Feb. 1, 1955 H. J. WOOLSLAYER ET AL 2,701,039

OIL WELL SUBSTRUCTURE FOR ROTARY DRILLING

Filed July 11, 1950 4 Sheets-Sheet 1

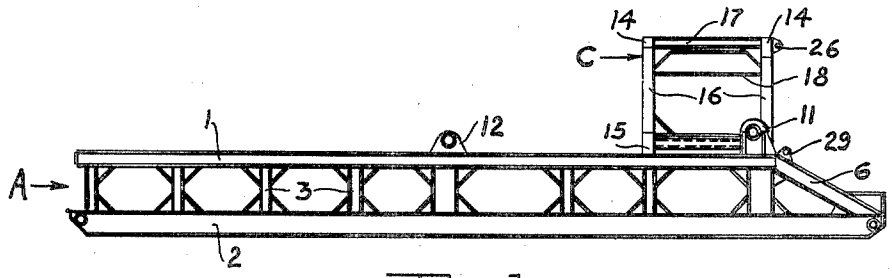


Fig. 1.

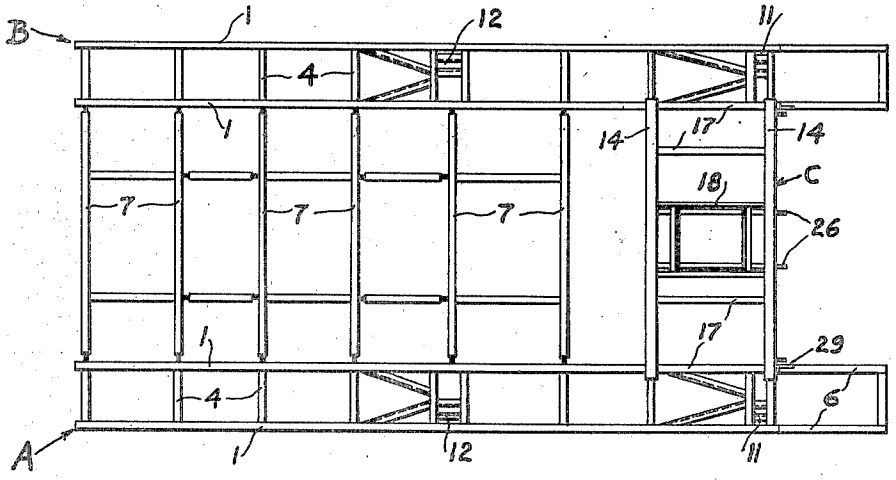


Fig. 2.

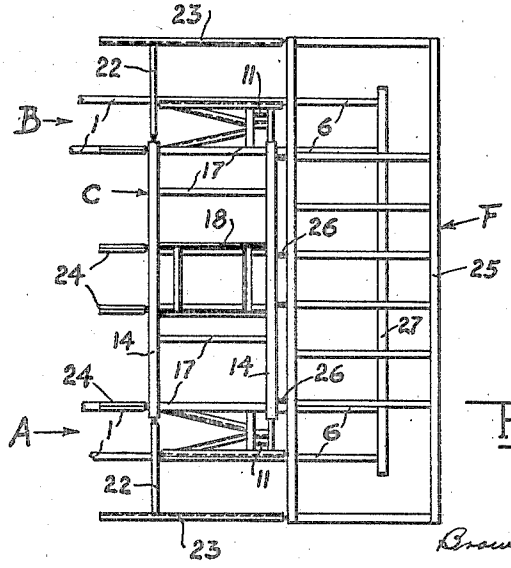


Fig. 5.

