July 2, 1946. H. D. HILBORN 2,403,080

METHOD AND MEANS FOR RAISING AND LOWERING PORTABLE DERRICKS

Filed May 6, 1944 2 Sheets-Sheet 1

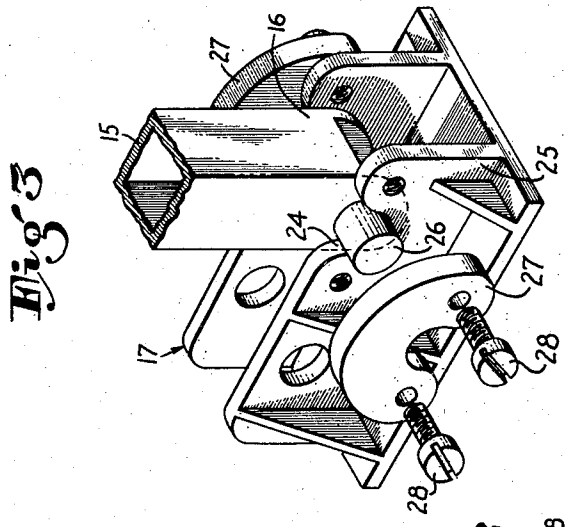


Fig. 3

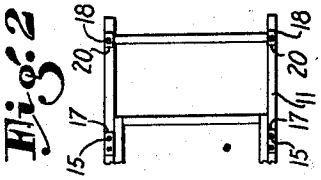


Fig. 2

Fig. 1

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Fig. 4

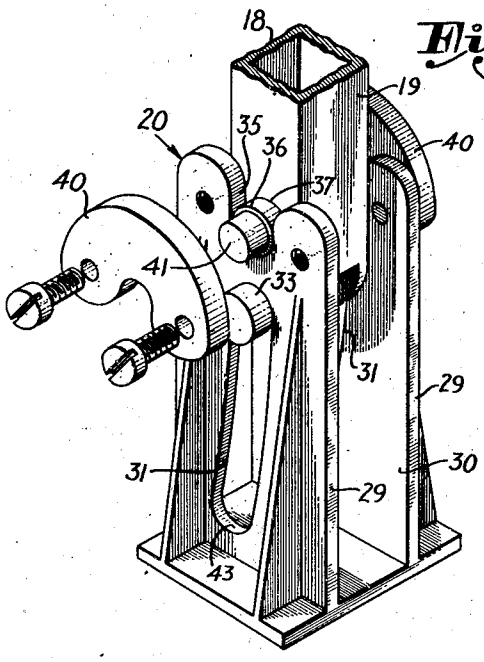


Fig. 5

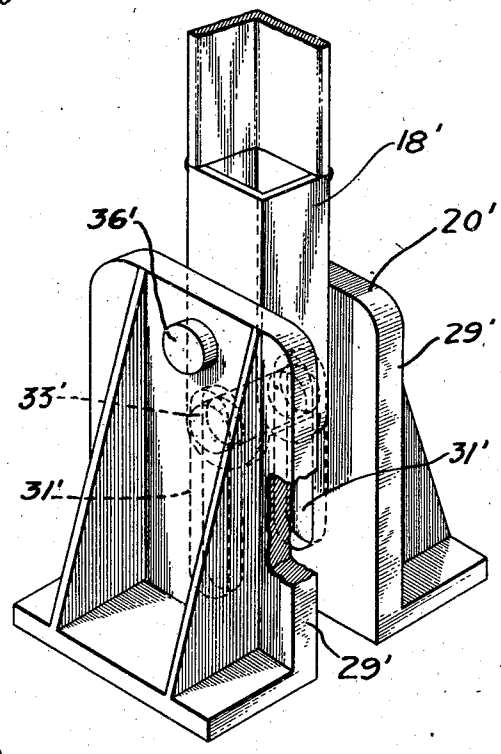
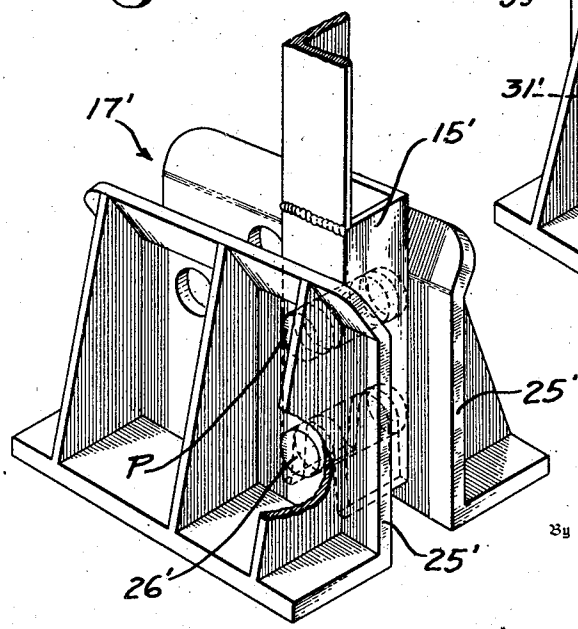


