J. H. WILSON.

CASING PULLING APPARATUS.

APPLICATION FILED FEB. 23, 1921.

1,398,822.

Patented Nov. 29, 1921.

4 SHEETS—SHEET 1.

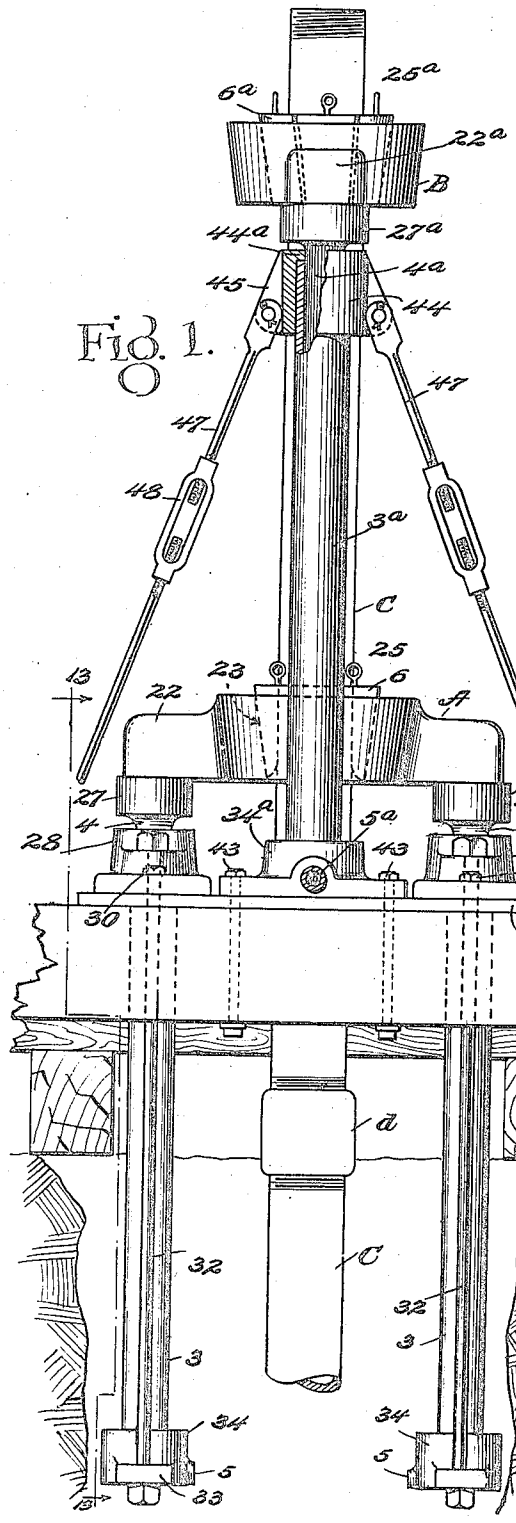


Fig. 1.

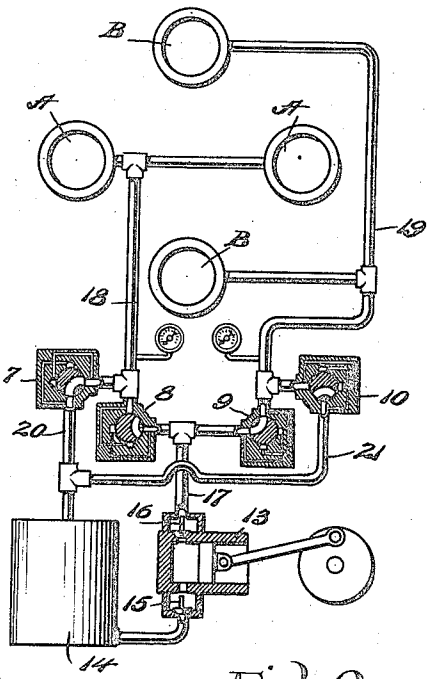


Fig. 2.

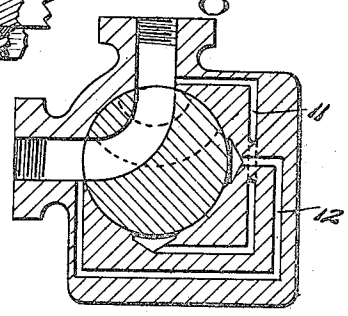


Fig. 10.

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4 SHEETS—SHEET 2.

Fig. 3.

