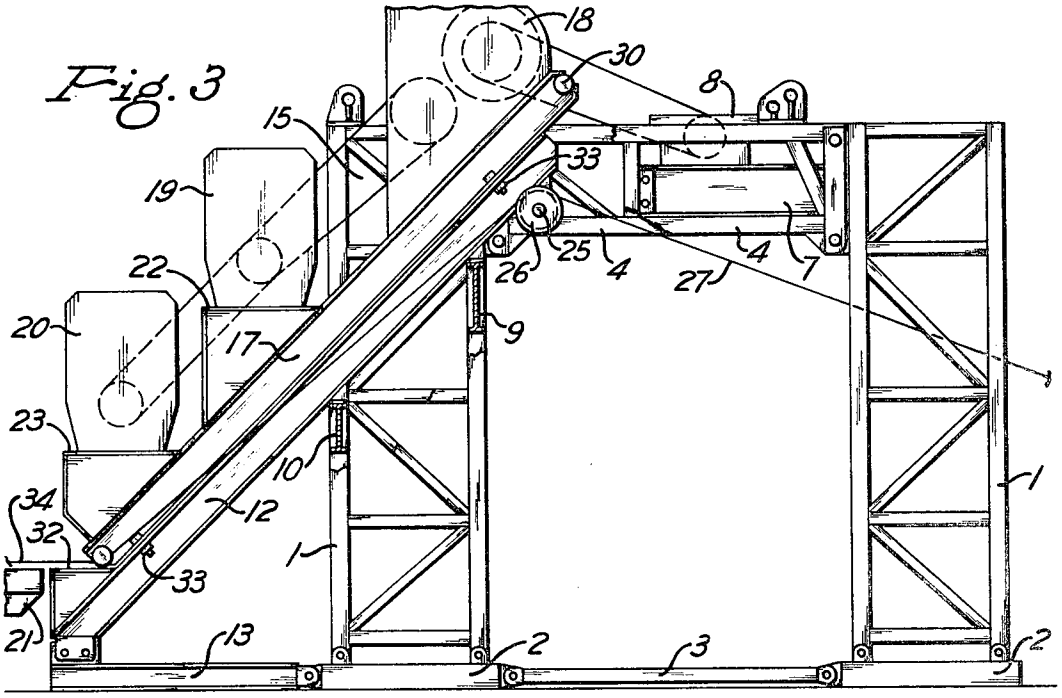
Fig. 3



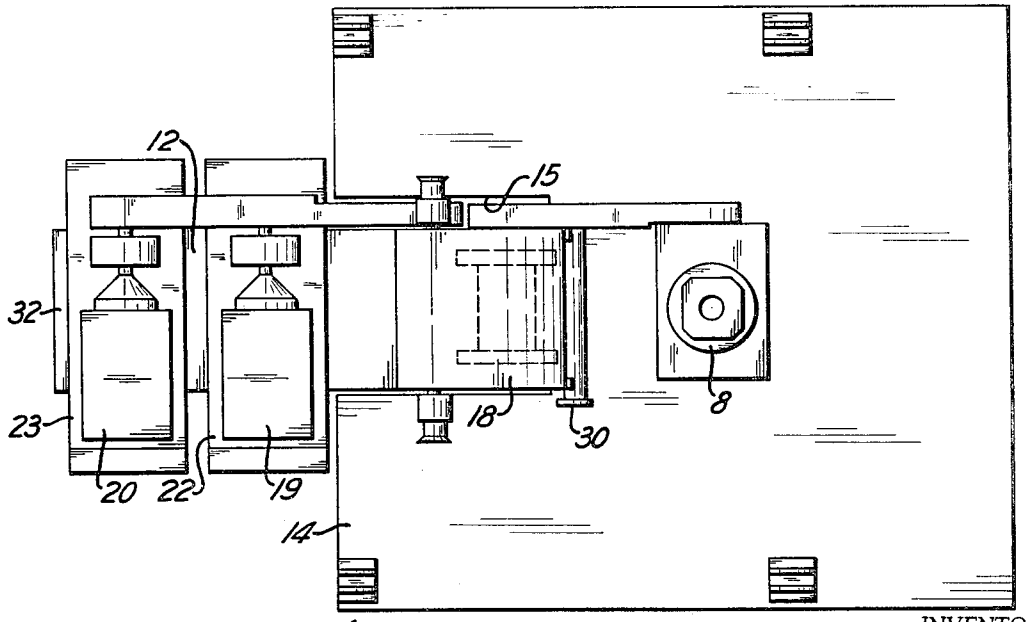


Fig. 4

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OIL WELL DRILLING SUBSTRUCTURE AND POWER PLANT

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U.S. Cl. 173—151 11 Claims

ABSTRACT OF THE DISCLOSURE

A forwardly inclined drawworks is mounted on the front end of a horizontal skid frame that also supports one or more engines in a forwardly inclined position. The frame is skidded up a ramp supported by the back of a tall substructure until the frame is flat against the ramp with the drawworks upright at the top of the substructure and the engines upright below and behind the drawworks. The inclined frame then is detachably connected to the ramp.

