

Feb. 24, 1942.

E. J. MILLER

2,274,273

WELL SPIDER

Filed Feb. 13, 1941

Fig. 1.

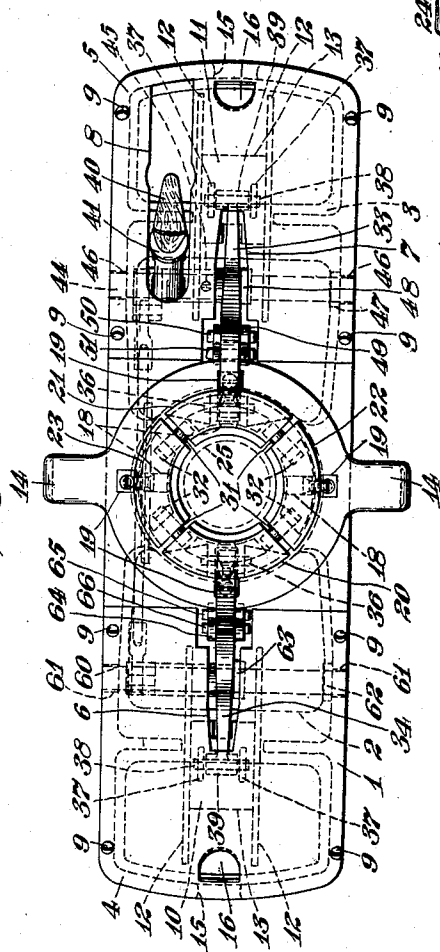


Fig. 3.

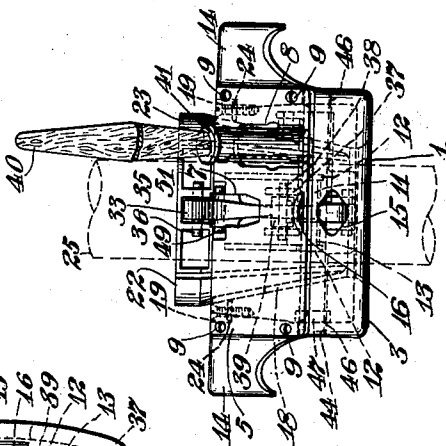
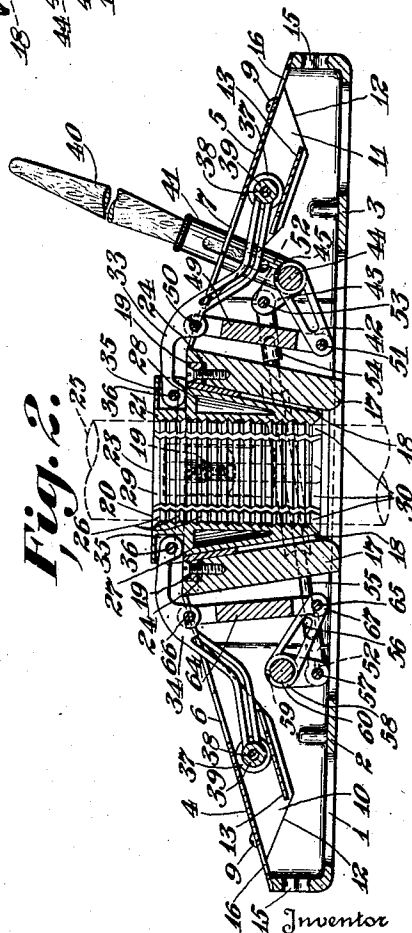


Fig. 2.



Earl J. Miller.

By R. S. C. Dougherty.

Attorney

UNITED STATES PATENT OFFICE

2,274,273

WELL SPIDER

Earl J. Miller, Bethlehem, Pa., assignor to Bethlehem Steel Company, a corporation of Pennsylvania

Application February 13, 1941, Serial No. 378,699

19 Claims. (Cl. 24—263)

My invention relates to new and useful improvements in casing and tubing spiders of the type used in oil field operations, and particularly to a rugged and dependable spider which will operate automatically in sudden emergencies.

It is, of course, obvious and well known that a long string of casing, when suspended freely in a petroleum well of great depth, is an object of tremendous weight. A 15,000 foot string of 6-inch outside diameter casing, for example, is equivalent to a dead load of 330,000 pounds or 165 tons. During lowering and raising operations a spider may be continually called upon to support virtually the whole weight of such a string of casing while the topmost joints are being connected to or disconnected from the string. In addition, the lowering or raising of such a weight is difficult and dangerous, and a break in the lifting means, without some such apparatus as the spider, might result in the loss beyond recovery or at least considerable damage to the whole expensive string of casing, followed by a costly fishing job ending perhaps in entirely abandoning the well and redrilling. Months of work might then be rendered fruitless.