Fig. 6



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METHOD AND MEANS FOR RAISING AND LOWERING PORTABLE DERRICKS

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Application May 6, 1944, Serial No. 534,419

5 Claims. (Cl. 189—15)

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My invention relates to portable derricks of the type employed for well drilling, and relates in particular to a method and means whereby the weight of the derrick is caused to act to swing the derrick in one direction only during the time the derrick is moved between fully erect and reclining positions.

An object of the invention is to provide a method and means whereby the pivot point around which the derrick swings when it is either raised from reclining position to erect position or lowered from erect position to reclining position is shifted from the front legs to the rear legs of the derrick as the center of gravity of the derrick passes over the lower extremities of the front legs, thereby making it possible to raise or lower the derrick without the use of a snubbing line during the time the derrick is being raised and without the necessity of pulling the derrick off center when starting to lower the derrick.

It is an object of the invention to provide means for adjusting or shortening the supporting means of the front side of the derrick so that the rear legs of the derrick will support substantially the entire derrick load during the time the center of gravity of the derrick is within the vertical projection of the base area defined by the lower ends of the four derrick legs, or, otherwise stated, during the time the center of gravity of the derrick is rearward of a position substantially vertically above the supporting means for the front legs of the derrick.

A feature of my invention is that during the operations of raising and lowering the derrick, the weight of the derrick tends to swing the derrick in one direction only, namely forwardly. By the expression adjusting in this disclosure I mean changing the position of one or more parts of the supporting means for the front legs, or removing part of the supporting means so that the supporting means at the front side of the derrick will be in effect removed, and the load of the derrick will be then carried substantially entirely by the rear legs of the derrick.

It is a further object of the invention to provide a method and means such as set forth in the foregoing having front supports for the derrick which will permit downward movement of the front side of the derrick so that the derrick will be swung by its own weight in forward direction around the lower ends of the rear legs of the derrick to a position wherein the center of gravity of the derrick is substantially vertically above the supporting means for the front legs of the derrick or slightly forwardly thereof, whereupon

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the derrick will be then supported substantially entirely upon its front legs during the time it is swung further toward and into reclining position.

It is also an object of the invention to provide a method and means whereby a derrick is lowered by first changing the height relationship of the lower ends of the front legs and rear legs of the derrick so that the derrick will be swung into an inclined position wherein the center of gravity is substantially vertically above or slightly forwardly of the supporting means for the front derrick legs and the derrick is thereafter swung into reclining position around the lower ends of its front legs, thereby avoiding the necessity of first pulling the derrick into an off center position to bring it to a position wherein its weight will thereafter act to move it downward to reclining position.

Further objects and advantages of the invention will be brought out in the following part of the specification.

Referring to the drawings which are for illustrative purposes only,

Fig. 1 is a schematic elevational view showing a preferred embodiment of my invention.

Fig. 2 is a cross section taken as indicated by the line 2—2 of Fig. 1.

Fig. 3 is a perspective view showing a rear leg support of Fig. 1.

Fig. 4 is a perspective view showing a front leg support of Fig 1.

Fig. 5 is a perspective view of an alternative front leg support which may be used in the practice of my invention.

Fig. 6 is a perspective view of an alternative form rear leg support.

In Fig. 1 I show the portable derrick in erect position on a base 11 shown as being supported on a foundation member 12, and carrying at its rear end engines 13 and a drawworks 14 arranged to be driven by the engines 13.