When tall substructures are used in conjunction with drilling oil wells, the drawworks and engines sometimes are supported at a much lower level, such as at truck bed height, so no provision has to be made for raising them. That simplifies things in one way, but it has the disadvantage that the drawworks is not on the working floor on top of the substructure close to the rotary table. On the other hand, to lift the drawworks and engines up to the top of the substructure requires cranes or long ramps and a considerable amount of mechanical power. An intermediate system has involved lifting the drawworks to the top of the substructure, but mounting the engines behind the substructure at one or more levels below the drawworks. This makes it unnecessary to lift the engines as high as the drawworks, but it still requires the different pieces of equipment to be raised one at a time independently of one another.

It is among the objects of this invention to provide oil well drilling equipment, in which moving power units such as drawworks and engines into and out of operative position on the substructure is facilitated, in which all of those elements are moved as a unit, in which with a given substructure the drawworks and engines do not have to be raised as far from trailer bed height as heretofore, and in which the size and cost of the substructure can be reduced.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a side view showing the power plant about to be skidded into operative position;

FIG. 2 is an enlarged plan view;

FIG. 3 is an enlarged side view, with parts of the substructure broken away; and

FIG. 4 is a plan view of the structure shown in FIG. 3.

Referring to the drawings, a tall substructure is constructed from structural steel members. For example, four skeleton corner towers or legs **1** can be mounted on base mats **2** connected at their ends by tie members **3**. Extending across the space between the upper ends of the legs at each side of the substructure are side frames **4** rigidly secured to the legs. As shown in FIG. 2, the front legs are connected at the top by a pair of spreaders **5**. The side frames likewise are connected by spreaders **6**, the lower central portions of which are connected by short beams **7** that support a rotary table **8** shown in FIGS. 3 and 4. The back legs of the substructure are connected by a pair of spreaders **9** and **10** at different levels. As shown in FIG. 3, the top spreader **9** is located at about the level of the bottom of the side frames, while the other spreader **10** is considerably lower.

In accordance with this invention, a ramp **12** at the back of the substructure leans against the two back spreaders **9** and **10**, to which it is securely fastened in any suitable manner. The lower end of the ramp is secured to the rear ends of tie members **13** that are connected to the rear base mat **2**. The angle of inclination of the ramp is not critical; the ramp shown being inclined at about a 45° angle. If the angle were much less, the ramp would have to extend farther than desirable behind the substructure. If the ramp were steeper, it would become more difficult to skid up its surface a power plant that will be described presently. The top of the substructure is formed by a floor **14**, shown only in FIG. 4, that has a bay **15** in it above the ramp, so that the back of the substructure is provided with a recess that opens upwardly and rearwardly.

The purpose of the ramp is to permit a power plant to be moved into operative position relative to the substructure. In accordance with this invention the power plant is formed from a skid frame **17**, on which power units are mounted. The power units generally will consist of a drawworks **18** and one or more engines **19** and **20** for operating it. The skid frame is transported to the substructure on a truck trailer **21** in substantially horizontal position, as shown in FIG. 1. The trailer is backed up to the foot of the ramp, so the end of the skid frame adjacent the ramp is the front end of the frame. The drawworks is rigidly mounted on the front end portion of the horizontal frame, but the drawworks is not upright. It is inclined upwardly and forwardly at substantially the same angle to the vertical as the ramp makes with the horizontal. Behind the drawworks-supporting area of the frame there is a step that likewise is securely attached to the frame. This step has a tread or supporting surface **22** that is inclined upwardly from the frame and rearwardly at substantially the same angle as the ramp angle, but in the opposite direction. Rigidly mounted on the supporting surface of the step is engine **19** for driving the drawworks. The engine is inclined forward at substantially the same angle as the drawworks. Behind the step there is another similar step **23** supporting engine **20** in inclined position. There can be as many steps and engines as desired.

The power plant is not intended to be raised bodily to the top of the tall substructure, which would be a difficult task, but to be skidded up the ramp until it can rest flat against the ramp. To effect the skidding, a stub shaft **25** projects laterally from the bottom of the upper end of the ramp, and a sheave **26** is journalled on the outer end of each shaft. The opposite ends of a cable that form a sling **27** are connected to the opposite sides of the skid frame. The sling extends forward over the sheaves and is connected to a line **28** that extends out of the front of the substructure and down to a winch truck **29**. Since it is desired to have the skid frame come to rest flat against the ramp, with the upper end of the frame at the top of the substructure, the sling is fastened to the frame behind its front end preferably near its rear end. Then, in order for the sling to help lift the front end of the frame as it is moved forward, the front corners of the frame are provided with laterally projecting members **30**, under which the sling extends in engagement therewith.