INVENTORS.
Homer J. Woolslayer
Cecil Jenkins
BY Charles D. Siddings
Brown, Critchlow, Flick & Peckham
their Attorneys

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OIL WELL SUBSTRUCTURE FOR ROTARY DRILLING

Filed July 11, 1950 4 Sheets-Sheet 2

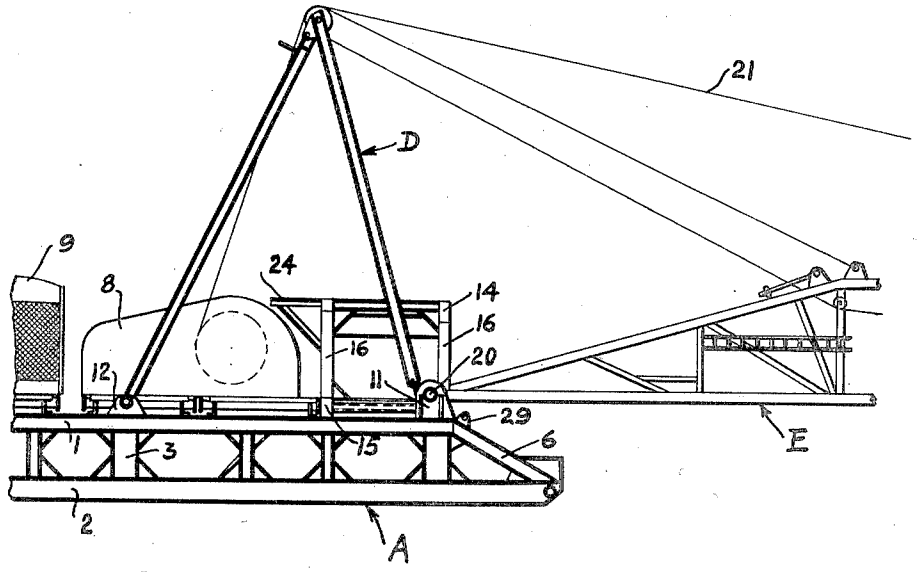


Fig. 3.

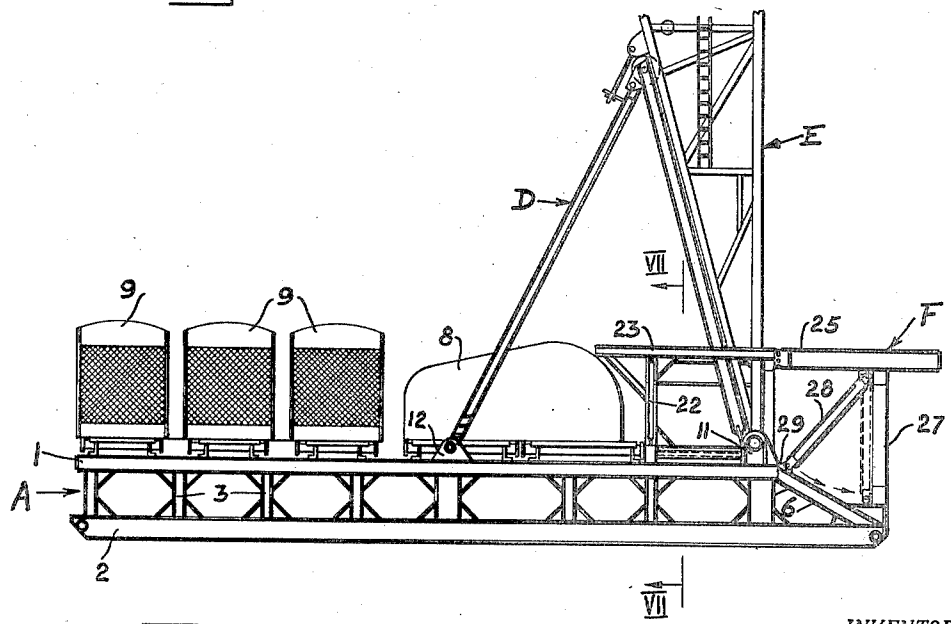


Fig. 4.

