

Sept. 21, 1926.

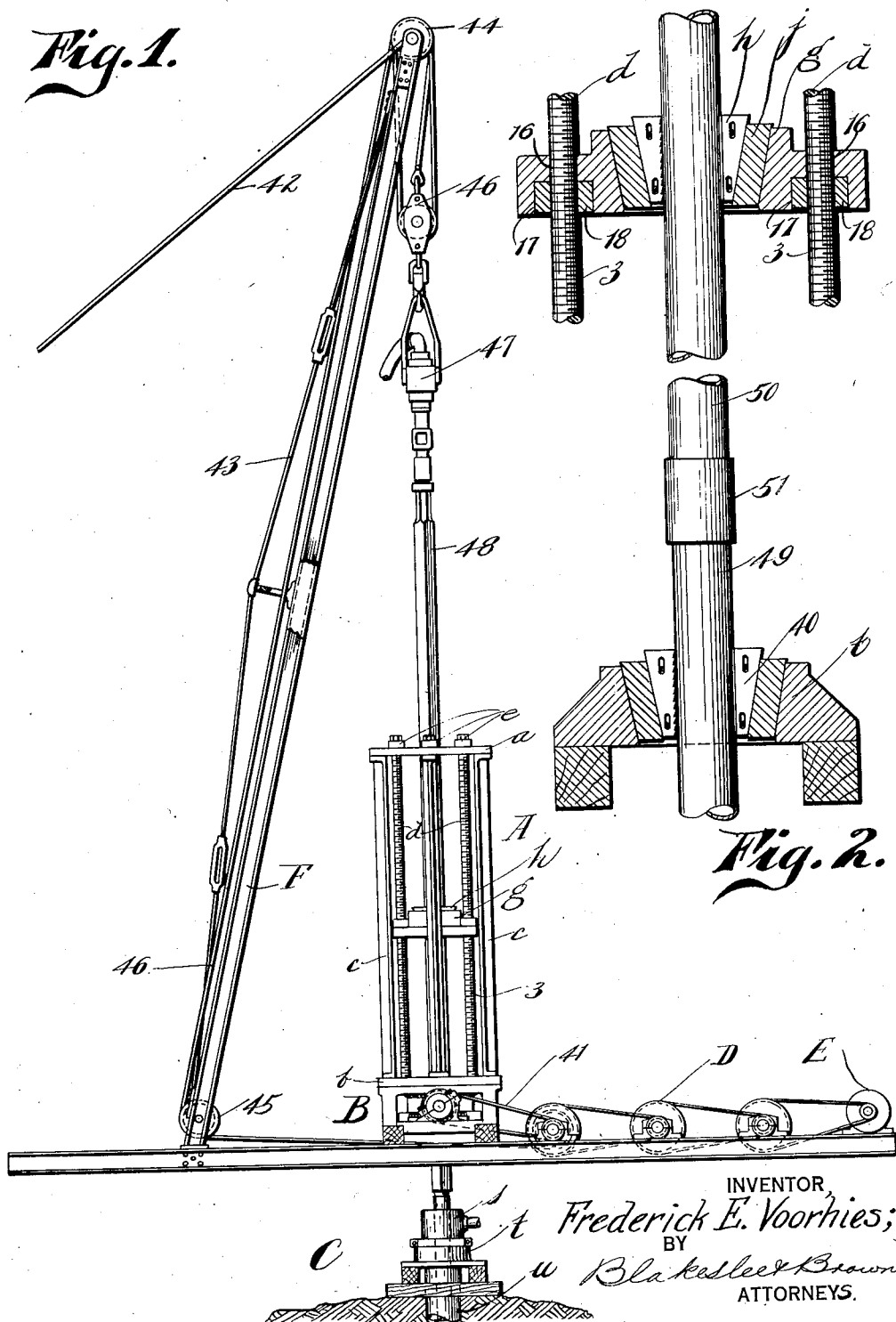
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F. E. VOORHIES

WELL APPARATUS

Filed July 15, 1925

2 Sheets-Sheet 1



Sept. 21, 1926.