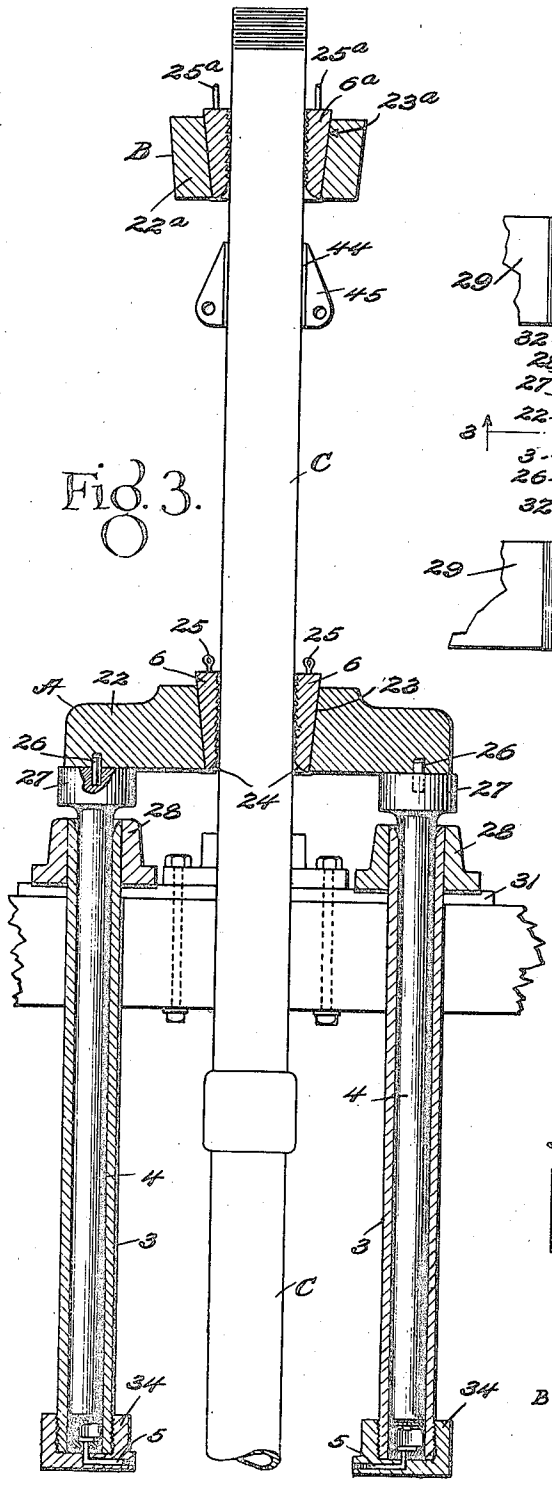


Fig. 4.

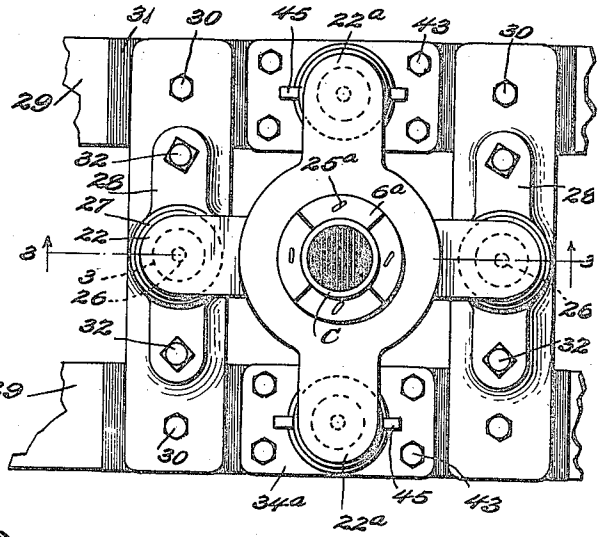
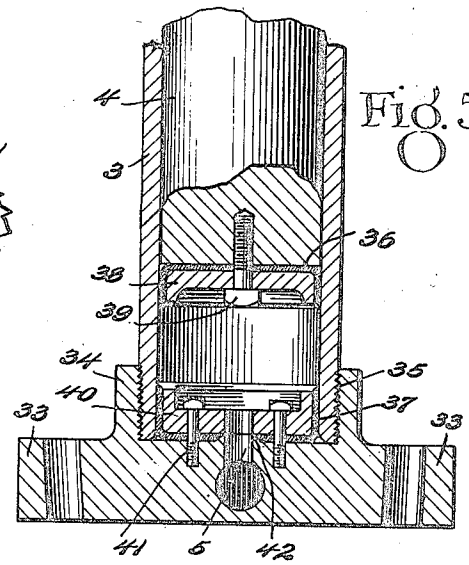


Fig. 5.



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4 SHEETS—SHEET 3.

FIG. 6.

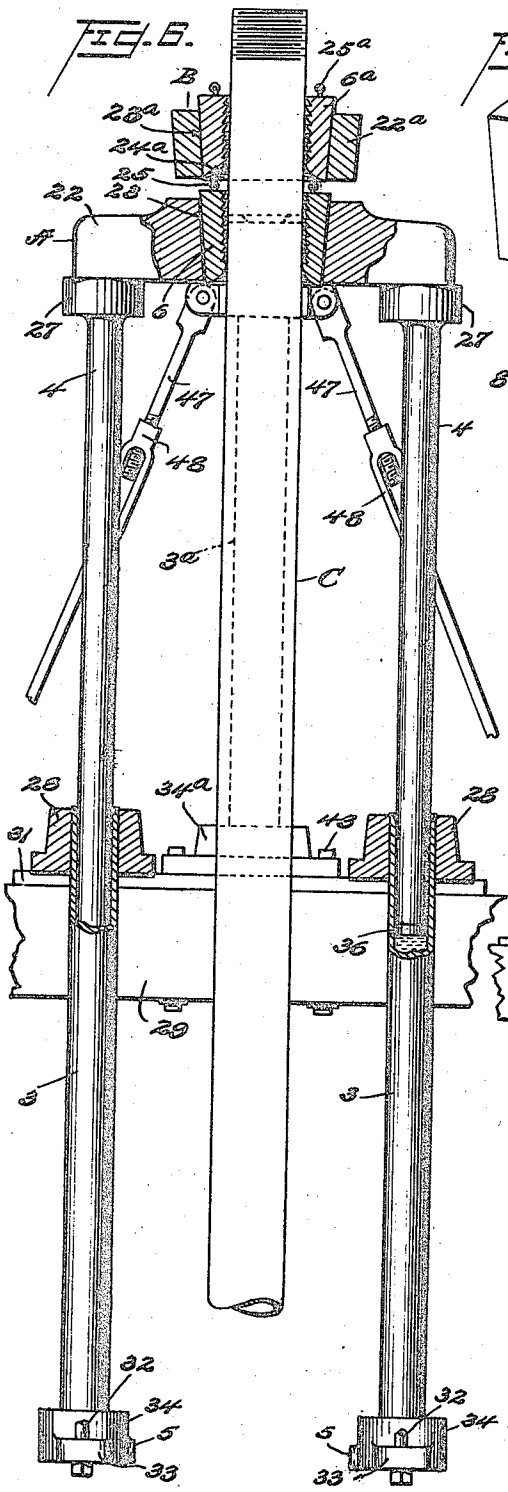


FIG. 9.

