Oct. 12, 1943. J. McEWEN ET AL 2,331,558

PORTABLE DERRICK

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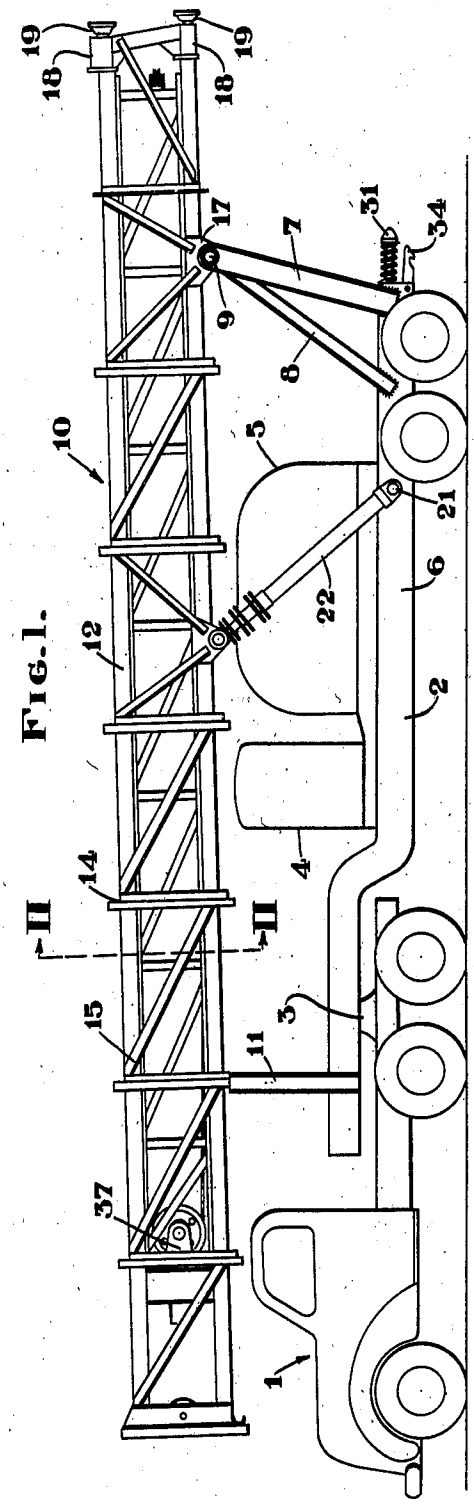


FIG. 1.

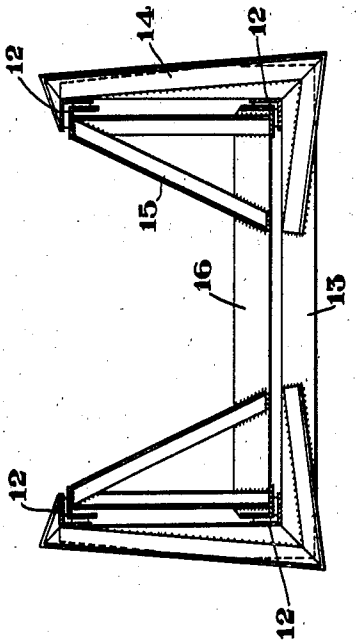


FIG. 2.

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FIG. 4.

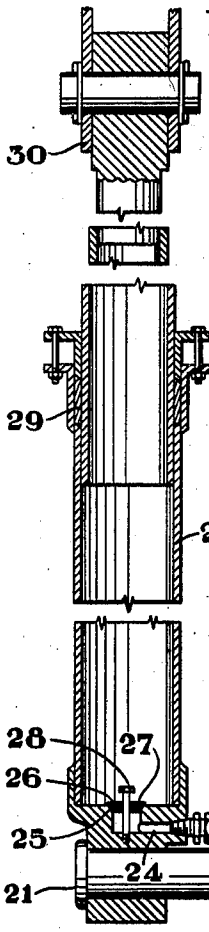


FIG. 3.

FIG. 5.

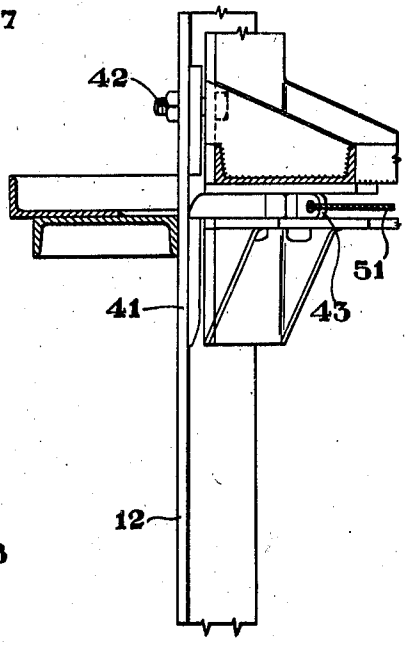
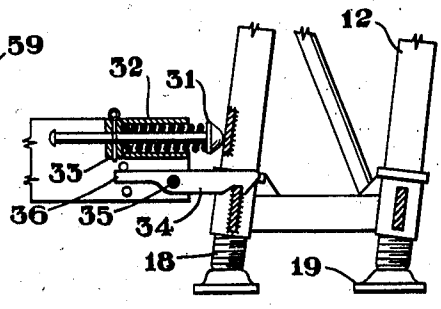


FIG. 6.



