Dec. 17, 1968 T. D. MANIU 3,416,267

COLLAPSIBLE DERRICK FOR DRILLING

Filed Sept. 10, 1965 2 Sheets-Sheet 1

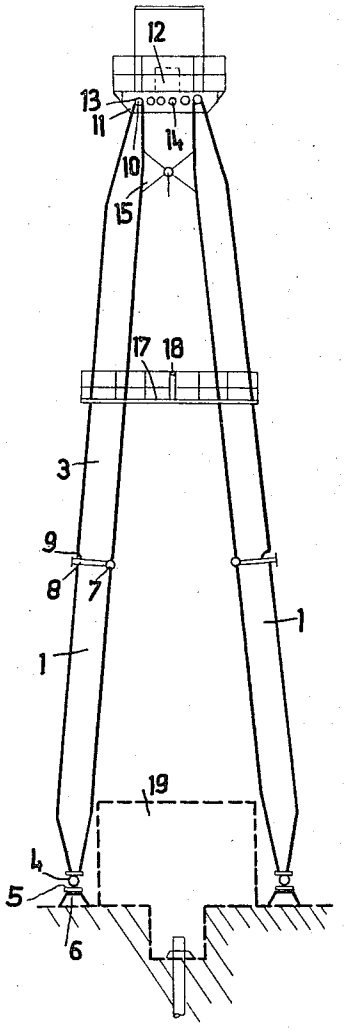


Fig. 1

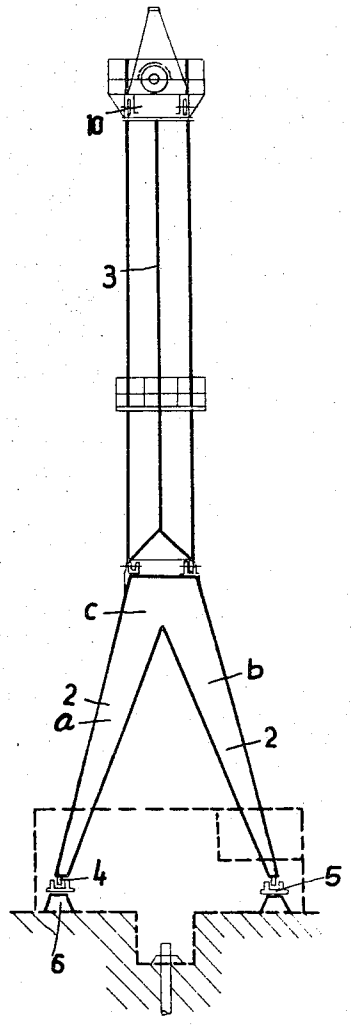


Fig. 2

Inventor:
Tiberiu Dimitrie MANIU
by: Arthur O. Klein
his Attorney

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COLLAPSIBLE DERRICK FOR DRILLING

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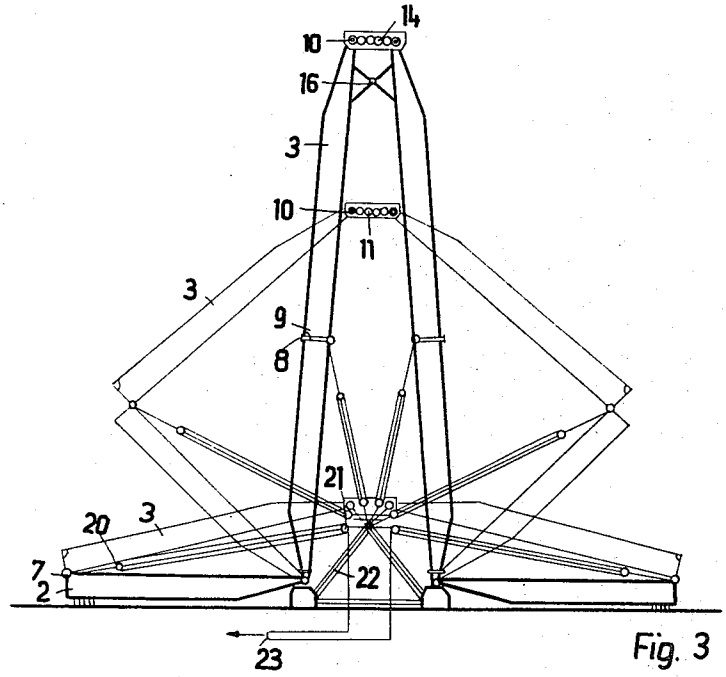