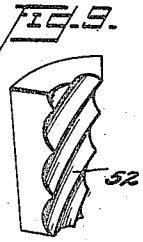
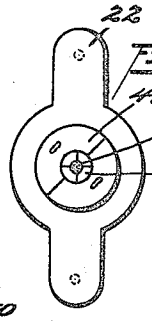


FIG. 8.



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CASING PULLING APPARATUS.

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4 SHEETS—SHEET 4.

FIG. 11.

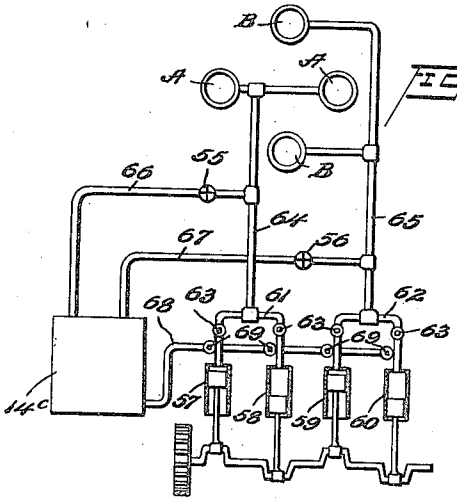


FIG. 12.

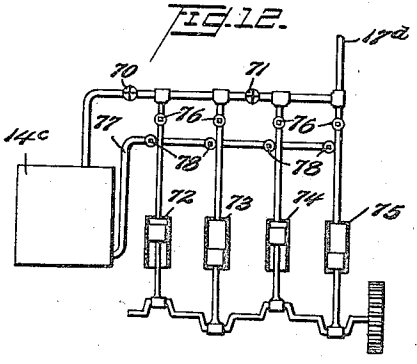


FIG. 13.

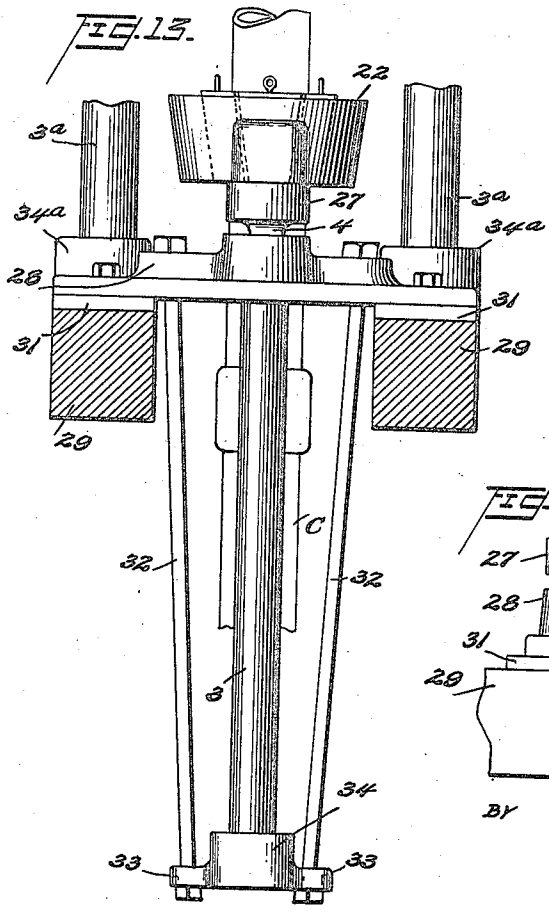


FIG. 14.

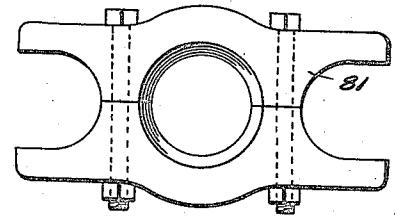
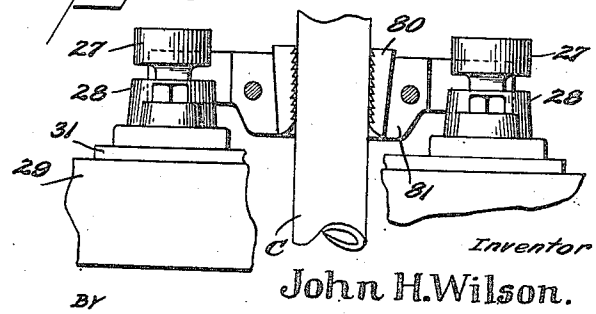


FIG. 15.



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UNITED STATES PATENT OFFICE.

JOHN HART WILSON, OF BURKBURNETT, TEXAS.

CASING-PULLING APPARATUS.

1,398,822. Specification of Letters Patent. Patented Nov. 29, 1921.

Application filed February 23, 1921. Serial No. 447,054.

To all whom it may concern:

Be it known that I, JOHN HART WILSON, a citizen of the United States, and resident of Burkburnett, in the county of Wichita, State of Texas, have invented certain new and useful Improvements in Casing-Pulling Apparatus, of which the following is a specification.

The present invention relates to apparatus for withdrawing pipes or well casings from the ground. In sinking or boring oil wells and gas wells it is necessary to insert into the ground a pipe or casing to prevent the surrounding earth from flowing into the cavity excavated by the boring tool and these pipes or casings, particularly in oil wells, are often of great length, sometimes several thousand feet long, the pipe being formed in sections and jointed together. Upon abandonment of such wells either upon cessation of flow of oil or gas or because of the fact that oil or gas was not encountered in the boring operations, it is usually the practice to remove the piping used in sinking the well, which may be disconnected at the joints and re-used at other places in well drilling, or for other purpose.