INVENTORS.
Homer J. Woolslayer
Cecil Jenkins
Charles D. Stevens
BY
Brown, Critchlow, Flick & Peckham
their Attorneys

Feb. 1, 1955 H. J. WOOLSLAYER ET AL 2,701,039

OIL WELL SUBSTRUCTURE FOR ROTARY DRILLING

Filed July 11, 1950 4 Sheets-Sheet 3

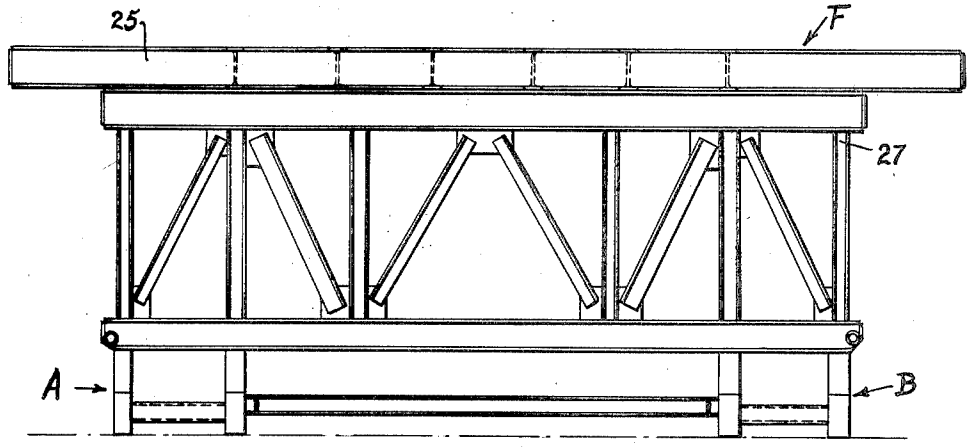


Fig. 6.

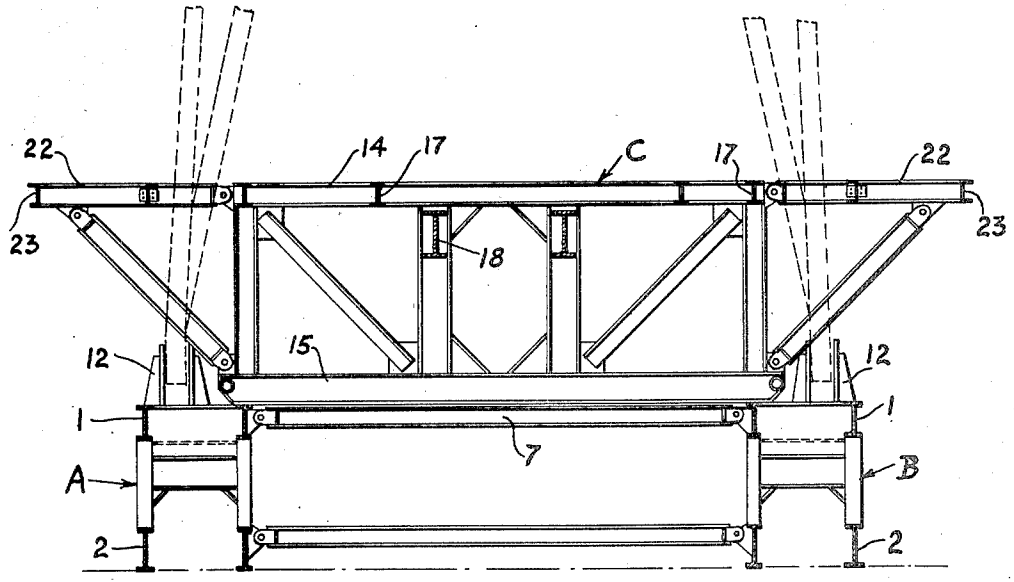


Fig. 7.