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FIG. 7.

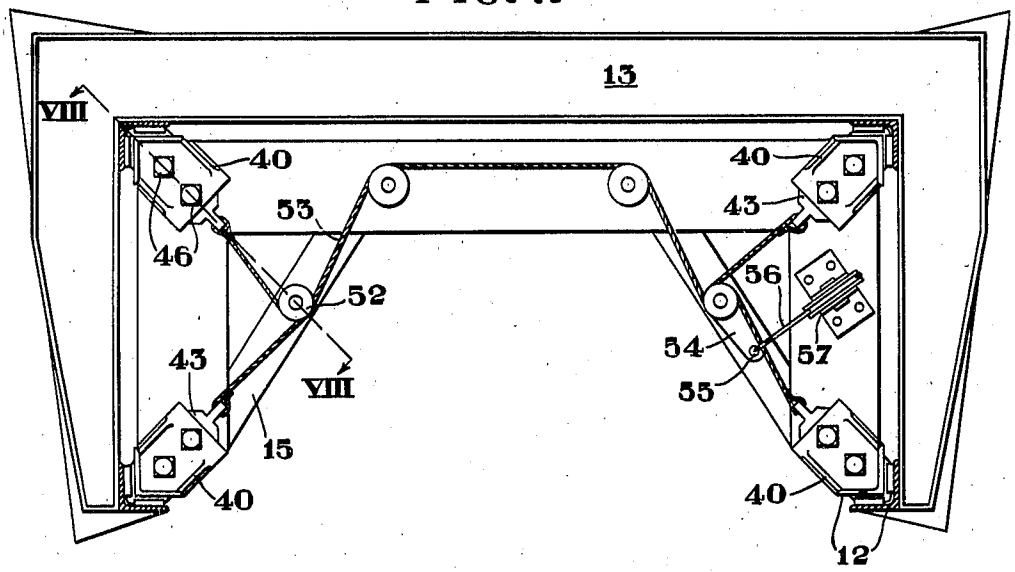


FIG. 8.

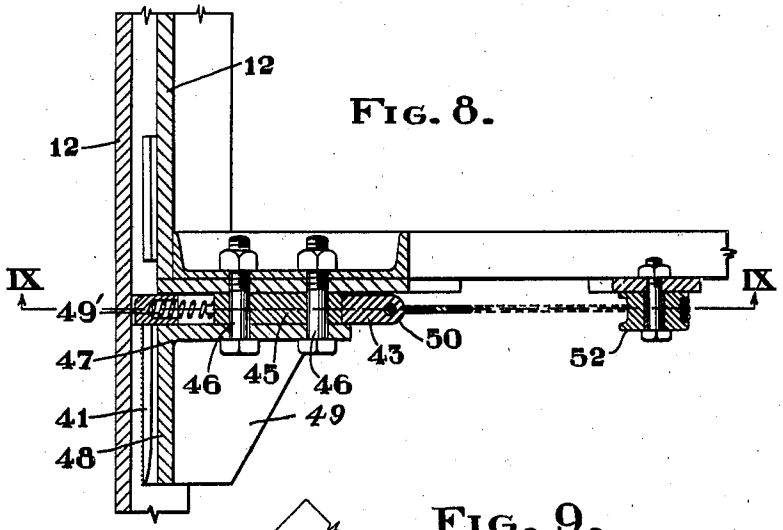
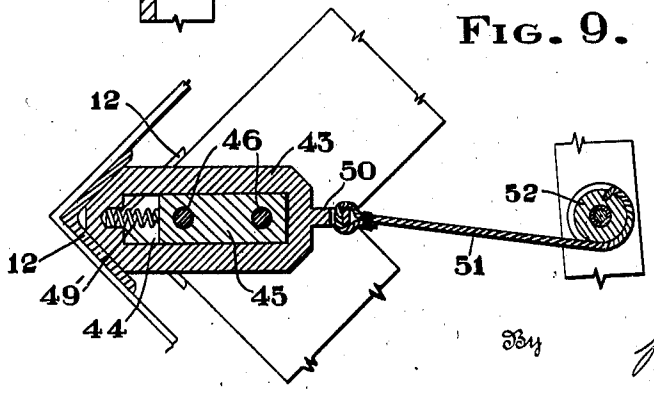


FIG. 9.