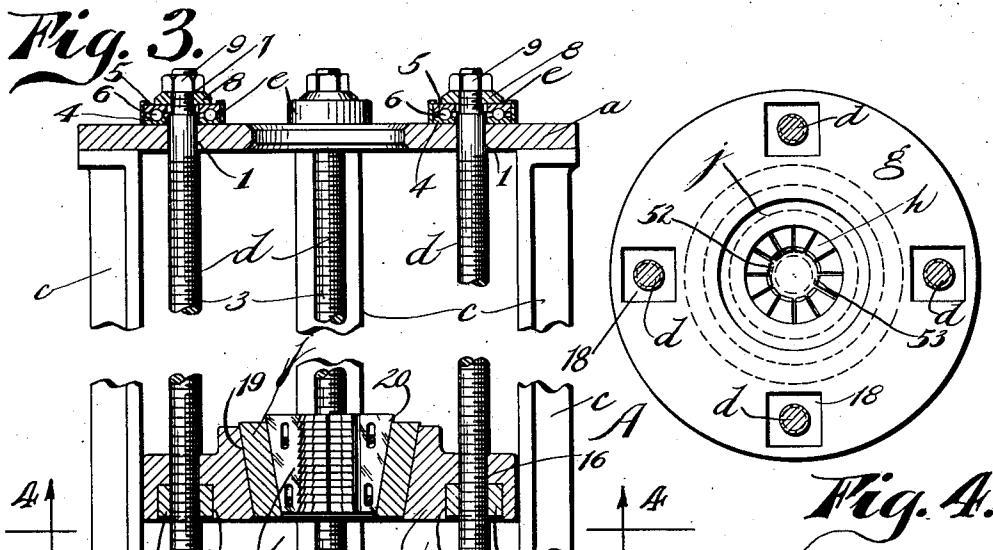
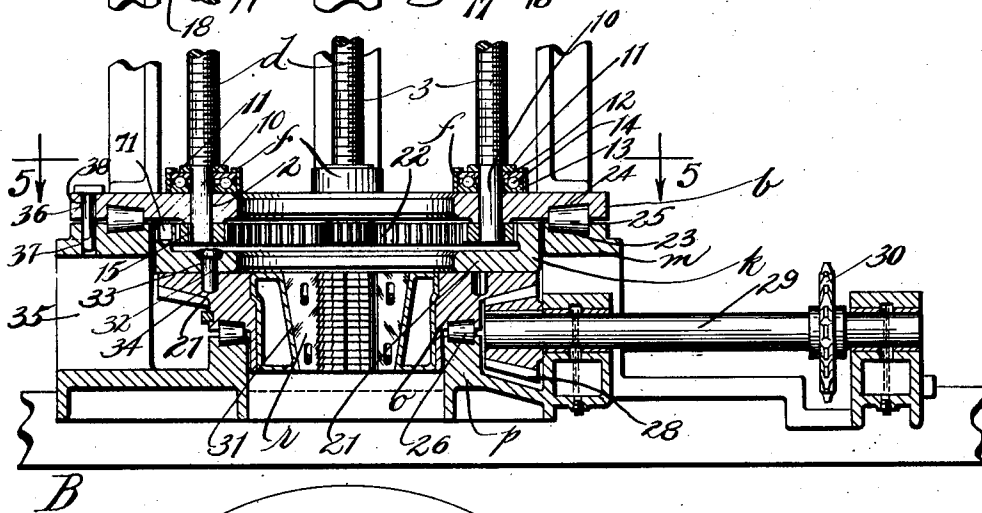
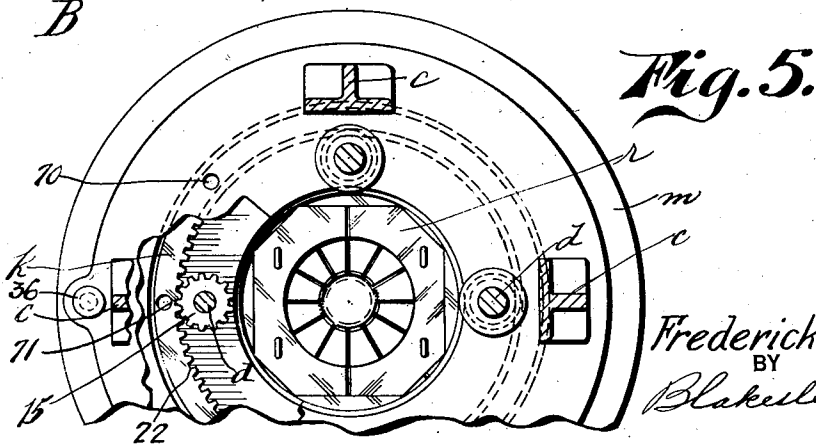
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WELL APPARATUS