INVENTORS.
Homer J. Woolslayer
Cecil Jenkins
BY Charles D. Iddings
Brown, Critchlow, Fisk & Peckham
their Attorneys

Feb. 1, 1955 H. J. WOOLSLAYER ET AL 2,701,039

OIL WELL SUBSTRUCTURE FOR ROTARY DRILLING

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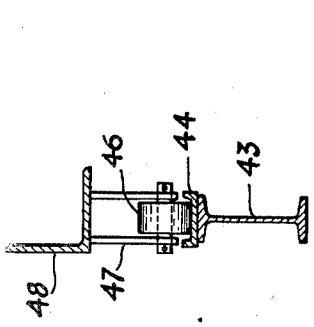


Fig. 9.

Fig. 8.

INVENTORS.
Homer J. Woolslayer
Cecil Jenkins
BY Charles D. Siddings
Brown, Critchlow, Flick & Peckham
their Attorneys

United States Patent Office 2,701,039 Patented Feb. 1, 1955

2,701,039

OIL WELL SUBSTRUCTURE FOR ROTARY DRILLING

Homer J. Woolslayer, Cecil Jenkins, and Charles D. Iddings, Tulsa, Okla., assignors to Lee C. Moore Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Application July 11, 1950, Serial No. 173,088

2 Claims. (Cl. 189—11)

This invention relates to rotary drilling structures for oil wells, and more particularly to the substructures that support the drilling derricks.

In the practice of drilling oil wells, certain equipment commonly is used to enable the drilling crews to close off the casing in the event that high pressure gas or liquid zones are encountered. This pressure control equipment is located at the upper end of the casing, and the rotary drill pipe operates through it. For this reason, the rotary table and the derrick floor, which must support the drill pipe from above the pressure control equipment, often are as much as ten or twelve feet above the ground level. This proves to be inconvenient, because of the heavy machinery, such as engines and drawworks, that has to be moved onto and removed from the derrick floor. Therefore, it has become common practice to provide substructures with two different levels and to locate the engines on a level lower than the drawworks. More recently, the drawworks also is sometimes located on a lower level than the rotary table and the working area around it. Due to the frequency with which drilling equipment must be taken apart and reassembled, it is important that every consideration be given to facilitating handling and transportation of the equipment. It is desirable, therefore, to limit the height of that part of the substructure where engines and drawworks are located to truck bed height, which is about five feet. When the part where the rotary table and working area are located is considerably higher, say about ten feet high, the substructure will make a truck load height of about fifteen feet when loaded on a truck for transportation. That height often is too great for highway clearance.

It is among the objects of this invention to provide a multiple level substructure in which the elevated portion for a rotary table is a separate prefabricated component removably mounted on prefabricated components adapted to support drawworks and engines, in which the elevated component is of a height that is not excesssive for truck loads, in which the elevated component may support shoes for supporting a mast, and which may include means for raising a pair of feet of a reclining mast to the level of shoes on such an elevated component.

In accordance with this invention, a pair of laterally spaced main box frames are connected by a plurality of removable parallel cross members to form a deck for engines and drawworks. Removably mounted on top of the main frames near one end is an elevated box frame that extends transversely of the other frames to form an elevated deck for a rotary drilling table. A box frame, as described and claimed herein, is a frame formed from pairs of upper and lower horizontal beams which are spaced apart several feet by vertical columns and are connected by horizontal cross pieces. Shoes are mounted on at least the main frames for supporting a drilling derrick. If the front shoes are mounted on the elevated frame, means are provided for raising the feet of a reclining derrick mast up to the shoes for attachment thereto. After the reclining mast has been swung up into upright position, a pipe setback support may be mounted on top of the main frames in front of the elevated frame.

The invention is illustrated in the accompanying drawings, in which Fig. 1 is a side view of the substructure main frames supporting the elevated frame; Fig. 2 is a plan view thereof; Fig. 3 is a fragmentary side view like Fig. 1 with engines and drawworks on the substructure and with a reclining derrick mast connected to it; Fig. 4 is a side view of the substructure with the derrick erected thereon and the pipe setback support added; Fig. 5 is a fragmentary plan view of the substructure of Fig. 4, without the derrick; Fig. 6 is an enlarged end view of the substructure; Fig. 7 is a cross section taken on the line VII—VII of Fig. 4; Fig. 8 is a fragmentary side view, similar to Fig. 4, of a modification; and Fig. 9 is an enlarged detail in section, taken on the line IX—IX of Fig. 8.