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FIG. 10.

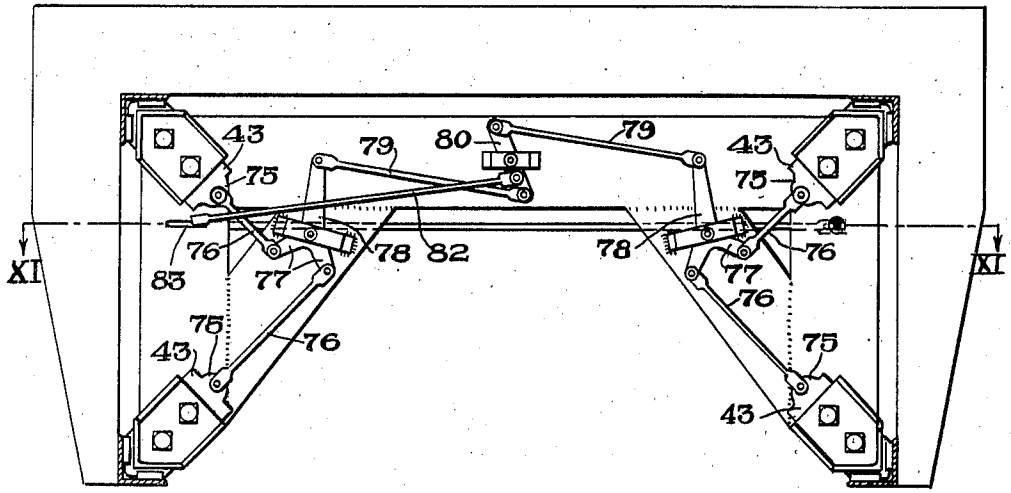


FIG. 11.

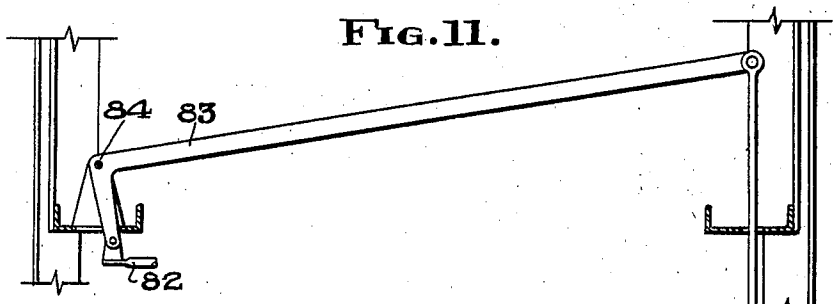
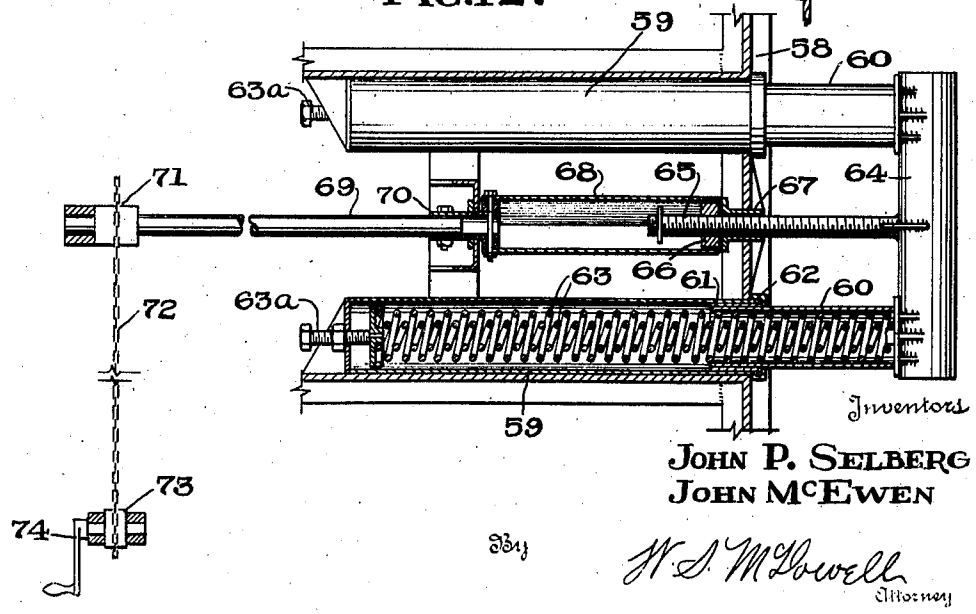


FIG. 12.