Fig. 3

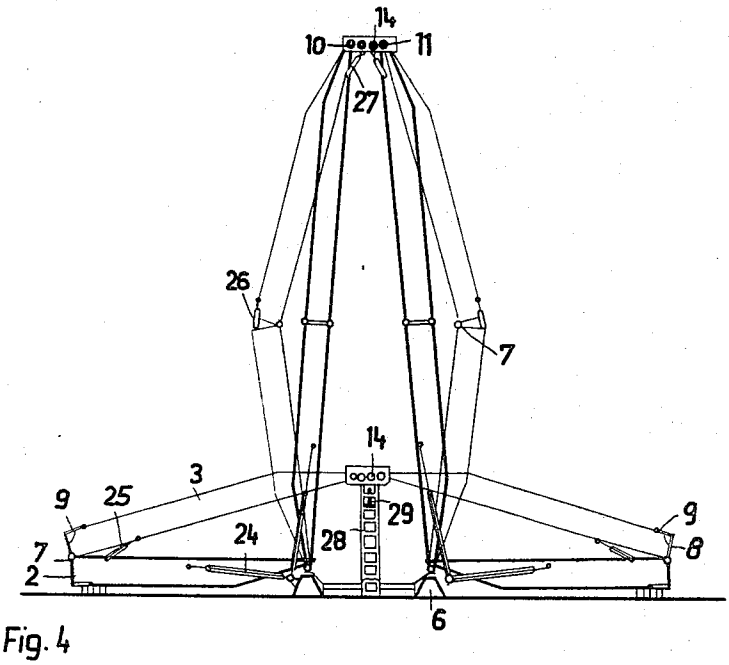


Fig. 4

Inventor:
Tiberiu Dimitrie MANIU
by: Arthur O. Klein
his Attorney

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3,416,267

COLLAPSIBLE DERRICK FOR DRILLING

Tiberiu Dimitrie Maniu, Bucharest, Rumania, assignor to Ministerul Petrolului, Bucharest, Rumania

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3 Claims. (Cl. 52—121)

The present invention relates to a collapsible derrick that can be used for drilling medium and deep wells, and which can be raised and lowered by means of some joints placed intermediate the ends of derrick columns, the derrick having a vertical plane of symmetry which remains unchanged during the raising and lowering operations.

It is known to raise a drilling derrick by folding the columns by means of some joints placed about half way up the columns. Each column has a shape similar to an inverted Y, in order to obtain a greater supporting area.

The upper end joint of each column is realized directly by a pin on which the crown block sheaves are placed. The derrick raising and lowering is achieved by means of rigid raising legs placed outside the column frame.

Since the crown block sheaves are placed on the upper ends of the columns, in case damages occur to crown block sheaves (failures, bearings gripping, etc.), it is necessary to lower and dismantle the derrick for replacing the faulty elements.

In addition, and due to this type of construction, the crown block sheave position is perpendicular to the drawwork axis. This arrangement leads to difficulties in connection with the drilling line, which requires the use of one or more guiding rollers.

The use of raising legs placed outside the derrick frame presents the disadvantage that when the derrick is lowered, the upper end of the raising leg, which makes with the horizontal an angle greater than 90°, needs supplementary devices to counteract, by counterpushing, the thrust caused by the derrick and raising leg weight.

It is therefore a primary object of the present invention to provide a structure which will avoid the above drawbacks.

The present invention avoids these shortcomings by the fact that the derrick columns, at their upper ends, are joined together by an independent element, namely a crown block water table, the derrick columns being connected by pivoted joints to this end, between these joints, a movement equalizing device constituted from an even member of gears is provided.

Any type of crown block can be mounted on this crown block water table, in such a position that the sheave axis is parallel with the drawworks drum axis.

For derrick raising and lowering operations, a set of blocks of a cable and pulley system is placed inside the derrick frame, or an extensible hydraulic jacks system is used. The raising or lowering, kicking or initial movement is realized by means of auxiliary hydraulic jacks, synchronized with main extensible jacks and placed near the approximately half height pivot points or on an assembling trestle.