Filed July 15, 1925

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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WELL APPARATUS.

Application filed January 15, 1925. Serial No. 2,560.

This invention relates to well apparatus, and has for an object the provision of a device which will handle strings of casing or tubing in a safe manner and which is so formed and constructed that the necessity for a rigid derrick system is entirely done away with, which device may be readily used for coupling or uncoupling long strings of casing without the necessity of providing external devices such as well tongs, and which is generally superior in point of relative simplicity and inexpensiveness of construction, taken in conjunction with utility, durability and general serviceability.

In practicing the invention and in one embodiment thereof, I contemplate using my improved device in conjunction with a rotary turn-table. Said device is so formed as to rotate bodily with such rotary turn-table or to remain stationary and directly above the turn-table. The device is so formed as to have a member adapted to engage and carry tubing, and which member is adapted to travel when the rotary turn-table is turned. Thus it is possible to lift strings of casing or tubing from a well hole and to stop movement of the rotary table, and by a simple change permit an uncoupling of a portion of such tubing from a remaining stand of tubing, transfer one stand to a rack or elsewhere, then lift a second stand of tubing, or to reverse the operation.

With the above mentioned and other objects in view, the invention consists in the novel and useful provision, formation, construction, combination, association and interrelation of parts, members and features, as illustrated in certain of its embodiments in the accompanying drawings, described generally, and finally pointed out in the claims.

In the drawings:

Figure 1 is an elevation of my improved device shown associated with a rotary turn-table, and with a mast device for holding a drilling stem;

Figure 2 is a fragmentary enlarged and vertical sectional view of certain features of the invention;

Figure 3 is a fragmentary vertical sectional view on an enlarged scale of a portion of the apparatus shown in Figure 1;

Figure 4 is a view taken on the line 4—4 of Figure 3; and,

Figure 5 is a fragmentary view taken on the line 5—5 of Figure 3.

Corresponding parts in all the figures are designated by the same reference characters.

Referring with particularity to the drawings, the improved device as an entirety is designated by A, and such device includes top and bottom annular plate members *a* and *b*, respectively, separated by uprights or standards *c*, of which there may be a plurality, as shown in the figures. In the showing four of such uprights or standards are provided, which uprights or standards are equidistantly spaced; that is to say, 90 degrees apart. Likewise in the showing of the device A the plates *a* and *b* are provided with transverse openings 1 and 2 respectively, and shafts *d* are adapted to have end portions thereof passed through such openings in the top and bottom plates *a* and *b*. In the showing four of such shafts are provided spacedly arranged 90 degrees apart with pairs of such shafts lying in the same plane as pairs of the uprights or standards *c*. The said shafts *d* are screw-threaded as shown at 3, and the top plate *a*, carries annular thrust bearings *e* for the upper end portions of such shafts *d*. One of such shafts *d* with its relation to elements *e* and *f* of the device will be described, it being understood that the remaining shafts are of the same construction, as are the elements *e* and *f* associated therewith. The thrust bearing *e* comprises a plate 4 formed with a ball-bearing race and an upper plate 5 likewise formed with a ball-bearing race with bearing members 6 between such races of the plates. The shafts *d* are reduced as to diameter and screw-threaded as shown at 7, and a block 8 is adapted to rest on the plate 6 with a nut 9 on the screw-threaded part 7 and bearing against the block 8. The opposite end of such shaft *d* is reduced in diameter as shown at 10, and is passed through the openings 2 in the bottom plate *b*. A thrust bearing *f* is provided for the bottom plate *b* and a collar 11 is carried on the reduced portion of the shafts and bears against the upper plate 12 of the thrust-bearing *f*, there being a bottom plate 13 for such thrust bearing, both of such plates 12 and 13 being formed with bearing races with roller members 14 between the races of such plates. The shaft likewise carries a pinion 15 which is keyed to the shaft.