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UNITED STATES PATENT OFFICE

2,331,558

PORTABLE DERRICK

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Application February 14, 1941, Serial No. 378,924

5 Claims. (Cl. 189—14)

This invention relates to portable derrick equipment for drilling oil, gas and water wells and for pulling rods, tubing and casing from such wells which have been previously drilled. A number of devices have previously been provided for such work but these have all been objectionable due to the inconvenience incurred in operating the same, the time required to set up and dismantle them, the necessity of special equipment and tools for their use, and the dangers to which the workmen employing the same are subjected during the use thereof. These prior devices have also been objectionable due to the difficulty of transporting them from one well location to another.

One of the objects of the present invention resides in the provision of a portable derrick which is so designed that it may be quickly and easily set up for operation or collapsed for transportation without requiring an undue length of time, the employment of special equipment, or the services of specially trained workmen.

Another object rests in the construction of a portable derrick having a movable base, in this instance the bed of a semi-trailer, on which a pair of pivot supporting standards are rigidly mounted, a sectional mast being carried by the pivots for movement between prone portable positions and upright working positions, one of the mast sections being telescopically received by the other whereby the overall length may be decreased when the derrick is set for transportation and the amount of power required to elevate or swing the mast into an upright working position materially lessened, the upper section being moved to an extended position after the telescoped sections have been swung to the upright position.

A further object resides in the provision of improved power actuated means for facilitating the operations of raising and lowering the mast, this means being supplemented by resilient bumper means employed to initiate the return of the swinging mast to its normal position.

It is also an object to provide the hydraulic pressure actuated mast moving means with safety valve devices to prevent too sudden or rapid movement of the mast in the event one or more parts of the fluid lines or pressure providing system should fail.

Another object is the provision of safety means for controlling the longitudinal movement of the telescoping section from extended to collapsed positions, said safety means preventing the sudden and complete return of the upper derrick section without the attention and control of an operator, said means also being accessible from the ground to avoid the necessity of having a workman climb the derrick during the operation of lowering the upper section.

Still another object resides in forming a derrick with telescoping sections, one of which is provided with longitudinally spaced stop shoulders and the other having movable latch means for engagement with the stop shoulders to limit the relative movement of the sections, means being provided for manually releasing the latches, and motion transmitting means being employed to connect the manual release and latch means whereby the power required to actuate the latter will be reduced to a reasonable degree and yet sufficient force may be exerted against the latches to positively move and hold the same in operative positions.

For a further understanding of the invention and additional objects, reference is to be had to the following description and the accompanying drawings in which a derrick has been disclosed in detail.

In the drawings:

Fig. 1 is a side elevational view of a tractor and semi-trailer to which a derrick formed in accordance with the present invention has been attached;

Fig. 2 is a detail vertical transverse sectional view taken through the derrick on the plane indicated by the line II—II of Fig. 1;

Fig. 3 is a side elevational view of the rear portion of the semi-trailer body and the derrick, showing the latter in its elevated or upright position;

Fig. 4 is a detail longitudinal sectional view taken through the hydraulic power unit employed to elevate the derrick, the plane of this section being indicated by the line IV—IV of Fig. 3;

Fig. 5 is a detail vertical sectional view taken on the plane indicated by the line V—V of Fig. 3;

Fig. 6 is a detail vertical sectional view taken through the lower portion of the derrick and showing the means for retaining the derrick in its upright position;

Fig. 7 is a detail horizontal sectional view taken on the plane indicated by the line VII—VII of Fig. 3, this section being taken when looking upwardly and showing locking means for holding the telescopic section of the derrick in its extended position;

Fig. 8 is a detail sectional view taken through the locking mechanism on the plane indicated by

the line VIII—VIII of Fig. 7, with the parts in normally erect position;

Fig. 9 is a detail horizontal sectional view taken on the plane indicated by the line IX—IX of Fig. 8;

Fig. 10 is a detail horizontal sectional view taken through the derrick when looking upwardly and showing mechanism for effecting positive actuation of the means for locking the inner section of the derrick in an extended position;

Fig. 11 is a detail sectional view taken on the plane indicated by the line XI—XI and showing lever and cable means for actuating the locking means shown in Fig. 10, showing the parts in their normally erect position;

Fig. 12 is a horizontal sectional view taken through the derrick supporting vehicle and showing a modified type of spring-pressed bumper for initiating the return of the derrick to a horizontal position.

Referring more particularly to the drawings, the numeral 1 designates a truck or tractor unit employed to move the derrick from one well location to another. This truck has a semi-trailer 2 connected therewith as at 3, the semi-trailer having an internal combustion engine 4 mounted thereon adjacent to the forward portion. Behind this engine, there is positioned a draw works 5 of the type generally used in well working equipment. At the rear end of the body 6 of the semi-trailer and at the sides thereof, there is provided a pair of standards 7 which, in this instance, are formed of channel members maintained in their substantially upright positions by braces 8. At the upper ends of the standards, there is provided a transversely extending shaft or pivot 9 upon which the derrick, designated generally by the numeral 10, is supported.