The derrick 10 has rear legs 15 which transmit substantially half the derrick load through the lower ends 16 thereof to rear leg supports 17, and the derrick has front legs 18 which carry the remainder of the derrick load through their lower ends 19 to front leg supports 20 which form parts of adjustable front leg supporting means of the invention. Adjacent the rear legs 15 of the derrick 10 there is a gin pole structure 21 carrying a suitable number of sheaves 22 over which lines or cables 22' and 23 may be carried for use in raising and lowering the derrick 10. The arrangement of lines or sheaves for raising and

lowering the derrick forms no part of the present invention, and it will be understood that any arrangement of cables attached to the derrick so as to pull rearwardly thereon may be employed in the practice of the invention, the rearward pull of the cables serving either to raise the derrick from reclining position to erect position or to restrain the movement of the derrick as it swings under its own load from erect position to reclining position upon the ground.

As shown in Fig. 3, each rear leg support 17 comprises a rest or depression 24 in which the lower end 16 of the rear leg 15 may rest and in which it may be secured when the derrick is in erect position as shown in Fig. 1. In the preferred form of the invention, the depression or socket 24 is formed in the upper edges of plates 25 which are spaced so that the lower extremity of the rear leg 15 may be received therebetween, and a portion of the rear leg, which rests in the depression or socket 24, comprises a pin 26 which is extended horizontally through the lower end of the leg 15. For holding the pin 26 in the depressions 24 of the plates 25, hold-down yokes 27 are provided, one of these yokes 27 being shown displaced laterally from its normal position. Each yoke 27 is removably held by cap screws or bolts 28 in a position to pass over a projecting end of the pin 26. The rear legs 15 of the derrick may swing on the rear support 17 as may be required in the operation of raising and lowering the derrick.

Each front leg support 20, as shown in Fig. 4, includes a pair of spaced plates 29 defining a space 30 to guide and receive the lower end of a front leg 18. Each of the plates 29 has therein a slot 31 which is substantially vertical, but preferably describes an arc around the axis of the socket 24 of the rear leg support 17 opposite thereto so that as the derrick 10 swings from the erect position thereof shown in full lines in Fig. 1 to the intermediate position indicated by dot and dash lines, a pin 33, carried by the lower extremity of the front leg 18 so that the ends thereof project through the slots 31, may travel downward in the slots 31 from the raised position thereof shown in Fig. 4.

The upper ends of the plates 29 have therein depressions or sockets 35 to receive the ends of a pin 36 adapted to be passed through an opening 37 in the lower end 19 of the front leg 18 when the pin 33 occupies a position near the upper ends of the slots 31. The lower end 19 of each front leg 18 constitutes a member which is in continuous overlapping relation with the front leg supporting member 20. This pin 36 transmits the load of the cooperating front leg 18 to the plates 29 when the derrick is in use in erect position, and yokes 40 are provided to superiorly engage the projecting end portions 41 of the pin to lock the lower ends 19 of the legs to the plates 29 which are secured to the base 11 in any desired manner.

The utility of my invention will be perceived from the following description of the manner of lowering and raising the derrick. If it is desired to lower the derrick, a strain is placed on the lines 22' and 23 which will tend to swing the derrick 10 in leftward direction, thereby relieving the strain from the pins 36 at the lower ends of the two front legs 18, whereupon the pins are removed from the normal operative positions thereof indicated in Fig. 4. It will be understood that the vertical weight of the derrick is now carried by the rear legs 15 and that the weight would swing the derrick 10 in clockwise direction on the pins 26 which support the lower ends of the rear legs 15 were it not for the restraining action of the lines 22' and 23.