Heretofore the removal of such piping has been effected by various mechanical means, as for instance by windlass mechanism and by hydraulic jacks. Where hydraulic jacks have been used it has been customary to position the jack adjacent the top of the casing, the movable member of the jack being provided with devices for gripping the casing upon its upward movement and releasing the same upon its downward movement, so that the casing has an intermittent upward motion. The removal of well casings by the various devices heretofore designed or suggested has involved the expenditure of a considerable time, usually several days for a single well, and such prior apparatus has not been entirely successful in removing the entire well casings, especially in deep wells and where the casings have been in the ground for a considerable length of time. To dislodge or loosen from the ground a well casing of great length requires a tremendous initial force and where this force is exerted entirely at the top of the casing there is a strong probability that the casing may break at some point along its length, the tensional stresses in the metal having become too great for it to withstand. This causes delay and often entire loss of the piping below the point of fracture.

An object of my present invention is to provide a casing pulling apparatus by means of which a pulling force may be exerted at two widely separated points along the casing, for instance at the top of the casing and at a point near its lower end, so when the great initial force which is necessarily exerted to loosen the casing from the ground is applied, the probability that the casing may part at an intermediate point will be greatly decreased.

Another object of the invention is to provide an apparatus by means of which a casing may be withdrawn speedily from the earth. It is desired that the casing be removed as rapidly as possible and for accomplishing this end I have provided means whereby casings may be withdrawn with a practically continuous movement instead of an intermittent movement, the withdrawal of the casing being halted only for the purpose of disconnecting the pipe joints above the surface of the ground.

Another object of the invention is to provide apparatus of the character indicated which may be adjusted to give a tremendous initial pulling force at the beginning of the operation, when such force is needed, and to give a smaller but more continuously acting pulling force when the withdrawing operation is well under way; and the casing is being freely withdrawn from the earth, and without the provision of an additional power plant for this purpose.

The objects of the invention may be accomplished by apparatus of widely differing detail constructions and in the following specification I describe one embodiment of the invention by way of example. In this embodiment fluid pressure is used to operate two jacks the movable members of which are adapted to be connected by suitable gripping devices to the casing. These jacks are independently operable and may be simultaneously actuated to exert a combined pull on the casing or may be independently operated to exert a practically continuous pull, depending upon the force to be overcome in the withdrawing operation. The use of hydraulic jacks is desirable inasmuch as they provide a powerful though light and

compact power means but it will be understood that the two casing gripping devices may be simultaneously or independently moved by other means, within the scope of the invention.

Another feature of the invention resides in the provision of novel fluid compressing means for supplying fluid under pressure to the jacks. Still another feature of the invention resides in the combination of the various parts to secure a compact and easily transportable apparatus which may be moved without difficulty from point to point through rough country such as is usually met with in localities where oil drilling operations are carried on.

Other objects of the invention and advantages will be apparent as it is disclosed in the specification and drawings.

In the drawings:

Figure 1 is a side elevation of the improved casing pulling apparatus, portions being broken away, showing the two hydraulic jacks in position to exert a combined lifting effort on the casing;

Fig. 2 is a diagram of the fluid compressing and supply means showing the valve mechanism by which the movements of the pistons of the hydraulic jacks are controlled;

Fig. 3 is a vertical section through the casing pulling apparatus, taken on line 3—3 of Fig. 4 the pistons of the hydraulic jacks being in the positions in which they are shown in Fig. 1, certain braces being omitted for clearness of illustration;

Fig. 4 is a plan view of the casing pulling apparatus;

Fig. 5 is a section through the lower end of one of the hydraulic cylinders, drawn to a larger scale, and showing how both the cylinder and plunger are armed against the escape of fluid;

Fig. 6 is a vertical section through the apparatus, parts being in elevation, showing the pistons of the lower jack at the completion of a lifting stroke and about to return, and the pistons of the upper jack in position to begin a lifting stroke;

Fig. 7 is a view on the order of Fig. 3, parts being shown in elevation however, illustrating the apparatus arranged to exert an initial simultaneous pull on both ends of the casing;

Fig. 8 is a horizontal section taken on the line 8—8 of Fig. 7;

Fig. 9 is a detail perspective view of one of the cable slips, used in connection with the upper hydraulic jack;

Fig. 10 is a detail horizontal section of one of the control valves, illustrating the arrangement of ports whereby the pressures on opposite sides of the valve plug are balanced to make turning easy;

Fig. 11 is a diagrammatic illustration of a multi-cylinder compressor especially adapted for operating the jacks, this construction being alternative to the construction illustrated in Fig. 2;

Fig. 12 is a diagram of another form of multi-cylinder compressor, to be used in connection with the valve mechanism shown in Fig. 2;

Fig. 13 is a vertical section on the line 13—13 of Fig. 1, and

Figs. 14 and 15 are two views of an attachment.

Usually, the uppermost end of the casing to be pulled terminates approximately flush with the ground surface as shown in Fig. 1. The present embodiment of the casing pulling apparatus comprises the jacks A and B, one above the other and in order to provide something to which these jacks may be connected to start the casing C, a short length of pipe or casing *c* is screwed into the coupling *d*.

The jack A comprises two cylinders 3, in each of which there is a plunger 4. Fluid under pressure is admitted at the inlets 5 to force the plungers upwardly, these in turn acting to raise the spider or casing ring 22 on top, and when this happens, the slips 6 in the spiders exert a powerful gripping action on the casing. The jack B, though differently supported, operates in a similar manner and in starting the casing it is intended to exert the combined lifting power of both hydraulic jacks, thus operating them in unison, but only so long as is necessary to overcome the tremendous initial friction on the casing due to the adhesion of the earth, and to break a path ahead of the couplings.