The forward ends of the side members of the trailer frame are also provided with uprights 11 for engaging a portion of the derrick and supporting one end thereof when the derrick is in a prone position. In the present form, the derrick includes a plurality of corner legs 12 formed from angles disposed at the corners of a rectangle when the derrick is viewed from the end. At longitudinally spaced points, the angles are connected on three sides by transversely extending girt members 13 suitably reenforced by angles 14 welded or otherwise secured thereto. These angle members extend slightly diagonally with respect to the girt members in order to form an angle brace, the corners of which are disposed a greater distance from certain of the legs 12 than the corners of the girt members. The relation of the corner legs is further maintained by providing truss members 15 which extend diagonally from one corner leg to the other between the girt members.

As illustrated in Fig. 2, by providing the girts and trusses only on three sides of the derrick body, one side is permitted to remain open and this side is disposed upwardly when the derrick is in a prone position. It will also be noted from Fig. 2 that the girts and trusses on the lowermost or outer derrick section are disposed on the outer sides of the corner legs while those on the inner telescoping section are arranged on the inner sides of the corner legs in order that the outer section will be free from obstructions which might interfere with the relative movement between the sections. The corner legs at the open side of the inner derrick section are braced by angularly extending bars 15 which extend from the corner legs to the girt members 16 at the back of the inner section. The lowermost corner legs or those at the back of the derrick are provided adjacent to the lower ends with plate members 17 through which the pivot 9 extends. Suitable bearings may be provided in connection with these plate members for receiving the shaft and providing for pivotal movement of the derrick on the shaft.

The plates are spaced from the lower ends of the corner legs a distance sufficient to permit the ends of the legs to be disposed in close relation to the ground surface when the derrick is elevated to an upright position, the lower ends of the legs having threaded sleeves 18 carried thereby for the adjustable reception of feet 19. These feet may be adjusted in the sleeves after the derrick section has been elevated to move them into firm engagement with a previously formed foundation of timbers 20, planks or other members disposed on the ground adjacent to the well bore.

To move the derrick from its prone to an elevated position, the trailer frame is provided at each side with a pivot 21 for the reception of the lower end of a hydraulic power unit 22. The pivots 21 may be adjustable to permit movement of the lower ends of the power units toward and away from the trailer body to reduce the transverse width when the device is adjusted for transportation. The power units include a plurality of tubular members, certain of which telescope the remaining portions to decrease the length of the power units when the derrick is moved to a prone position. The tubular members which are connected directly with the pivots 21 have flexible conduits 23 connected therewith to conduct the fluid under pressure to the interior of the power units, the conduits being threaded or otherwise secured to the fittings at the lower ends of the power units and communicating with passages 24 formed in these fittings, these passages communicating at their inner ends with the interior of the tubing sections.

Between the passage 24 and the interior of the lowermost sections, there is provided a valve seat 25 with which a valve disk 26 may be engaged. This disk is formed with a plurality of reduced openings 27 for the controlled passage of fluid from the power unit back to the reservoir or power generator through the conduit 23. The disk 26 is fitted in this instance on a bolt 28, the head of the latter member serving to limit the disk in its movement. When fluid under pressure is introduced to the power unit through the conduit 23, the disk will be lifted from its seat to provide for a rapid introduction of the fluid into the power unit. After the power unit has elongated a distance sufficient to elevate the derrick, the disk 26 will return to its engagement with the seat and in the event the derrick would again move downwardly, the speed at which its could move would be governed by the rate of flow of fluid through the reduced ports 27. This mechanism forms a safety device to prevent injury to the workmen or the apparatus which might be caused if the derrick should suddenly fall to its lowermost position in an unchecked manner.

As illustrated in Fig. 4, suitable packing 29 is employed to prevent the escape of fluid under pressure around the joints between the various sections of tubing forming the power cylinder. The upper ends of these units are connected with plates 30 secured to the rear corner legs of the lowermost derrick section, pivots passing through the plates and the perforated upper ends of the innermost movable section of the power unit. While the form of power unit illustrated in the

drawing has been described in detail, it is obvious that this type of unit could readily be replaced by any other unit capable of receiving fluid under pressure and transmitting motion to movable elements.