The invention is illustrated by way of example, in connection with the FIGURES 1–5 in which:

FIG. 1 is a front view of a collapsible derrick;

FIG. 2 is a side view of a collapsible derrick;

FIG. 3 is a front view of a collapsible derrick during the raising operation, by means of a block system; and

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FIG. 4 is a front view of a collapsible derrick during the raising operation, by means of a hydraulic jacks system.

The derrick, according to invention, is constituted of two identical and symmetrically arranged columns, each column **1** being constituted of two main elements: a lower element **2** and an upper element **3**.

The lower elements **2** are split in two symmetrical branches *a* and *b*, each connected by a common section *c*.

These elements can be manufactured from one or more sections.

The elements **2**, at their lower ends, are each provided with a pivot joint **4** which is seated, by means of a centering and height adjusting device **5**, on a base **6**, which on its turn can be placed upon a foundation or substructure section.

The upper elements **3** are constituted of many sections, rigidly assembled together, and are joined to the elements **2**, at their upper ends, respectively, by means of the pivot or hinge joint **7** and automatic locking devices **8**.

Between the derrick column elements **2** and **3**, near the automatic locking device **8**, a mechanism **9** is placed, which is used for kicking or initiating the derrick collapsing at the beginning of the lowering operation and for dampening the shock at the end of the derrick raising operation.

The upper end of each element **3** terminates in a pivot joint **10** which joins the columns **1** to a water table having beams **11** on which usually common type crown blocks are placed.

A mechanism **13** composed of an even number of gears **14**, permanently engaged together, is placed in the crown block water table beams **11**, ensuring the derrick assembly stability during movements and having also the role to maintain the crown block frame **11** horizontal during derrick raising or lowering. Thus, a pair of gears are respectively connected to the upper ends of the columns **3**, at their joints **10**, for turning movement with the columns **3**, and the latter gears mesh with the series of gears **14** which are permanently in mesh with each other, the total number of gears being even, so that in this way an equalizing means is provided for compelling the column sections **3** to turn, with respect to a horizontal plane which includes the axes of all of the gears **14**, by equal and opposite angles while maintaining the latter plane horizontal at all times.

On each of the two derrick columns, at a certain distance below the water table there are mounted the arms **15**, provided with an automatic latch **16** at their ends, which are coupled together at the end of the derrick raising operation, and which maintain the derrick shape in case the overhauling of the crown block frame is necessary.

The derrick is provided with a racking platform **17**, which can have different shapes and can be placed at many levels and heights. The platform is provided with guards and windbreaks **18**.

The racking platform can be raised with the derrick or pulled up separately by means of the rig travelling block.

The derrick is provided with all the necessary accessories, annexes, stairs, light installation, etc. which are not shown in the drawings.

Inside the derrick, a substructure **19** can be mounted,

necessary for supporting the rotary table and other drilling equipment. The substructure is independent of the derrick, so that the derrick may be used with any type of drilling rig.

The characteristic movement which accompanies the derrick raising and lowering is performed equally and oppositely on the pair of columns **1** with respect to a vertical plane of symmetry situated midway therebetween and is realized, in a first variant, by means of a cable and pulley or block and tackle system, as shown in FIG. 3. This system is constituted of a set of pulleys or sheaves **20**, tied to the derrick columns **1** at joints **7**, and a second set of sheaves **21** which is tied to a mounting trestle **22** placed in the derrick base center.

The rest of sheaves **21** is attached to the top of mounting trestle **22**.

The blocks system is actuated by a wire line **23**, which is pulled by a tractor, hoist or other corresponding device: When the raising stroke of the derrick is ended, the locking device **8** is actuated, in connection with the starting and shock absorbing device **9** and latch **16**.

When the derrick is lowered, the latches **8** and **16** are unlatched, and the collapsing is started by means of kicking and shock absorbing mechanism **9**, the derrick lowering continuing under the derrick's own weight, the movement being controlled by unreeling the wire line **23**. The same cable and pulley system can be used for many derricks.

In case of the variant in which the vertical movement is accomplished by means of hydraulic jacks, the raising-lowering principle is maintained, the derrick having other corresponding elements for attaching the respective hydraulic devices also.

The hydraulic jack assembly includes two main pushers **24** (FIG. 4) having one end on the derrick support **6** and another placed about half way up the column element **2**. These main pushers **24** are instrumental in raising the derrick and, at the same time act as a hydraulic brake when the derrick is lowered.