An annular block member or spider *g* is formed to be carried by the shafts *d* and said spider member is provided with one or

more transverse bores 16. In the showing there would be four of such bores 16 arranged 90 degrees apart and such bores are enlarged as shown at 17, the enlarged portion receiving nuts 18 having a screw-threaded engagement with the screw threads of the shafts. The said spider is likewise formed with a tapered inner annular surface 19 so as to receive and carry slips or the like *h* which are provided with taper walls as shown at 20. In the showing a member *j* is interposed between the surface 19 of the spider *g* and the surfaces 20 of the slips *h*. It will be seen that the construction as described so far is a very rigid one, as the spider *g* tends to hold the shafts *d* in a given relation, and as certain of the shafts lie in the planes of the uprights or standards *c*, twist and side-sway, and the like, in the entire structure is practically done away with. Further members forming a part of the device include an internal gear *k* and an annular plate *m*. The annular plate *m* acts to confine the gear *k*, and which gear is formed with an annular flanged base 21. The teeth of such gear are shown at 22, and the pinions 15 associated with each shaft *d* are adapted to be in engagement with the teeth 22 of such gear *k*. The plate *m* is formed with an annular cone-shaped race 23. The plate *b* is likewise provided with an annular cone-shaped race 24 which lies in the same plane as the race 23, and received between such plates *b* and *m* and in the races thereof, are cone-shaped roller members 25.

The device A as just described is adapted to be used in conjunction with other well apparatus such as rotary apparatus. In the present embodiment the said device A is associated with the rotary turn-table, which turn-table as an entirety is designated as B. Such turn-table includes the turn-table member *o*, and a base member *p*, there being rollers 26 between such base and turn-table, the turn-table being provided with teeth arranged in annular formation as shown at 27, with which teeth a pinion 28 is adapted to mesh and which pinion is associated with a shaft 29, the shaft 29 in turn carrying a sprocket 30. The rotary draw-works will not be shown, but it is generally understood that a chain or a similar member is adapted to rotate the shaft 29 to rotate the turn-table *o*. As is customary, the turn-table *o* is provided with an inclined or beveled annular wall 31 so that the same may receive and carry slips *r*.

If it is desired to utilize the device A in conjunction with the rotary apparatus B just described, the annular gear *k* is placed on top of the turn-table *o*, and secured thereto by passing a pin or pins 32 through a transverse opening or openings 33 in the flanged base of such gear and into an open-

ing or openings 34 in the turn-table *o*. To support the device A above such turn-table there may be placed upon the base portion of such turn-table or integrally formed therewith pedestal members 35 which carry the member *m*. It is of course understood that the member *m* must be rigidly secured to such pedestals, and likewise that the pedestals must be suitably anchored to the base of the turn-table if such pedestals are not integrally formed with such base. Thus if the shaft 29 were rotated, which would rotate the turn-table *o*, the internal gear *k* would be rotated which would turn the pinions 15 and likewise turn the shafts *d*, and if some means were used to hold the plate *b* against movement, the block *g* would travel upwardly or downwardly upon the shafts *d*, dependent upon the direction of rotation of the turntable. Accordingly I have formed in the member *b* one or more transverse openings 36 which are adapted to align with one or more transverse openings 37 in the member *m*, and through such aligned openings I may pass a pin 38 for the purpose of locking the members *b* and *m* together to prevent rotation of the member *b*. Quite obviously by locking the member *b* against rotation the remaining structure of the device A, namely, the frame, which includes the uprights *c* and the top plate *a*, are prevented from bodily rotating.