After this has been accomplished, that is to say, after the casing has been started, the pairs of hydraulic jacks are subsequently operated alternately, this operation consisting in a pull first by jack B, then by jack A, again by the jack B, and so on in alternation, resulting in a practically continuous pull on the casing until the whole pipe is lifted out, the movement being halted however from time to time to allow the uncoupling of the uppermost pipe section.

The simultaneous or alternate operations of the jacks are produced by certain adjustments of the valves shown in Fig. 2. Four valves are shown, 7, 8, 9 and 10. These are operated manually, one at a time. Although not so shown, the reader should understand that each valve plug is provided with a handle by which the valve is turned either off or on. Ports 11 and 12 are arranged to transmit the fluid pressure to the sides of the plug opposite the main inlet and outlet ports so that the pressures on the plug will be balanced, enabling it to be easily turned.

In Fig. 2 the two pairs of cylinders are indicated at A—A and B—B. Any suitable type of compressor 13 provides fluid under

pressure for the system, the fluid returning from the system into the reservoir 14, and passing through the pump and past check valves 15 and 16. To operate both jacks in unison so that the combined lifting force may be exerted on the casing, the valves 7 and 10 are closed and valves 8 and 9 opened.

In passing, attention is directed to the diagrammatic Figs. 11 and 12. These disclose multi-cylinder compressors which may be used instead of the single cylinder compressor 13 disclosed in Fig. 2. The arrangement in Fig. 11 does away with two of the valves shown in Fig. 2, only two valves being required for the effectual operation of the jacks. It is not intended to describe these diagrams in detail at this place but attention is directed to the detailed description of each which follows, from which the advantages of the respective arrangements will readily become apparent.

When the apparatus has been set up in operative position and it is desired to commence the withdrawal of the casing the first step will be to start the compressor 13, it being understood that the pistons of jacks A and B are in their lowermost positions and that valves 7, 8, 9 and 10 are open. With the valves in this position the fluid passes from the compressor through pipe 17, valves 8, 9 and 7, 10 and into the storage tank 14 through pipes 20 and 21 respectively. A slight pressure will be exerted in the cylinders to raise the pistons inasmuch as these cylinders are not actually cut off from the compressor, but this pressure is negligible. In loosening the casing it is desired to operate both jacks simultaneously and valves 7 and 10 are therefore both closed so that the fluid from the compressor exerts its pressure on the pistons. When the pistons have been sufficiently elevated valve 9 is closed and valve 7 opened immediately after the closing of valve 9. The fluid beneath the pistons of jack B is now locked and these pistons will remain in raised position holding the casing against a return movement, but the pistons of jack A will fall due to their own weight and the weight of the spider mounted on their upper end, inasmuch as valves 7 and 8 are now both open.

When the pistons of jack A have fallen to their lowermost positions, valve 10 is opened whereupon the pistons of jack B will start to descend. This descending motion will allow the casing to fall a slight distance but it will be quickly gripped by the slips of jack A which can no longer move downwardly inasmuch as the upper ends of the pistons of this jack are now supported upon the head casting 28. When the pistons of jack B have fallen to their lowermost positions both sets of pistons may again be driven upwardly to exert their combined pull, upon the closing of valves 7 and 10 and the opening of valve 9. This combined operation of the two jacks may be continued as long as necessary.

When it is thought that one jack will have sufficient force to perform the lifting operation the valve 8 is closed and valve 7 opened in the middle of a lifting stroke of the pistons, leaving valve 10 closed and valve 9 open. The pistons of jack A will then fall while the pistons of jack B will rise twice as rapidly as before, due to the fact that the entire supply of fluid is entering the cylinders of jack B. When the pistons of jack A have reached the bottom of their strokes valve 7 is closed and when the pistons of jack B are near the upper limit of their working strokes valve 8 is opened slowly so that the gripping devices of jack A will take hold of the casing. Valve 8 is now opened fully, valve 9 closed, and valve 10 opened, whereupon the pistons of jack B will fall while the pistons of jack A move upwardly. When the pistons of jack B are at the lower limit of their movement valve 10 is closed and when the pistons of jack A are again near the upper limit of their movement valve 9 is opened, valve 8 closed, and valve 7 opened so that these pistons may again fall. This cycle of operations may be continued until the pipe has been withdrawn from the earth, the operation being stopped only to uncouple the lengths of pipe as they emerge.

The stationary slips 80 in the spider 81 which is illustrated in Fig. 14 will serve to prevent the casing from falling in case that both gripping devices are moved downwardly at the same time, whether by accident or intent. The use of these slips may be dispensed with if desired, the spider 81 being easily removable from the apparatus, but in case it is desired to frequently operate the jacks to exert a combined pull this additional gripping device will be found of value. It will also be useful when it is not found desirable to operate the jacks singly in the manner above outlined. These stationary slips prevent the falling back of the casing at all times and it will not therefore be necessary to positively grip the casing by the gripping device which is at the lower limit of its movement before the gripping device which is at the upper limit of its movement can be lowered.

It has been stated that all of the valves are operated manually and singly, preferably so because mechanism designed to produce a certain differential action in the operation of the valves would be complicated. This differential action is best described by briefly reviewing the preferred mode of operation. Take the position in Fig. 6. Instead of waiting until the instant when the pistons of upper jack B and lower jack A commence their upward and return movements respectively, to reverse the

valves, the valve 9 should be slowly opened while the pistons of jack A are still performing their upward strokes and the valve 8 is still open.