The lower portion of the ramp may be provided with a shelf **32** at trailer bed height for receiving the lower end of the skid frame as it leaves the trailer. The shelf also serves to support the lower end of the frame and position the frame correctly longitudinally of the ramp. When the skid frame has been pulled up the ramp far enough for it to rest flat against the ramp, with the lower end of the frame seated on the shelf as shown in FIG. 3, the frame is clamped to the ramp such as by bolts **33**. The drawworks then is in upright operating position and projects up above the working floor **14**, and the steps **22** and **23** on the skid frame, due to its slope, become horizontal

so that the engines also are substantially vertical or upright.

As the skid frame is pulled up the ramp by the winch truck, it is desirable to exert some back pull on the frame to help keep it aligned with the ramp. This can be done by looping the end of a line **34** around the rear end of the skid frame and paying the line out from a winch **35** on the trailer truck as the frame is pulled forward. This same line can be used for transferring the power plant from the ramp back to the trailer when the plant is to be moved to another location.

With this invention, the drawworks and its engines can be permanently mounted on the skid frame, and the power plant thus formed can be skidded into and out of operative position in the substructure, wherein the drawworks is disposed at the same general level as the rotary table and close behind it. Nevertheless, it is not necessary to raise the engines to the top of the substructure. In fact, the lower engine is hardly raised at all, but is merely tilted upright. It is much simpler and easier to simply skid the power plant part way up the ramp and leave it there than to lift it to the top of the substructure or to lift the drawworks and engines individually to their supports. Furhermore, the top of the substructure does not have to be large enough to accommodate the engines, thereby simplifying the construction of the substructure, reducing its cost and making it easier to assemble, disassemble and move.

We claim:

1. Oil well drilling equipment comprising a tall substructure having front and rear ends, a ramp rigidly connected to the substructure and extending rearwardly and downwardly from the upper part of it, an inclined skid frame seated on the ramp, means detachably holding the skid frame on the ramp, the upper portion of the frame having an inclined drawworks-supporting area, and at least one substantially horizontal step rigidly mounted on the skid frame below said area for supporting an upright engine.

2. Oil well drilling equipment according to claim **1**, in which the rear portion of the substructure is provided with a rearwardly and upwardly opening recess, and the upper portions of the ramp and skid frame are disposed in said recess.

3. Oil well drilling equipment according to claim **1**, in which the rear portion of the substructure is provided with a rearwardly and upwardly opening recess, and the upper portion of the skid frame is disposed in said recess with its upper end at the top of the substructure.

4. Oil well drilling equipment according to claim **1**, including sheaves mounted in the substructure adjacent the upper end of the ramp for receiving lines by which said skid frame was pulled into position on the ramp.

5. Oil well drilling equipment according to claim **1**, including sheaves mounted in the substructure adjacent the upper end of the ramp for receiving lines by which said skid frame was pulled into position on the ramp, means at the sides of the skid frame below its upper end for connecting said lines to it, and laterally projecting members at the upper end of the frame adapted to rest on the lines while the frame is being pulled up the ramp.

6. Oil well drilling equipment according to claim **1**, including a support for the lower end of the skid frame extending rearwardly from the ramp above its lower end.

7. Oil well drilling equipment according to claim **1**, including an upright engine mounted on said step, and an upright drawworks mounted on said inclined supporting area of the skid frame.

8. Oil well drilling equipment comprising a tall substructure having front and rear ends, a ramp inclined rearwardly and downwardly from the upper part of the substructure, means rigidly connecting the ramp with the substructure, a substantially horizontal skid frame disposed behind the ramp and extending lengthwise toward it, a forwardly and upwardly inclined drawworks rigidly mounted on the front portion of the frame, a step rigidly mounted on the frame behind the drawworks and having a supporting surface inclined upwardly from the frame and rearwardly at substantially the same inclination as the ramp, a forwardly and upwardly inclined engine rigidly mounted on said step surface, means for skidding the frame up the ramp into inclined position against the ramp, whereby said engine and drawworks will be upright, and means for holding the frame on the ramp.

9. Oil well drilling equipment according to claim **8**, in which the rear portion of the substructure is provided with a rearwardly and upwardly opening recess containing the upper portion of the ramp, and said skidding means include sheaves mounted in the substructure adjacent the upper end of the ramp, and lines attached to said skid frame and passing forward over the sheaves, the front ends of the lines being adapted to be pulled to draw the skid frame up the ramp into said inclined position.

10. A power plant for attachment to the tall substructure of oil well drilling equipment, comprising a substantially horizontal skid frame having front and rear ends, and longitudinally spaced power units mounted on the frame, said frame being adapted to be tilted lengthwise into an inclined operating position with its front end higher than its rear end, and said power units being so mounted on the frame that they are in upright operating position when the frame is in said inclined operating position.

11. A power plant according to claim **10**, in which said power units include a drawworks rigidly mounted on the front portion of the frame and inclined at substantially the same angle to the vertical that the frame makes with the horizontal when the frame is in said inclined position, and an engine behind the drawworks, said power plant including a step rigidly mounted on the frame behind the drawworks and having a supporting surface inclined upwardly and rearwardly at substantially the same inclination as the frame when tilted, the inclined engine being rigidly mounted on said step surface, and said step surface being substantially horizontal when the frame is in said inclined operating position.

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