A spider is thus a device which will permit ready passage of well casing and couplings while operations are proceeding normally, but which will quickly and firmly grasp the casing when required, as in cases of sudden emergency. The gripping portions of a spider comprise the slips, two or more wedge-shaped pieces of steel, arcuate in form, with roughened tooth-like interior surfaces. The spider itself consists of a base, usually of cast steel, containing a tapered aperture in which the slips are contained, and operating means to release or engage the slips as needed. Such operating means have hitherto been of great variety, very often with springs or other un dependable parts, and nearly all have been known to jam occasionally at critical moments. My invention reduces this possibility to a minimum.

The chief object of my invention, therefore, is to provide a casing spider which is lighter and more rigid, simpler, safer, and more dependable, less expensive and quicker-acting than the conventional casing spider, although other objects and advantages will appear in the specification and claims following.

Another object of my invention is to provide a well spider which has no obstructions above the slips to interfere with operating the elevator.

A further object of my invention is to provide a smooth and more easily operated means of imparting motion of translation to the slips.

My invention having been thus generally described, I shall now in order to make my detailed description more clear refer to the sheet of drawings hereto annexed, in which like characters of

reference indicate like parts, and which I desire to be read and considered as a part of this specification.

Figure 1 is a top plan view of an automatic well spider constructed in accordance with my invention;

Fig. 2 is a vertical longitudinal section; and

Fig. 3 is an end elevation thereof.

The base or body 1 of the spider is, as shown, preferably a one-piece box type steel casting, having transverse webs 2 and 3 if extreme strength is needed, and dispensing with said webs if a lighter weight spider is desired. The spider is provided with protecting cover plates 4 and 5, slotted as at 6, 7 and 8 to allow necessary freedom to projecting operating parts, and fastened to the base by lag screws 9. Tracks or guide-ways 10 and 11 are formed by welding or similarly attaching side plates 12 to which are welded bottom plates 13 centrally and longitudinally to the underside of each cover plate. Means of coupling with crane or elevator links (not shown) are afforded by lugs 14 and openings 15 in the base and openings 16 in the cover plates.

The downwardly decreasing hollow interiorly, uniformly tapered portion or bowl of the spider is shown at 17, and therein keyways 18 receive dovetailed keys 19 of driving slips 20 and 21 and floating slips 22 and 23 with taper corresponding to the bowl. Said dovetailed keys seat upon ring seats 24, and are rigid enough to permit the spider to be used in place of back-up tongs whenever the string of casing 25 is sufficiently heavy not to turn in the slips, though their primary purpose is to prevent rotation of the slips while allowing them full freedom for vertical reciprocation.

The inner faces of the tapered slips 20, 21, 22 and 23 are deeply serrated as at 26 for firmer gripping of the casing 25. Said slips are also preferably of steel, cast or forged, cored and ribbed as at 27 and 28 to reduce excess weight to a minimum, and beveled at top and bottom as at 29 and 30 to lessen the possibility that a coupling might hang onto the slips while the casing is being raised or lowered.

Horizontally disposed dowel pins 31 secured to driving slips 20 and 21 and fitting loosely in aligned openings 32 of floating slips 22 and 23 allow the slips to be raised or lowered together and provide convenient points of engagement for lifting hooks or the like when removing the slips from the bowl for changes or repairs. Goosenecks 33 and 34, projecting through cover slots 6 and 7, are attached to driving slips 20 and 21 in recesses 35 of said slips by pins 36, said pins being readily removable to permit quick changes of the slips to accommodate different sizes of casing or the like. When the slips are raised or lowered in use the opposite ends of said

goosenecks move easily in tracks or guideways 10 and 11 on rollers 37 attached to the goosenecks by shafts 38 in tubular end portions 39.

Projecting angularly from the spider through cover slot 8 is a handle 40, of wood or other convenient material, which has its lower end seated in the socket of a lever 41 which is provided with bell crank arms 42 and 43 and is mounted to rotate on the transverse shaft 44, being fastened thereto by means of a set screw 45. Said transverse shaft 44 is journaled in openings 46 in the sides of the base casing and is retained in position by means of set collars 47 and 48. Clevises at each end of link 49 fastened by pins 50 and 51 connect bell crank arm 42 of the lever 41 to gooseneck 33. Integral clevis bell crank arm 43 of the lever 41 fastens by set screw 52 to pin 53 on which pivots by means of tapped coupling 54 the threaded connecting rod 55. This rod in turn is threaded onto coupling 56, pivoting on pin 57 in inverted bell crank 58. Said bell crank is fastened centrally by set screw 59 to transverse shaft 60 journaled in openings 61 in the sides of the base and is retained therein by set collars 62 and 63. Clevises at each end of link 64 fastened by pins 65 and 66 connect end 67 of bell crank 58 to gooseneck 34.