It is customary in rotary apparatus to provide in the cellar portion designated as C a casing head *s* and a casing clamp *t*. It is thus possible to hold tubing which is shown in Figure 1 and designated as *u* by means of slips received in the casing clamp member such as illustrated in Figure 2 at 40.

In an adaptation of the invention as illustrated in Figure 1 I have provided a plurality of hoisting drums D, one of which may drive the rotary apparatus through the medium of a suitable chain or belt 41, said drums being driven by a motor or the like shown at E, and there may be placed adjacent the rotary turn-table and the device A a mast F suitably guyed by means shown at 42 and 43, with sheaves 44 and 45 journaled to such mast at upper and lower portions thereof, there being a cable 46 adapted to be wound or unwound on or over certain of the hoisting drums, with such cable passed over such sheaves 44 and 45 and connected with a traveling block 46, which traveling block in turn is connected with and supports a swivel 47 for rotary drilling apparatus, it being noted that the swivel in turn is associated with a drill stem 48 which is passed through the annular openings in the upper and lower plates *a* and *b* of the device A and through the opening in the spider *g* and through the turn-table base into the cellar portion C where it is connected with tubing through the medium of a tool joint.

The operation, uses and advantages of the device A are as follows: If we assume that it is desired to raise tubing from the well hole and to remove stands of such tubing for placement elsewhere, such as on racks, it will be noted that no complicated derrick system is necessary and stands of tubing designated as 49 and 50 connected by a coupling 51 may be held in a given position by means of the slips 40 in the clamp *t* located in the cellar C. If the spider *g* is in the position as illustrated, for instance, in Figure 1, the slips *r* may be removed from the turn-table *p*, the direction of rotation of the turn-table reversed, so that the shafts *d* may be turned to lower the spider *g*, it being noted that the pin 38 is holding the plate *b* against rotation. The slips *h* may then be inserted within the spider *g*, and the turn-table rotated so as to raise the spider *g* which will raise the stand or pipes or tubing from the well hole. I have assumed in this instance that the grief stem or drilling stem 48 has been removed. When the spider has reached its upward excursion or approximately upward excursion, the rotary table is stopped as to rotation and slips may then be inserted in the turn-table to hold the tubing, or in the clamp *t*. It may be noted at this time that the slips might remain in the clamp *t* during the upward movement of the tubing, although it is advisable to remove same to allow passage of the coupling 51 therethrough. Assuming that the slips have now been replaced in the clamp *t* to hold the tubing, and it is desired to disconnect a stand of tubing from a remaining stand, in other words, disconnect the tubing 50 from the tubing 49 at the coupling 51, the pin 38 is removed from between the members *b* and *m*.

Referring now to Figure 4 it will be observed that certain of the slips carried by the spider *g* are provided with vertical serrations, as illustrated at 52 and 53. Likewise there would be received in the clamp *t* slips similar to those shown at 52 and 53. The pin 38 is removed from the bores 36 and 37 and placed in aligned holes 70 and 71 in the members *b* and *k*. Thus upon turning the shaft 29 to rotate the turn-table the entire structure A would be revolved, which would tend to uncouple the tubing 49 and 50 from the coupling 51. It will be noted of course that the spider *g* is not traveling upwardly or downwardly, but is simply holding the tubing and the tubing is slipping through the same, it being noted that the teeth in the remaining slip members are formed to allow movement of the tubing in one direction only.