After the power units have been elongated and the derrick has reached its upright position, the longitudinal axis of the derrick will have passed a slight distance beyond a true vertical plane. Immediately prior to reaching this vertical plane, the lower ends of the derrick legs, or a brace extending therebetween, will engage the outer ends of a plurality of spring-pressed plungers 31 carried by the frame of the trailer. As the derrick continues to move beyond the upright position, the springs 32 will be compressed. These springs are relatively heavy and require considerable force to effect their compression. To prevent the springs from moving the derrick toward a lowered position, suitable locking means, such as pins 33, are engaged with the plungers to hold the springs 32 in their compressed condition and thus prevent the force of the spring from being applied to the derrick while it is being used in its upright position. If desired, a latch 34 may be pivoted to the trailer frame as at 35 for engagement with part of the derrick to retain it in its elevated position, this latch having means to limit the movement and insure the engagement with the portions of the derrick provided therefor when the derrick is being elevated, this means being indicated at 36 in Fig. 6.

After the derrick has been moved about the pivot 9 to its upright position and is positively secured therein, the inner section may be moved longitudinally within the outer section to elevate the crown block 37 to a greater distance from the ground. Any suitable means may be provided for moving the inner section, the means in this instance constituting a plurality of pulleys 38 journaled at the upper end of the lower section and receiving cables 39 secured at one end to the lower end of the inner derrick section and extending to the draw works. When power is applied to the draw works, the cable 39 will be wound thereon and, due to the force applied by the cable to the inner derrick section, this member will be elevated until the crown block reaches the proper height.

To retain the inner derrick section in its elevated position, the lower end thereof is provided with a plurality of latch members designated generally by the numeral 40 which cooperate with longitudinally spaced stops 41 carried by the corner legs of the outer section on the inner surfaces thereof. When the inner section has reached its proper extended position, bolts 42 may be inserted through registering openings in the corner legs of the sections to positively hold the upper section in its extended position. The latches, by cooperating with the stops 41, temporarily hold the derrick sections in their positions of adjustment while the bolts 42 are being inserted. The stops 41 are provided at longitudinally spaced points on the lowermost section to prevent accidental telescoping of the upper section into the lower section.

These latches, which are illustrated in detail in Figs. 8 and 9, are fastened to the girt member at the lower end of the inner derrick section. These latches include slidable blocks 43 which are V-shaped at their outer ends in order that they may enter the angle legs. The blocks have central slots 44 for the reception of guide members 45 through which bolts 46 project to secure these members to the girt at the lower end of the inner section. These bolts also hold the plates 47 which form part of the guides for the blocks 43 to the derrick section. These plates include angle sections 48 and braces 49, the angles and braces reenforcing the plates and preventing buckling or other movement when the load of the upper derrick section rests on the blocks 43. Coil springs 49' are positioned between one end of the slot 44 and the guide member, these springs serving to move the blocks 43 into engagement with the inner surfaces of the corner legs.

To effect the disengagement of the blocks 43 from the stops 41, the former are provided at their rear ends with perforated ears 50 for the reception of one end of cables 51, the opposite ends of which are connected with spools 52 journaled on the lowermost braces 15. The spools at the opposite sides of the derrick are connected by another section of cable 53, this cable transmitting movement from one spool to another. One of the spools has an arm 54 projecting therefrom, the outer end of this lever being perforated as at 55 to receive one end of a pull cord 56 which extends around a pulley 57 journaled on the under side of the lowermost girt and downwardly to the lower end of the derrick when it may be grasped by a workman to impart tension thereto to effect the movement of the blocks 43 against the action of the springs 49'.

Due to the leverage provided by the arm 54, the springs 49' may be formed of relatively heavy gage wire so that they may positively move the blocks 43 into engagement with the angle legs and still not require the operator to exert a great amount of force to effect the release of the latches. As long as tension is applied to the cable 56, the latches will be held free from engagement with the stops 41. If, however, the cable 56 should be released during the downward movement of the inner derrick section, this movement will be precluded as soon as the lower end of this derrick section reached the next set of stop members. The movement may then be resumed only when tension is again applied to the cable to retract the latches. By reason of the latches, the danger of destroying or injuring the derrick parts or the workmen is greatly minimized. Through the provision of the pull cord to govern the operation of the latches, the necessity of having a workman climb to the upper portion of the lower derrick section to release the upper section is eliminated.

When the derrick is to be adjusted for transportation, the bolts 42 may be removed, then the workmen may descend prior to the lowering of the upper derrick section. After this section has moved to its lowered position, the movement of which is controlled by the cable 39 and the draw works, the derrick may be swung to a horizontal or prone position over the trailer. To effect this movement, power is applied to the units 22 to move the lower end of the derrick into a firm engagement with the plungers 31. This movement will relieve the pins 33 from the force of the springs 32 and the pins 33 may be removed. The latch 34 may then be disengaged from the derrick and the fluid pressure released from the units 22. When this pressure is released, the springs 32 will expand and move the derrick from its position on one side of a true vertical plane to a position on the other side of this plane. Gravitational force

will then cause the derrick to continue to move to its horizontal position. It will be understood, of course, that the feet 19 are adjusted into the sleeves 18 before the latch 34 is released so that they will not interfere with the movement of the derrick.