Casing 25 cannot be dropped or lowered until handle 40 is drawn back since the weight of the casing and slips will normally hold the casing in position in the spider without manual attention. To release the casing the handle is retracted, which lifts the inner ends of goosenecks 33 and 34 to raise simultaneously the driving slips 20 and 21 and the connected floating slips 22 and 23.

While for purposes of illustration I have described this invention in considerable detail, I wish it clearly understood that I may use if I so desire any or all such substitutions, modifications or equivalents thereof as are embraced within the scope of the invention or as are pointed out in the claims.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent is:

1. A well spider comprising an elongated supporting base, a uniformly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, a supporting member pivoted to the slips at opposite sides of the bowl, a track for supporting and guiding the opposite end of each of the supporting members, and means connected to the intermediate portion of each supporting member for moving the slips upwardly and downwardly in the bowl.

2. A well spider comprising an elongated supporting base, a uniformly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, a curved arm pivoted to the slip at opposite sides of the bowl, a track for supporting and guiding the opposite end of each of the curved arms, operating means connected to the intermediate portion of each curved arm for moving the slips upwardly and downwardly in the bowl, and means for covering and protecting the operating means.

3. A well spider comprising an elongated substantially hollow supporting base, transverse webs in the base to strengthen and brace the same, a uniformly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, supporting members pivoted to the slips at opposite sides of the bowl, a track for guiding the opposite end of each of the supporting members, and means connected to the intermediate

portion of each supporting member for moving the slips upwardly and downwardly in the bowl.

4. A well spider comprising a one-piece supporting base, a uniformly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, lifting members pivoted to the slips at opposite sides of the bowl, rollers attached at the opposite end of each of the lifting members for supporting the same and means connected to the lifting members for vertically reciprocating the slips.

5. A well spider comprising a one-piece supporting base, an interiorly uniformly tapered bowl formed in the supporting base, quadrant gripping slips mounted in said bowl, gooseneck arms pivoted to the slips at opposite sides of the bowl, a track for guiding and supporting the opposite end of each of the gooseneck arms, and means connected to the intermediate portion of each gooseneck arm for upwardly and downwardly reciprocating the slips as required.

6. A well spider comprising a one-piece supporting base, a uniformly downwardly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, gooseneck arms each pivoted to a slip at opposite sides of the bowl, rollers attached to the opposite ends of each of the gooseneck arms for movably supporting the same, a track for guiding the rollers, and means connected to the intermediate portion of each gooseneck arm for upwardly and downwardly reciprocating the slips.

7. A well spider comprising an elongated substantially rectangular supporting base, a uniformly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, a gooseneck arm pivoted to a slip at opposite sides of the bowl, rollers attached to the opposite ends of each of the gooseneck arms for movably supporting the same, protecting cover plates slotted to admit the gooseneck arms, tracks for guiding the rollers attached beneath the cover plates, and means connected to the intermediate portion of each gooseneck arm for upwardly and downwardly reciprocating the slips.

8. A well spider comprising an elongated substantially rectangular supporting base, a uniformly tapered bowl formed therein, gripping slips mounted in said bowl, gooseneck arms provided with tubular end portions pivoted at the other ends to slips at opposite sides of the bowl, shafts rotatably mounted in the tubular end portions, rollers on the ends of said shafts for movably supporting the gooseneck arms, tracks for guiding the rollers, and means connected to the intermediate portion of each gooseneck arm for upwardly and downwardly reciprocating the slips.

9. A well spider comprising an elongated substantially rectangular supporting base, a uniformly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, supporting members pivoted to the slips at opposite sides of the bowl, a track comprising a bottom and side plates for guiding the opposite ends of each of the supporting members, and means connected to the intermediate portion of each supporting member for moving the slips upwardly and downwardly in the bowl.

10. A well spider comprising a substantially rectangular supporting base, a uniformly downwardly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, supporting members pivoted to the slips at opposite sides of the bowl, partially enclosed box-like trackways for guiding the opposite ends of each

of the supporting members, and means connected to the intermediate portion of each supporting member for moving the slips upwardly and downwardly in the bowl.

11. A well spider comprising a substantially rectangular supporting base, a uniformly downwardly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, supporting members pivoted to the slips at opposite sides of the bowl, cover plates for protecting the interior of the spider, a track disposed below and parallel to each cover plate for guiding the opposite ends of each of the supporting members, and means connected to the intermediate portion of each supporting member for moving the slips upwardly and downwardly in the bowl.