If it so happened that the screw threads of the tubing and the coupling were of the same pitch as the screw threads of the shafts *d*, the pin 38 might be replaced, and the un-

coupling of the tubing would be completed as before, but raised during the uncoupling. If it were desired to disconnect the tubing at the coupling portion and within the cellar portion C and simply use the slips *h* in the spider *g* for lifting the uncoupled stand of such tubing, the slips *r* in the turn-table might be utilized for this purpose, it being noted that certain of such slips are provided with vertical teeth, as illustrated in Figure 5. Similar slips would of course be provided in the clamp *t* and the pin 38 would be in position to hold the member *b* against rotation. When the turn-table was rotated the tubing would be uncoupled and the spider with its slips would lift the disconnected tubing upwardly. A hoisting block similar to that shown at 46 in Figure 1 might be utilized with other elements for removing the disconnected tubing.

The device A might be used with other apparatus to rotate the same and it would be seen that the device could be used for drilling operations, as it could hold drilling pipe or tubing and rotate the same for performing such drilling operation, it being understood of course that a bit would be associated with the tubing. Downward movement of such tubing during the drilling operation would be performed by locking and unlocking the plate *b* so as to cause or not cause travel of the spider *g*.

A device of the character just described does away with the necessity of providing a complicated derrick system, as it often happens that the cables used for supporting tubing break or the derrick collapses under the terrific strain of lifting tubing. The shafts *d* may of course be placed under compression by tightening nuts 9, so that the chief strain is borne by the framing or up-rights *c*. The size or height of the device A is not material, although it should be of a sufficient height to readily lift a stand of tubing so that an uncoupling operation may be performed. It is of course possible to raise a stand of the tubing a certain height, then hold the stand by slips in the turn-table or in the clamp *t*, reverse the movement of the turn-table so as to lower the spider *g*, then re-insert the slips *h* within the spider *g* and repeat the operation of lifting the stand of tubing.

It is obvious that various changes and modifications and variations may be made in practicing the invention, in departure from the particular showing thereof, without departing from the true spirit of the invention.

Having thus disclosed my invention, I claim and desire to secure by Letters Patent:

1. The combination with a rotary turn-table, a framing approximately perpendicular with respect to the top of such turn-

table, and means whereby said framing may be caused to rotate when the rotary table is turned; further means being provided for holding such framing against rotation when the turn-table is turned.

2. In combination with a rotary turn-table, an internal gear mounted on said turn-table, top and bottom plates, and up-rights extending there-between, a screw-threaded shaft extending between said top and bottom plates, a pinion carried on said shaft and adapted to mesh with the teeth of said internal gear, and a spider mounted on said screw-threaded shaft, whereby when the rotary turn-table is turned the internal gear is turned to rotate the pinion and the shaft to cause movement of the spider.

3. The combination with a rotary turn-table having a base member, of framing mounted approximately perpendicular with respect to the top of the turn-table, said framing including top and bottom plate members spaced apart and intermediate up-rights between said plate members, equidistantly spaced screw threaded shafts extending between said top and bottom plate members, pinions mounted on the ends of said shafts, an internal gear carried on the turn-table, and rollers between the turn-table base and said bottom plate member.

4. The combination with a rotary turn-table having a base member, of framing mounted approximately perpendicular with respect to the top of the turn-table, said

framing including top and bottom plate members spaced apart and intermediate up-rights between said plate members, equidistantly spaced screw-threaded shafts extending between said top and bottom plate members, pinions mounted on the ends of said shafts, an internal gear carried on the turn-table, a spider carried on said screw-threaded shafts and adapted for travel on said shafts, and means whereby said framing and spider may rotate when the turn-table is rotated.

5. The combination with a rotary turn-table having a base member, of framing mounted approximately perpendicular with respect to the top of the turn-table, said framing including top and bottom plate members spaced apart and intermediate up-rights between said plate members, equidistantly spaced screw-threaded shafts extending between said top and bottom plate members, pinions mounted on the ends of said shafts, an internal gear, in mesh with the pinions carried on the turn-table, a spider carried on said screw-threaded shafts and adapted for travel on said shafts, and means whereby said framing and spider may rotate when the turn-table is rotated; further means being provided for maintaining the framing against rotation to rotate the shafts and cause movement of the spider.

In testimony whereof, I have signed my name to this specification.

FREDERICK E. VOORHIES.