This gives the slips of the upper jack B an opportunity to secure a grip on the casing, and obviates any tendency of the casing to slide back pending the securing of this grip. The operator should now watch the lower jack A and when he finds that the pistons of the jack have reached the limit of their intended movement, must open the valve 7 to let them fall back while the pistons of jack B continue their upward movement, the oil or fluid from the hydraulic cylinders of the jack A returning by virtue of the weight of the parts superposed on the fluid column.

Extending across the tops of the pistons of jack A is a heavy casting or spider 22 with a conical opening 23 in which the slips 6 fit. These slips consist of four, six or any other desired number of sections, tapered on the outside to correspond with the opening 23, and toothed on the inside to secure a firm hold on the casing. The slips are rounded at 24 at the bottom to facilitate riding over a coupling, should such be in the way of the slips when the pistons return to the lower position, and each is provided with an eyebolt 25 so that it may readily be lifted out.

Dowel pins 26 keep the spider 22 in proper relationship with the plungers 4 the heavy spider not being otherwise secured in position. The cylinders 3 have a driving fit in each of the head castings 28 which bridge the sills 29 to which they are bolted at 30. These sills constitute the foundation or stationary member above and below which the hydraulic jacks are erected. This arrangement is of considerable importance in that it makes for the saving of such room, because obviously were the pairs of jacks situated one above the other and above the foundation, the place where the final unscrewing of the casing sections must be done, would be objectionably high in the air. The ends of the head casting rest on metal plates 31 which keep the castings from wearing or bearing into the wooden sills at the places where they would otherwise come.

Depending from the thickened parts of the head castings adjacent to the places where the cylinders 3 are driven in, are stay bolts 32 which extend through ears 33 at opposite sides of the foot castings 34. When fluid is admitted to the bottom of each hydraulic cylinder, the pressure exerted between the plunger and the foot castings is naturally very great. The stay bolts 32 transfer the pressure; which would otherwise tend to force the foot and head castings away from the body portion of the cylinders and impose a tension on this portion, to the head castings above, and so to the sills 29, which are amply strong to withstand it.

Means is provided for preventing the fluid from leaking past the plunger and also past the threads 35 at the place where the cylinder is screwed into its foot casting. Such provision is illustrated in Fig. 5. Ordinary cup washers 36 and 37 are used on the plunger and at the bottom of the cylinder respectively. The upper washer is retained by the plate 38 by means of the bolt 39. The lower cup washer 37 is secured by the plate 40 and bolts 41.

Adjacent the inlet 5 there is a circumferential ridge 42 against which the margin of the circular opening in the middle of the cup washer 37 is compressed when the bolts 41 are screwed home. This results in the margin being beveled in cross section as shown, but by virtue of the compression of the material around the circumferential ridge, a very tight joint is provided, preventing the escape of any fluid to either side of the cup washer. The purpose of the bottom washer 37 is to prevent any fluid from getting out toward the threads 35 and exerting a pressure on the lower rim of the hydraulic cylinder. The upper edge of the cup washer is also beveled or feathered so that the pressure exerted against the beveled surface will tend to further press the wall of the washer against the wall of the cylinder and thus make it more difficult for the fluid to escape. The upper jack B is similar to the lower jack A except for certain de-details, and different means for supporting it on the base, comprising hydraulic cylinders 3^a, plungers 4^a, inlets 5^a, etc. The spider 22^a of the upper jack stands at right angles to the spider 22 below. This is shown in Fig. 4. The cylinders 3^a are screwed into foot castings 34^a, but these are secured directly to the sills 29 by screw bolts 43 instead of being suspended by stay bolts as is the case in respect to the foot castings 34.

Now with respect to the difference in construction found in connection with the upper pair of jacks, the hydraulic cylinders 3^a are each capped at 44, and these caps are furnished with internal flanges against which the hydraulic cylinders abut so as to take the strain from the fit between the two. The caps are shrunk on and each is provided with lateral ears 45 between which and eyebolts 46 in the sills, guys 47 are fitted. The desired tension of the guys is secured by means of the turn-buckles 48.

In Fig. 7 the apparatus is illustrated as it would be arranged to exert a pull on both the top of the casing and the bottom simultaneously. For this purpose the casing gripping slips of the upper jack B are removed and replaced by a sectional filler

block 49 in the tapering opening 23 of the spider 22.

Slips 50, considerably smaller than the casing slips 6 or 6ª, are fitted into a tapering opening 51 in the filler block, and these are grooved at 52 to fit the strands of the cable 53 and insure a good grip thereon without cutting the strands. At the lower end of the cable there is a casing spear 54 of any appropriate type, but preferably of the trip-spear type, as shown in Fig. 7. The two parts of the figure are to be read as connected along the lines *a*—*b*.

In starting a casing the trip-spear 54 is let down to the lower extremity of the casing where a grip is secured on one of the lowermost sections. A grip is secured on the upper extremity of the casing by means of the slips of the lower pair of jacks A.

The jacks A and B are now operated to exert a combined pull on both the cable 53 and the top of the casing, so as to insure the loosening of the casing throughout its entire length. According to methods of casing pulling heretofore employed, no provision is made for applying the forces at both the upper and lower extremities of the casing simultaneously.

This method of exerting pulling forces on the casing serves well under circumstances where it is thought there might be a possibility of the casing parting near the top. In such circumstances, the cable spear 54 is used, and in operation the effect is to pull on the upper end of the casing and push on the lower end. After the casing has been started, the spear 54 may be tripped and withdrawn and the pulling operation completed with the slips replaced in jack B, as shown in Fig. 1.