12. A well spider comprising a substantially rectangular supporting base, a uniformly downwardly tapered bowl formed in the supporting base, gripping slips mounted in said bowl, supporting members pivoted to the slips at opposite sides of the bowl, cover plates for protecting the interior of the spider, a trackway made integral with the cover plate by welding or the like for guiding the opposite ends of each of the supporting members, and means connected to the intermediate portion of each supporting member for moving the slips upwardly and downwardly in the bowl.

13. A well spider comprising a supporting base of substantially rectangular horizontal section, a uniformly downwardly convergent bowl formed in the supporting base, gripping slips mounted in said bowl, supporting members pivoted to the slips at opposite sides of the bowl, cover plates for protecting the spider, a longitudinal trackway adapted for guiding the opposite end of each of the supporting members, and means connected to the intermediate portion of each supporting member for moving the slips upwardly and downwardly in the bowl.

14. A well spider comprising a supporting base of substantially rectangular horizontal section, a uniformly downwardly convergent bowl formed in the supporting base, gripping slips mounted in the said bowl, dovetail keys on the slips to prevent the rotation thereof, keyways in the bowl for engaging the dovetail keys, seats for supporting the dovetail keys, a lifting member pivoted to the slips, a track for guiding the opposite end of each lifting member, and means connected to each lifting member for vertically reciprocating the slips.

15. A well spider comprising a substantially rectangular supporting base, a uniformly downwardly convergent bowl formed in the supporting base, quadrant gripping slips mounted in said bowl, bevels at top and bottom of each slip to permit freer passage through the slips, a supporting member pivoted to the slips at opposite sides of the bowl, a track for guiding the opposite end of each of the supporting members, and means connected to the intermediate portion of each supporting member for moving the slips upwardly and downwardly in the bowl.

16. A well spider comprising a substantially rectangular supporting base, a uniformly, interiorly tapered bowl formed therein, tapered interlocking slips beveled at the top and bottom within said bowl, gooseneck arms pivotally connected at one end of each arm to said slips, a roller at the

other end of each gooseneck arm, tracks for guiding the rollers, an operating lever mounted pivotally on the base, an inverted lever arm also mounted pivotally on the base at the opposite end, means connecting the operating lever with the inverted lever arm, and means connecting the operating lever and inverted lever arm with their respective gooseneck arms for simultaneously raising or lowering the slips to release or grip any inserted tubular object as desired.

17. A well spider comprising a substantially rectangular base frame, a uniformly, interiorly tapered bowl therein, correspondingly tapered interlocking slips within the bowl, gooseneck arms connected to said slips, rollers at the other end of each gooseneck arm, protecting cover plates above the frame, guideways formed integral with the cover plates to direct the movement of the rollers, an operating lever mounted pivotally in the frame, a lever arm similarly mounted at the other end of the frame and inverted with relation to the operating lever, rigid linking means connecting operating lever with inverted lever arm, and linking means connecting operating lever and inverted lever arm with their respective gooseneck arms for simultaneously raising and releasing the slips.

18. A well spider comprising a supporting box-like base, a bowl formed therein converging uniformly within from top to bottom, vertical side walls formed integrally with said base and bowl, driving and floating slips inserted within said bowl, dowel pins connecting said slips, gooseneck arms pivotally connected to the driving slips, rollers at the far end of each such arm supporting said arm, guideways in which the rollers may roll freely, openings in the said vertical side walls, transverse shafts journaled pivotally in said openings, an operating lever provided with bell-crank arms mounted pivotally on one shaft, a bell-crank mounted pivotally on the other shaft and inverted with relation to the operating lever, rigid means connecting the upper bell-crank arm of the operating lever with the lower arm of the inverted bell crank, means connecting the lower bell-crank arm of the operating lever with the adjacent gooseneck arm, and means connecting the upper arm of the inverted bell-crank with the gooseneck arm adjacent thereto.

19. A well spider comprising a base frame having transverse bracing bottom webs, a central uniformly, interiorly tapered bowl therein, tapered interlocking serrated quadrant slips within said bowl, gooseneck arms connected pivotally to said slips, a roller at the other end of each gooseneck arm, guideways in which the rollers may roll freely, openings in the sides of the base frame, transverse shafts journaled in said openings, set-collars holding said shafts in position, an operating lever mounted pivotally on one transverse shaft, a bell-crank mounted pivotally on the other transverse shaft and inverted with relation to the operating lever, a rod connecting operating lever with the bell-crank, and connecting links from operating lever and bell-crank to their respectively adjacent gooseneck arms for simultaneously raising and releasing the slips.

EARL J. MILLER.