The lines 22' and 23 are now gradually released or extended so that the derrick 10 may swing from the position in which it is shown in full lines toward the position indicated by dot and dash lines in Fig. 1, during which time the pins 33 will travel downward in the slots 31, the weight of the derrick 10 acting eccentrically with relation to the pins 26, producing this clockwise swinging movement of the derrick 10. The bottom walls 43 of the slots 31 are so placed that they will be engaged by the ends of the pins 33 when the derrick 10 has swung through such distance as to bring its center of gravity G into a position G' substantially vertically above a line drawn through the lower ends of the front legs 18 of the derrick, or substantially vertically above the pins 33 so that there will be no difficulty in producing a continued forward or downward movement of the derrick from the position shown in dot and dash lines to the reclining position shown in dotted lines in Fig. 1. It will be understood, however, that before this further swinging movement of the derrick may be carried out, the pins 26 must be unlocked from the plates 25, which is done by removing the yokes 27 so that the pins 26 may swing upward through an arcuate path. During this downward swinging movement of the derrick—that is to say, the movement of the derrick which results in a rightward movement of its center of gravity from the position indicated at G'—the vertical load of the derrick is carried by the lower ends 19 of the front legs 18.

Erection of the derrick at a suitable location is carried on as follows. The base 11, Fig. 1, is supported by suitable foundation such as indicated at 12 and the parts 13, 14, and 21 are mounted thereon. The derrick 10 is assembled in reclining position with the lower ends 19 of the front legs 18 connected to the front supports 20, the pins 33 then resting in the lower ends 43 of the slots 31. The derrick is then swung upward around the pins 33 until the center of gravity of the derrick reaches the point G', or relatively close thereto, whereupon the pins 26 will engage the sockets 24 of the rear supports 17, with the result that the pivot point on which the derrick swings is transferred from the pins 33 to the pins 26. The derrick is then pulled leftward so as to swing the center of gravity from the position G' to substantially the position G and the supporting pins 36 are placed as shown in Fig. 4, and are then locked in position by the yokes 40. Upon release of strain from the lifting lines 22' and 23, the load of the derrick will be allowed to settle upon the four leg supports 17 and 20. The placing of the yokes 27 so as to extend over the ends of the pins 26 will lock the lower ends 16 of the rear derrick legs 15 to the rear supports 17.

In the practice of the invention there is an adjustment of the supporting means for the front legs 18 of the derrick which will permit the weight of the derrick to act to swing the derrick forward to such position that the center of gravity of the derrick is brought into a position substantially above or slightly forwardly of the lower ends of the derrick front legs at the time support under the front legs is reestablished so that the weight of the derrick will continue to act to swing the derrick forwardly into reclining position.

In Fig. 5 I show a derrick front leg 18' which is locked to a front leg support 20' consisting of a pair of plates 29' having vertical channels 31' to

receive the ends of a pin 33' which extend through the lower end of the leg 18', making it possible for the front leg 18' to move downward when a supporting pin 36' is removed from the position in which it is shown. The lower end of each front leg 18' constitutes a member which is in continuous overlapping relation with the front leg supporting member 20'. This pin 36', when the leg 18' is raised, is passed through openings in the upper parts of the plates 29' and the leg member 18' and transmits the load from the leg 18' through the supports 20' to the base or foundation. The rear leg support 17', shown in Fig. 6, comprises a pair of vertical plates 25' between which a permanent pin 26' extends so that it may be engaged by the notched lower end of a rear leg 15', so that the derrick will be thereby supported. The leg 15' is held against upward movement by a locking pin P which is passed through aligned openings in the plates 25' and in the leg member 15'. When it is desired to tilt the derrick forwardly, as described in relation to Fig. 1, the locking pin P is removed so that the leg 15' may swing upward from engagement with the supporting pin 26'.

I claim as my invention:

1. A portable derrick assembly comprising a supporting base, a derrick which is tiltable on the supporting base between erect and reclining positions, rear legs for said derrick having their lower ends positioned rearwardly of the center of gravity of the erect derrick and front legs for said derrick having their lower ends positioned forwardly of such center of gravity, a rear mounting means for pivotally mounting the lower ends of each of said rear legs on said base and for permitting separation of said rear legs from said base, and front mounting means for mounting the lower ends of each of said front legs on said base, the front mounting means for each front leg including an upwardly extending member on said base having vertically spaced first and second load supporting shoulders thereon, a projection on each front leg for engaging said first shoulder for supporting said front legs while said derrick is in erect position, said projection being removable from engagement with said first shoulder to permit initial forward tilting of said derrick about said rear mounting means, and a second projection on each front leg positioned above said second shoulder while said derrick is in erect position but engaging said second shoulder after said initial forward tilting has occurred to thereafter support said front leg whereby further forward tilting of said derrick is about said second shoulder as a center.