Referring to the drawings, a pair of laterally spaced box-like main frames A and B, which are quite long in relation to their height and width, are each fabricated from upper and lower beams **1** and **2** connected by vertical columns **3** and horizontal cross pieces **4**. The front ends of the lower beams may extend forward beyond the upper beams, to which they are connected by inclined beams **6**. Preferably, the combined width of the two frames does not exceed eight feet, so that they can be carried side by side on a truck. The two main frames are spaced the desired distance apart by means of horizontal cross members **7** detachably connected to their inner, upper beams. The cross members and the tops of the frames form a deck on which drawworks **8** and driving engines **9** can be mounted, as shown in Figs. 3 and 4. The height of this deck above the ground preferably is about truck bed height, which is about five feet, so that the machinery just mentioned can be skidded more or less horizontally off a truck and directly onto the deck. Each main frame supports a pair of conventional derrick shoes **11** and **12** spaced longitudinally thereof. The front shoe **11** is located between the front ends of the upper beams, just behind the inclined beams **6**. The rear shoe may be located about halfway back along the frame. These shoes receive the feet of an oil well derrick, as will be described presently.

Removably mounted on the upper beams of the main frames, between their front shoes **11**, is an elevated box-like frame C formed from upper and lower beams **14** and **15** connected by vertical columns **16** and horizontal cross-pieces **17**. The opposite ends of the lower beams **15** rest on the inner, upper beams **1** of the main frames. The transverse elevated frame supports at or near its top a heavy framework **18** designed for supporting the rotary table (not shown) that drives the drill pipe in the well casing below it. The frame C is high enough to support the rotary table at a level that will give adequate room for pressure control equipment below it. When the main frames A and B are about five feet high, the elevated frame C need not extend more than seven feet above them. This will give a truck load height of not over twelve feet when the elevated frame is skidded from the main frames onto a truck, which is adequate for highway clearances. The elevated frame is not over eight feet wide, so that it will fall within highway load width regulations.

In erecting a derrick on this substructure, an upwardly tapered gin pole D first is connected to the shoes **11** and **12** on the main frames, as shown in Fig. 3. A reclining mast E, which has been assembled from prefabricated sections along the ground in front of the substructure, then is moved back toward the substructure until the feet at the substructure end of the front or lower side of the mast are received in the front shoes. The feet then are pivotally connected to the shoes by pins **20** so that the mast can be swung up and back into upright position in a well-known manner by means of a line **21** extending from the drawworks to the crown block of the mast. The upright mast is secured to the gin pole to form a drilling derrick. After the derrick has been erected, the working floor area of the elevated frame C can be enlarged by attaching to its opposite ends brackets **22**, the outer ends of which, beyond the sides of the derrick, help to support horizontal members **23**. At the same time, or earlier, other brackets **24** can be attached to the back of the frame.

A pipe setback support F also can be mounted in front of the elevated frame after the mast has been erected. This support consists of a prefabricated rectangular spreader **25** that is detachably connected in horizontal position to brackets **26** on the front upper beam **14** of the elevated frame. The spreader also is supported by a truss **27** removably mounted on the front ends of the main frames A and B. Pivotally connected to the back side of the top of the truss are the upper ends of braces **28**. Dur-

ing transportation of the truss these braces lie against it, but when the truss is mounted on the main box frames the lower ends of the braces are swung rearward and are connected to brackets **29** mounted on the upper ends of the inclined beams **6** of the main frames. This pipe setback support and the extension brackets **22** and members **23** at the opposite ends of the elevated frame C have to be removed before the mast can be swung forward and down to the ground for removal and transportation to a new location.