On each column between the lower element **2** and upper element **3**, a secondary hydraulic jack **25** is placed, which serves to kick or initiate the derrick raising, and to brake the collapsing movement at the end of derrick lowering operation. Another secondary hydraulic jack **26** is placed in each of the joints between column elements **2** and **3** articulation points, toward the outside, having only the role of kicking or initiating the derrick collapsing during the lowering operation and working as a hydraulic brake during the final phase of raising, so that the automatic locking devices **8** have a smooth action.

At the upper ends of derrick columns **1**, toward the points of pivotal connection with the water table **11**, a secondary hydraulic jack **27** is placed in each joint, having the role to kick or initiate derrick collapsing during the lowering operation, and acting as hydraulic brakes at the end of raising operation.

A mounting trestle **28**, which can be placed either on the derrick substructure, or on its own skids, and having a corresponding height, is used for supporting the derrick in collapsed position, and can be provided with a hydraulic jack **29** also, for helping to kick the derrick raising.

During the derrick raising operation, the main hydraulic jacks **24** and the secondary hydraulic jacks **25** operate simultaneously, or, in case the mounting trestle **28** is provided with a secondary hydraulic jack **29** also, the latter starts working also.

The main raising effort is taken up by the main hydraulic jacks **24**, and the secondary hydraulic jacks are used only for kicking the raising, in order to overcome the inertia due to derrick weight, thus working only for a limited distance.

The secondary hydraulic jacks **26** and **27** start working at the end of the derrick raising stroke as hydraulic brakes, allowing the automatic locking devices **8** to start working smoothly.

When the derrick is lowered, the secondary hydraulic jacks **26** and **27** are the first which begin to work, kicking the derrick collapsing mechanism, and then the main hydraulic jacks **24** take the load, working as a hydraulic brake.

At the end of the derrick collapsing operation, the secondary hydraulic jacks **25** and **29** operate also, at this time as hydraulic brakes, allowing a smooth depositing of the derrick on the supports.

The derrick, according to the invention, presents the following advantages:

It can be used with any type of drilling rig which has the corresponding load capacity.

It is independent of the well substructure.

It has its own safe support and does not need supplementary resistance guiding.

The derrick can be rigged up either by using the rig assemblies or by using other independent assemblies, so that the derrick is independent of the drilling rig elements.

What is claimed is:

1. In a collapsible derrick for drilling operations and the like, a pair of identical columns symmetrically situated with respect to a vertical plane of symmetry situated midway between the columns, said columns each having upper and lower ends and including upper and lower column elements pivotally connected to each other substantially midway between the upper and lower ends of each column so that the columns can be collapsed and raised by turning movement of the column elements with respect to each other at the connection therebetween, a table having an elongated portion extending between and connected to the upper ends of the columns for spacing said upper ends of said columns from each other, raising and lowering means operatively connected to the columns for raising and collapsing the same, and equalizing means extending along said table in the space between and connected to the upper ends of the columns for maintaining the table which extends therebetween horizontal during raising and collapsing of the columns, said equalizing means including an even number of gears which extend between and are operatively connected with the upper ends of the columns and which are permanently in mesh with each other, said gears including a pair of end gears, respectively situated at said upper ends of said columns and a plurality of additional gears situated between said end gears.

2. The combination of claim **1** and wherein said raising and lowering means includes a cable and pulley system which is made up at least in part of a support situated at the bottom of the plane of symmetry between the columns, a first set of pulleys connected with the joints between the elements of each column, a second set of pulleys connected to the support, and a wire cable cooperating with said pulleys and adapted to be pulled or let out from a location distant from the columns to respectively raise and collapse the columns.

3. The combination of claim **1** and wherein said raising and lowering means includes a system of hydraulic jacks which is made up at least in part of two main hydraulic jacks connected with a base of the column and with the lower column elements substantially midway between their ends, respectively, for raising the columns and for acting as brakes during collapsing operations, secondary hydraulic jacks respectively connected with the column elements at the joints therebetween to initiate raising operations and to brake movement at the end of a collapsing operation, additional secondary hydraulic jacks connected to the column elements at the region of their joints for initiating collapsing operations and to act as brakes at the end of a raising operation, and hydraulic jacks operatively connected with the upper ends of the columns, respectively, and the table at the region of the connections therebetween for initiating collapsing operations and to act as brakes at the end of raising operations.

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FRANK L. ABBOTT, *Primary Examiner.*

P. C. FAW, *Assistant Examiner.*

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