As a preliminary step to the operation for pulling the casing with the internal and external gripping members arranged to exert a combined pull it is desirable to stretch the cable so that the jacks A and B exert substantially equal forces on the casing. To accomplish this the jack to which the cable is secured is operated by itself, after the spear 54 is in position, and the spider 22ª raised to its uppermost position. The cable is then gripped or held by any convenient means, as by a hook or clamp suspended from a derrick to hold it taut and the spider lowered to again grip the cable at the bottom of its stroke. If necessary this action may be repeated two or three times to obtain the desired tension in the cable before the two jacks are simultaneously operated to give a combined pull on the casing.

In Fig. 11 a diagram of a fluid distribution system is shown, which system has some advantages over that shown in Fig. 2, in that here only two valves 55 and 56 are employed, whereas there four valves are employed. The former are exhaust valves. A multi-cylinder compressor or two separate compressors are used, those 57, 58 and 59, 60 constituting pairs, are connected by manifolds 61 and 62 with check valves 63.

Pipes 64 and 65 lead from the manifolds 61 and 62 to the jacks A and B respectively, pipes 66 and 67 leading from the other side of the valves 55 and 56 in those pipes, discharging into the reservoir 14ᵉ which would be the equivalent of the reservoir in Fig. 2. An inlet or supply pipe 68 has a common connection with all cylinders of the compressor, there being, however, a back check valve 69 at each cylinder to produce a flow of fluid from the reservoir in to the cylinders on a suction stroke of the piston but prevent that fluid flowing back on the discharge stroke.

In operation, all cylinders of the compressor pump fluid into the distribution system, but only one or the other set of cylinders may be effective in elevating the pistons of the hydraulic jacks, depending on whether the valves 55 and 56 are open. Should it be desired to operate jack A, the valve 55 is closed. Fluid is now introduced into the lowermost jack from the corresponding pair of cylinders 57, 58. Each set of cylinders comprises a separate compressor.

The other pair of cylinders are also pumping fluid, but should the valve 56 be opened, the preponderance of fluid will enter the reservoir 14ᵉ and so not operate the jack B which might be said (for the purpose of illustration) to be then making a return stroke. Naturally, upon closing both valves 55 and 56, the whole output of the multi-cylinder compressor will operate both of the jacks in unison, thereby producing the combined lifting effort spoken of above. The reader needs only to be reminded that with this arrangement the operator has to care only for two valves, making the manipulation of the casing pulling apparatus less intricate.

The compressor shown in Fig. 12 may be connected in place of the compressor 13, Fig. 2, the pipe 17ᵈ in this view corresponding to the pipe 17 in Fig. 2. Instead of a single cylinder compressor, there is now a four-cylinder compressor. The pipe 79 is provided with two cocks 70 and 71 by means of which either one pair or both pairs of the cylinders 72, 73 and 74, 75 may be made to discharge their contents into the circulation system disclosed in Fig. 2. The discharge pipe of each cylinder has a back check valve 76, while the common supply pipe 77 from the reservoir 14ᵈ also has a back check valve 78 adjacent each inlet of each cylinder.

The multi-cylinder compressor is intended to operate continuously while the casing pulling operation goes on. It may be found necessary under some circum-

stances to employ only the first pair 74, 75 of the cylinders to operate the hydraulic jacks. In such case, the cock 71 closed, the cock 70 opened. The fluid from the first pair will now discharge into the system leading to the jacks, while that from the other pair will discharge into the reservoir 14^d by way of the pipe 20^d.

When the output of all four cylinders is intended to be utilized, the cock 70 is closed and the cock 71 opened. Fluid is now prevented from returning to the reservoir by way of the pipe 79, all being introduced into the circulation system for either the combined or alternate operation of the pair of jacks.

Certain other component parts of this apparatus have been omitted from the drawings and specification of this invention for the purpose of simplicity; or because they are covered by other applications for patents; or because they are not considered new in the art. Included among these are necessary platforms and control stands for the use of workmen in operating same, means for unscrewing the joints of pipe or casing as they are withdrawn, means for handling and disposing of the joints of casing when they are removed; means for handling the wire cable and other parts of spear used for pulling at the bottom end of casing; means for cutting off or shooting off the bottom joints of casing when it is found otherwise impossible to withdraw the entire string; and other necessary or useful appurtenances for use in connection with this invention.

While the construction and operation of the improved casing pulling apparatus as herein described and claimed, is that of a generally preferred form, obviously modifications and changes may be made without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. Apparatus for withdrawing well casings comprising, in combination, a plurality of casing gripping devices, and means for independently operating said devices to effect longitudinal movement of the casing.

2. Apparatus for withdrawing well casing comprising, in combination, a plurality of casing gripping devices, and fluid operated means for independently operating said devices to effect longitudinal movement of the casing.

3. Apparatus for withdrawing well casings comprising, in combination, a plurality of casing gripping devices, and power means associated with each of said devices whereby they may be independently operated to effect longitudinal movement of the casing.

4. Apparatus for withdrawing well casings comprising, in combination, a plurality of casing gripping devices, and a hydraulic jack associated with each of said devices whereby each may be operated independently of the other in effecting longitudinal movement of the casing.

5. Apparatus for withdrawing well casings comprising, in combination, a plurality of casing gripping devices, and means for independently operating said devices whereby they may be simultaneously or alternately operated in effecting longitudinal movement of the casing.

6. Apparatus for withdrawing well casings comprising, in combination, a plurality of vertically reciprocable devices for gripping a casing, said devices being spaced vertically and each adapted to grip the casing when raised and to release the casing when lowered, and means for independently reciprocating said devices vertically to effect the longitudinal movement of the casing.

7. Apparatus for withdrawing well casings comprising, in combination, a plurality of vertically reciprocable devices for gripping a casing, said devices being spaced vertically and each adapted to grip the casing when raised and to release the casing when lowered, and fluid operated means for independently reciprocating said devices to effect the longitudinal movement of the casing.