The raised floor level of the elevated frame encroaches on the derrick height, which requires the derrick to be built higher to compensate for this encroachment. However, a way to increase the height of the derrick without increasing its actual length is shown in Fig. 8 of the drawings. This can be done by using a longer elevated frame C', which rests on both upper beams of main frame A' and of the other main frame, and by mounting the front shoes **40** on top of the opposite ends of the elevated frame. In such a case the rear legs **41** of the gin pole D' are increased in length and may be reinforced by inclined braces **42** extending from them down to the rear upper beam of the elevated frame. Raising the front shoes of the substructure in this manner presents another problem, however. They are too high for connection to the feet of a mast E' assembled along the ground in front of the substructure, as indicated in broken lines. Therefore, provision is made for raising the feet of the mast to the higher level of the front pair of shoes.

This can be done by mounting ramps on the front portions of the main frames extending in front of the elevated frame, the ramps extending from the front ends of the main frames backward and upward to the top of the elevated frame. Each ramp is in line with the adjacent shoe **40** and may be formed from an inclined beam **43**, on which a channel-like track **44**, preferably extending up into the shoe, is rigidly mounted. These channels are adapted to receive small rollers **46** mounted in brackets **47** projecting a very short distance down from the front legs **48** of the reclining mast close to its perforated feet **49**. When the mast is backed up against the substructure and the rollers are engaged with the inclined tracks, further backward movement of the mast will cause the rollers to roll up the tracks until the mast feet are received in the shoes. They then can be pinned in position by pins **50**, and the mast can be swung up into upright position against the gin pole, as described previously. When the mast is lowered, this procedure is just reversed. By locating rollers **46** as close as possible to the feet of the mast, normal slight variations in the height of the outer end of the reclining mast relative to the substructure will not tilt the feet enough to make it difficult to pin them to the shoes.

The two level substructures disclosed herein can be used for rotary drilling and yet be broken down into three main components of such size that they can be trucked over highways. With one form of the invention it is a simple matter to raise, by means of ramps, the feet of a reclining mast from a level where the mast can be assembled conveniently to a considerably higher level where the feet can be pinned to elevated front shoes.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A well drilling structure comprising a pair of laterally spaced main box frames several feet high, a plurality of removable parallel cross members rigidly connecting the tops of said frames and forming a deck for engines and drawworks, an elevated box frame several feet high removably mounted on top of said main frames near their front ends and extending transversely thereof and forming an elevated deck for a rotary drilling table, the main frames having front portions extending forward from the elevated frame, a pair of shoes mounted on the elevated frame near its opposite ends, ramps mounted on said front portions of the main frames and extending from their front ends backward and upward to the top of the elevated frame, a drilling mast extending above the frames and having a pair of feet at its lower end, means detachably pivoting the feet to said shoes, and rollers projecting from the front side of the mast near its lower end, said rollers being positioned to engage the upper ends of the ramps when the mast is swung forward and down to reclining position along the ground, whereby the rollers can roll down the ramps after said feet have been disconnected from the shoes and thereby carry the feet down to a lower level.

2. A well drilling structure comprising a pair of laterally spaced main box frames several feet high, a plurality of removable parallel cross members rigidly connecting the tops of said frames and forming a deck for engines and drawworks, an elevated box frame several feet high removably mounted on top of said main frames near their front ends and extending transversely thereof and forming an elevated deck for a rotary drilling table, the main frames having front portions extending forward from the elevated frame, a pair of shoes mounted on the elevated frame near its opposite ends, ramps mounted on said front portions of the main frames and extending from their front ends backward and upward and substantially into said shoes on top of the elevated frame, a drilling mast extending above the frames and having a pair of feet at its lower end, means detachably pivoting the feet to said shoes, and small rollers projecting a very short distance from the front side of the mast closely adjacent to said pivoting means, said rollers being positioned to engage the upper ends of the ramps when the mast is swung forward and down to reclining position along the ground, whereby the rollers can roll down the ramps after said feet have been disconnected from the shoes and thereby carry the feet down to a lower level.

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