A more elaborate type of spring bumper has been illustrated in Fig. 12. When this form is employed, the rear sill 58 of the vehicle frame is provided with a plurality of openings for the reception of spring containers 59 which extend longitudinally of the vehicle and are secured to the frame thereof. These containers telescopically receive complemental containers 60 having annular rings 61 for engagement with the caps 62 of the containers 59 to limit the degree of outward movement of the members 60. A plurality of nested springs 63 are positioned within the containers 59 and 60 and tend to force the latter out of the former. A transverse pipe 64 connects the outer ends of the members 60 to engage the derrick when it is being swung to an elevated position. After the derrick engages the pipe 64, continued movement will force the containers 60 into the containers 59 in opposition to the force of the springs 63.

The bumper is held in a retracted position by a screw 65 welded to the pipe 64 and a nut 66 carried thereby, the latter member being moved longitudinally on the screw to engage the end of a sleeve 67 welded or otherwise secured to the sill 58. When the bumper is moved by the derrick, the screw will slide through the sleeve 67 and as the nut is mounted on the screw, it will also move therewith longitudinally of a tube 68 having a polygonal cross section to fit the nut. After the springs have been compressed, the tube 67 is revolved to move the nut into contact with the sleeve 67 through the use of a shaft 69 connected with the tube as at 70 and provided with a sprocket 71. The latter member receives an endless chain 72 which is also trained around another sprocket 73.

Rotation of the member 73 is accomplished through the use of a crank 74 journaled at a suitable location on the vehicle. When the nut has engaged the sleeve and the fluid pressure is relieved on the power units, the force of the springs is sufficient to prevent rotation of the nut. To effect the movement of the derrick to a lowered position, it is necessary to apply fluid pressure to the power units to relieve the nut from the force of the springs at which time the nut can be rotated and moved away from the sleeve, turning the crank 74 in a reverse direction. The force exerted by the springs may be varied through the adjustment of the screws 63*a* carried by the inner ends of the spring containers. These screws engage spring seats which transmit the movement of the screws to the springs. The use of the bumper and screw type lock, shown in Fig. 12, avoids the necessity of having the workmen approach the lower end of the derrick during the lowering operations.

In Figs. 10 and 11, there has been illustrated a modified type of mechanism for controlling the latch blocks 43. These members are slidably carried by the lower end of the inner section of the derrick as previously described and are yieldably urged to extended positions by springs. To effect movement thereof in opposition to the springs, the blocks 43 are provided with perforated ears 75 at their inner ends. Links 76 connect the blocks 43 with short arms 77 forming parts of pivoted levers 78. The latter members have longer arms which are connected by links 79 with an equalizing bar 80 pivoted on the derrick section as at 81. The bar also has another link 82 connected therewith, which transmits movement to the bar from the short arm of a bell crank lever 83 mounted for pivotal movement as at 84 on the derrick. The longer arm of the lever 83 has a cable 85 secured to the outer end thereof, this cable corresponding to the cable 56, previously described, and serving the same purpose, that is, the transmission of power and motion from an operator stationed on the ground to the latch members.

From Figs. 10 and 11, it will be apparent that a pulling force applied to the cable 85 will cause the longer arm of the lever 83 to swing downward and the short arm will transmit motion to the bar 80 through the link 82. Similar movement will be imparted by the links 79 to the levers 78 which in turn move the latch blocks through the links 76. Due to the use of the links and levers, the latches will be positively moved to retracted positions when the cable 85 is pulled with sufficient force. The amount of power necessary to effect movement of the latches has been reduced to a minimum by providing the lever 83 with an arm of considerable length.

When the derrick is in use, cables 58 will be trained around the pulleys in the crown block and those in a traveling block 59. These cables may be retained in this position even when the derrick is disposed in its prone position, the traveling block resting in the derrick as illustrated in Fig. 1. The cables need not be removed from the crown block and the necessity of having to thread these cables prior to each use of the derrick will be avoided.

From the foregoing, it will be apparent that a telescopic and pivoted derrick has been provided which readily lends itself to transportation from one well location to another. Due to the simplicity of construction, the services of specially trained workmen need not be employed, the use of the derrick requiring only the attention of average mechanics. Through the use of the flow controlling means in the hydraulic power units and the latch means between the lower end of the inner derrick section and the other section, the derrick is made safe in its operation.