2. A portable derrick assembly comprising a supporting base, a derrick which is tiltable on the supporting base between erect and reclining positions, rear legs for said derrick having their lower ends positioned rearwardly of the center of gravity of the erect derrick and front legs for said derrick having their lower ends positioned forwardly of such center of gravity, a rear mounting means for pivotally mounting the lower ends of each of said rear legs on said base and for permitting separation of said rear legs from said base, and front mounting means for mounting the lower ends of each of said front legs on said base, the front mounting means for each front leg including an upwardly extending member on said base having vertically spaced upper and lower load supporting shoulders thereon, a projection on each front leg for engaging the upper shoulder for supporting said front legs while said derrick is

in erect position, said projection being removable from engagement with said upper shoulder to permit initial forward tilting of said derrick about said rear mounting means, and a second projection on each front leg positioned above said lower supporting shoulder while said derrick is in erect position but engaging said lower shoulder after said initial forward tilting has occurred to thereafter support said front leg whereby further forward tilting of said derrick is about said lower shoulder as a center.

3. A portable derrick assembly comprising a supporting base, a derrick which is tiltable on the supporting base between erect and reclining positions, rear legs for said derrick having their lower ends positioned rearwardly of the center of gravity of the erect derrick and front legs for said derrick having their lower ends positioned forwardly of such center of gravity, a rear mounting means for pivotally mounting the lower ends of each of said rear legs on said base and for permitting separation of said rear legs from said base, and front mounting means for mounting the lower ends of each of said front legs on said base, the front mounting means for each front leg including an upwardly extending member on said base having vertically spaced upper and lower load supporting shoulders thereon, a pin projecting from each front leg in a position to engage said upper shoulder to support said front legs while the derrick is in erect position, said pin being removable to permit initial forward tilting of said derrick about said rear mounting means, and a second pin projecting from each front leg in a position above said lower shoulder while said derrick is in erect position but engaging said lower shoulder after said initial forward tilting has occurred to thereafter support said front legs whereby further forward tilting of said derrick is about said lower shoulder as a center.

4. A portable derrick assembly comprising a supporting base, a derrick which is tiltable on the supporting base between erect and reclining positions, rear legs for said derrick having their lower ends positioned rearwardly of the center of gravity of the erect derrick and front legs for said derrick having their lower ends positioned forwardly of such center of gravity, a rear mounting means for pivotally mounting the lower ends of each of said rear legs on said base and for permitting separation of said rear legs from said base, and front mounting means for mounting the lower ends of each of said front legs on said base, the front mounting means for each front leg including a member on the base and a member on the front leg in continuous overlapping relation, one of said members having first and second shoulders thereon in vertically spaced relation and the other of said members having a first projection for engagement with said first shoulder for supporting the front leg while the derrick is in erect position, said first projection being disengageable from said first shoulder to permit initial forward tilting movement of said derrick about said rear mounting means, and a second projection on said other member for engaging said second shoulder after said initial forward tilting movement has occurred to thereafter support said front leg whereby further forward tilting of said derrick is about said second shoulder as a center.

5. A portable derrick assembly comprising a supporting base, a derrick which is tiltable on the supporting base between erect and reclining positions, rear legs for said derrick having their

lower ends positioned rearwardly of the center of gravity of the erect derrick and front legs for said derrick having their lower ends positioned forwardly of such center of gravity, a rear mounting means for pivotally mounting the lower ends of each of said rear legs on said base and for permitting separation of said rear legs from said base, and front mounting means for mounting the lower ends of each of said front legs on said base, the front mounting means for each front leg including a member on the base and a member on the front leg in continuous overlapping relation, one of said members having first and second shoulders thereon in vertically spaced relation and the other of said members having a first projection for engagement with said first shoulder

for supporting the front leg while the derrick is in erect position, said first projection being disengageable from said first shoulder to permit initial forward tilting movement on said derrick about said rear mounting means, a second projection on said other member for engaging said second shoulder after said initial forward tilting movement has occurred to thereafter support said front leg whereby further forward tilting of said derrick is about said second shoulder as a center, and means of interengagement operative between said members for limiting the extent of upward movement of the front leg whereby rearward toppling of the derrick about said rear mounting means is prevented.

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