8. Apparatus for withdrawing well casings comprising, in combination, a plurality of vertically reciprocable devices adapted to grip the casing when moved vertically upward and to release the same when moved vertically downward, and a hydraulic jack associated with each of said devices for effecting its vertical reciprocation.

9. Apparatus for withdrawing well casings comprising, in combination, a plurality of vertically reciprocable devices adapted to grip the casing when moved vertically upward and to release the same when moved vertically downward, a hydraulic jack associated with each of said devices for effecting its vertical reciprocation, said jacks being supported one above the other and upon a common base.

10. Apparatus for withdrawing well casings comprising, in combination, two vertically reciprocable members, means for effecting vertical reciprocation of said members, means associated with one of said members for gripping the casing adjacent the ground level and means associated with the other of said members for gripping the casing below the surface of the ground, said members being adapted to be simultaneously raised.

11. Apparatus for withdrawing well casings comprising, in combination, means for gripping a casing at a plurality of widely separated points and means for simultaneously raising said casing gripping means to effect a longitudinal movement of the casing.

12. Apparatus for withdrawing well casings comprising in combination, a plurality

of casing gripping devices, one of which is adapted to grip the portion of the casing which projects above ground and one of which is adapted to grip the interior of the casing below the surface of the ground, and means for effecting a simultaneous upward vertical movement of said gripping devices.

13. Apparatus for withdrawing well casings comprising in combination, a plurality of vertically movable casing gripping devices one of said devices being adapted to grip externally the portion of the casing which extends above the ground and one of which is adapted to grip the casing internally at a point below the ground, and an independently operable hydraulic jack associated with each of said gripping devices.

14. Apparatus for withdrawing well casings comprising, in combination, a plurality of reciprocable casing gripping devices, a hydraulic jack associated with each of said devices whereby they may be independently operated in effecting the withdrawal of a casing, and a common support for said jacks.

15. Apparatus for withdrawing well casings comprising, in combination, two reciprocable casing gripping members, a base, and two hydraulic jacks supported on said base, one jack being connected to each gripping member for reciprocating the same, one of said jacks being supported above and the other suspended from said base.

16. Apparatus for withdrawing well casings comprising, in combination, two vertically reciprocable casing gripping members, a hydraulic jack connected to each of said members for independently reciprocating the same in the longitudinal withdrawal of a casing, and a common support for said jacks, one jack having its base resting on the support and extending upwardly therefrom and the second jack having its upper end secured to the base and extending below the same.

17. Apparatus for withdrawing well casings including, in combination, a casing gripping device, fluid actuated means for vertically reciprocating said device in longitudinally moving the casing and a fluid compressor connected to said means comprising a plurality of compressing cylinders, and means for connecting part or all of said cylinders to said fluid actuated apparatus.

18. Casing pulling apparatus, comprising two hydraulic jacks, a gripping device associated with each jack, a fluid compressor, and means for controlling the flow of fluid to cause one jack to grip a casing preparatory to the other returning for a pulling stroke.

19. Casing pulling apparatus, comprising two hydraulic jacks, one above the other; and a common mid-foundation from which the respective pairs of jacks are supported.

20. Casing pulling apparatus, comprising a base, a pair of cylinders in a plane and depending from the base, and, a second pair of cylinders in a plane at right angles to said first plane and rising vertically from the base.

21. Casing pulling apparatus, comprising two hydraulic jacks, a casing gripping device associated with each jack, means for letting fluid into one jack to perform a pulling stroke, means to let fluid into the other jack before the first completes its stroke, to insure a grip on the casing when the first jack prepares to return.

22. Casing pulling apparatus, comprising a plurality of hydraulic jacks, each with suitable mechanism to grip a casing, and fluid controlling mechanism, including a compressor and valve devices for admitting fluid to one jack to pull the casing through the gripping means of another jack, and other valve devices for admitting fluid to another jack before the preceding jack completes its stroke, to insure the gripping of the casing by its gripping mechanism when the first jack and its gripping mechanism return idly.

23. Casing pulling apparatus, comprising a plurality of hydraulic jacks, and means, including a hydraulic compressor and valve mechanism, for controlling the flow of fluid either to operate all jacks in unison for a combined lifting force, or the pairs successively to obtain a continuous pulling motion of the casing.

24. A pipe puller consisting of a stationary member, a plurality of vertically movable members with means to grip the pipe, means carried by the stationary member, including two hydraulic jacks, to elevate both movable members; and mechanism to control said means, including a valve to admit fluid to operate the movable member of one jack, while the movable member of the second jack is returning, and a second valve to admit fluid to the second jack before the movable member of the first completes its stroke, to insure an uninterrupted grip on the pipe.

25. A pipe puller consisting of a stationary member, a plurality of vertically movable members with means to grip the pipe, means carried by the stationary member, including hydraulic jacks, to elevate said movable members; and mechanism to control said means, including a valve to admit fluid to one jack, while the movable member of the other is returning; and other valves for controlling the return of fluid from each jack.

26. Casing pulling apparatus, comprising a hydraulic jack, with plungers; a spider laid across the plungers, with means preventing it sliding off; and slips in a tapered opening in the spider, each with rounded entrances to insure riding over couplings in a casing string.

27. Casing pulling apparatus, comprising

two hydraulic jacks each having two plungers, with spiders bridging said plungers said spiders being disposed at an angle to each other; slips carried by the lower spider to grip a casing, slips carried by the upper spider to grip a cable, said cable extending into the casing and having means for gripping one of the lowermost sections; and means for operating said jacks simultaneously by fluid pressure, producing a lifting force on the casing at two widely separated points.

In testimony whereof I hereunto affix my signature.

JOHN HART WILSON.