The various parts may be modified from the construction shown and such modifications may be made without departing from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:

1. In a telescoping derrick structure of the type embodying a lower derrick section having rectangularly spaced vertically extending angled corner legs, said legs being formed with inwardly positioned stop shoulders and being united in rigid spaced order by transverse bracing and an upper derrick section having corresponding legs and bracing, said upper section having telescoping engagement with the lower section, the improved latching mechanism for maintaining the upper section of such a derrick in its extended position with respect to the lower section, comprising slidable latch blocks having beveled outer ends and mounted for movement in a horizontal plane between stationary guiding and supporting devices carried by the lower part of the upper section, each of said blocks being longitudinally slotted for the reception of said devices, spring means disposed in said slots and operating

between said devices and the ends of the slots in order to normally force the beveled outer ends of said block into engagement with the angled corner legs and the stop shoulders of said lower derrick section, and manually operated means accessible from the lower part of the derrick structure to retract said blocks simultaneously against the forces exerted thereon by said springs, whereby to permit said upper section to be slidably telescoped into the lower section.

2. In a telescopic derrick structure of the type embodying a lower derrick section composed of rectangularly spaced vertically extending angled corner legs formed with inwardly disposed stop shoulders, said legs being united in rigid spaced order by transverse bracing and an upper derrick section having complemental corner legs and bracing, the improved latching mechanism for maintaining the upper section of such a derrick in its extended position with respect to the lower section, comprising a plurality of slidable latch blocks mounted for movement in a common horizontal plane on the bracing provided at the lower end of said upper section, each of said blocks having angular outer ends formed for engagement with the angled corner legs of said lower section and the stop shoulders provided thereon, said blocks being longitudinally slotted for the reception of stationary guiding and supporting devices carried by the bracing of the upper section, spring means disposed in said slots and operating between said devices and the ends of the slots to normally force the angled outer ends of said blocks into engagement with said corner legs, and manually operated means for simultaneously operating said blocks to move the latter between latching and unlatching positions.

3. In a telescopic derrick structure of the type embodying a lower derrick section composed of rectangularly spaced vertically extending angled corner legs formed with inwardly disposed stop shoulders, said legs being united in rigid spaced order by transverse bracing and an upper derrick section having complemental corner legs and bracing, the improved latching mechanism for maintaining the upper section of such a derrick in its extended position with respect to the lower section, comprising a plurality of slidable latch blocks mounted for movement in a common horizontal plane on the bracing provided at the lower end of said upper section, each of said blocks having angular outer ends formed for engagement with the angled corner legs of said lower section and the stop shoulders provided thereon, said blocks being longitudinally slotted for the reception of stationary guiding and supporting devices carried by the bracing of the upper section, spring means disposed in said slots and operating between said devices and the ends of the slots to normally force the angled outer end of said blocks into engagement with said corner legs, manually operated means for simultaneously operating said blocks to move the latter between latching and unlatching positions, said latch operating means embodying a plurality of cables joined with the inner ends of said latch blocks, and a rockable element for applying tensioning forces to said cables of such order as to effect the withdrawal of the latch blocks from engagement with the stop shoulders of said corner legs.

4. In a telescopic derrick structure of the type embodying a lower derrick section having rectangularly spaced vertically extending angled corner legs formed with stationary stop shoulders, said legs being united in rigid spaced order by transverse bracing, and an upper derrick section having corresponding corner legs and bracing, the improved latch mechanism for maintaining the upper section of such a derrick in its extended position with respect to the lower section, said mechanism comprising slidable latch blocks mounted for movement in a horizontal plane on the bracing provided at the lower end of said upper section, said blocks having angled outer ends formed for engagement with the angled corner legs of said lower section and the stop shoulders carried thereby, stationary guiding and supporting devices carried by the lower part of said upper section for confining and limiting the sliding movement of said latch blocks, spring means cooperative with said blocks normally urging the latter to assume extended latching positions, manually operated means simultaneously retracting said blocks against the forces exerted thereon by said spring means, said retracting means embodying a plurality of flexible elements connected with the inner ends of said blocks, and a rockable member joined with said flexible elements for imparting tensioning forces thereto of a character sufficient to retract the blocks from their latching positions.

5. Latching mechanism for telescopic derrick structures wherein the latter embody upper and lower sections composed of interfitting corner legs and transverse bracing of structural steel, said mechanism comprising a plurality of sliding latch blocks carried by the lower part of the upper section, spring means normally urging said blocks in an outward direction for coaction with shoulders provided on the corner legs of the lower section, manually operated retracting means for simultaneously withdrawing said latch blocks from their latching positions against the resistance of said spring means, said withdrawing means embodying a pair of pivoted Y-shaped levers, links uniting said levers with the inner ends of said blocks, a pivoted equalizing lever, links uniting said equalizing lever with said Y-levers, a pivoted bell crank lever, and means actuated by the movement of said bell crank lever to actuate said equalizing and Y-shaped levers.

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