April 27, 1965 C. C. BROWN 3,180,617

WELLHEAD ELEVATING DEVICE

Filed Oct. 17, 1963 2 Sheets-Sheet 1

Fig. 1

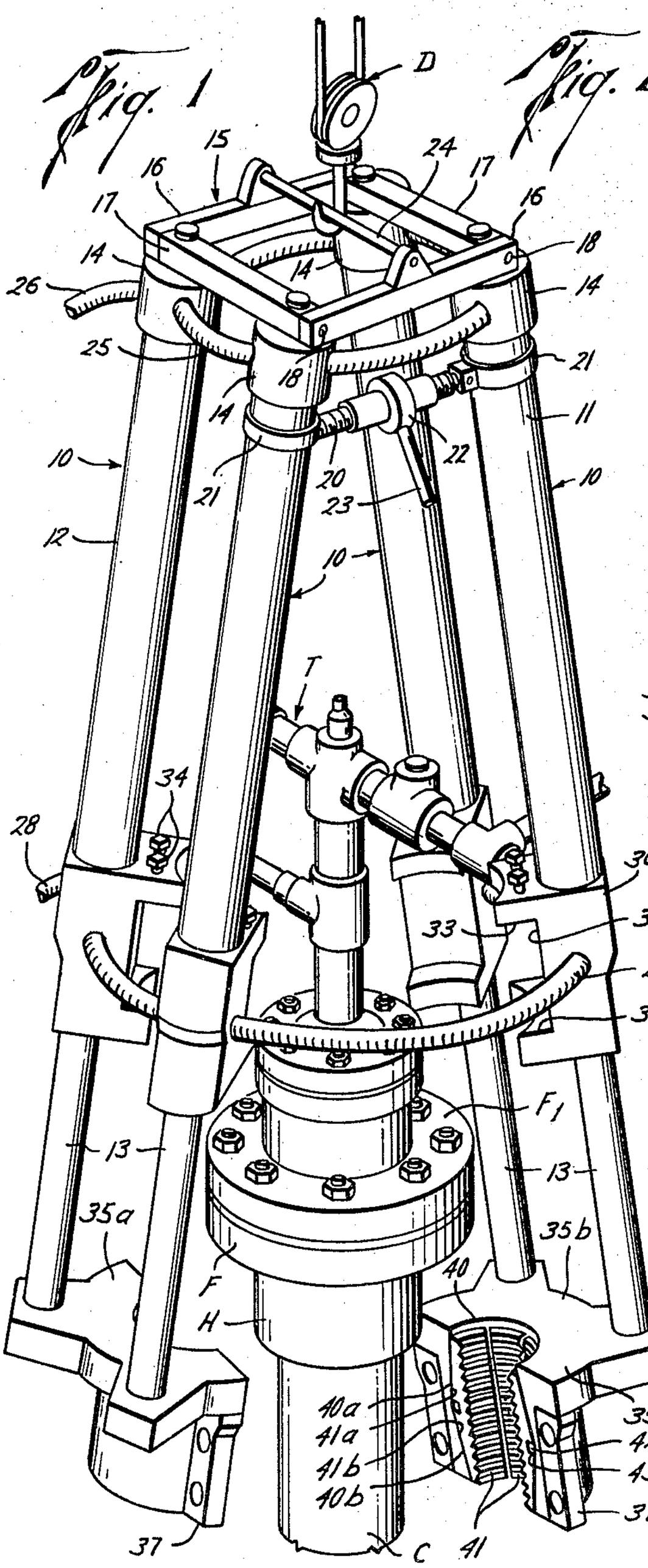

Fig. 2

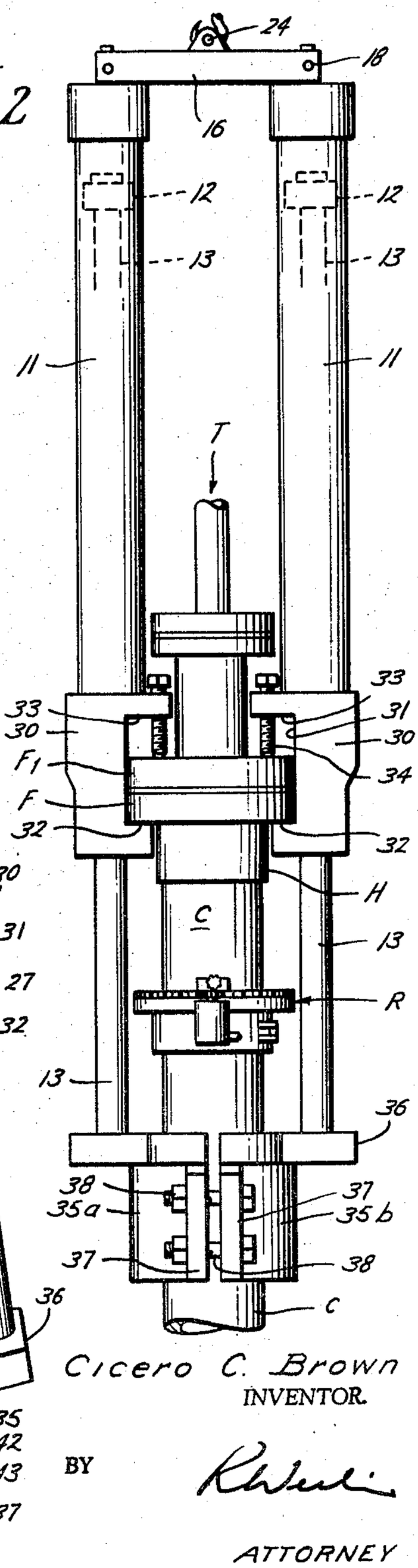

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Fig. 3

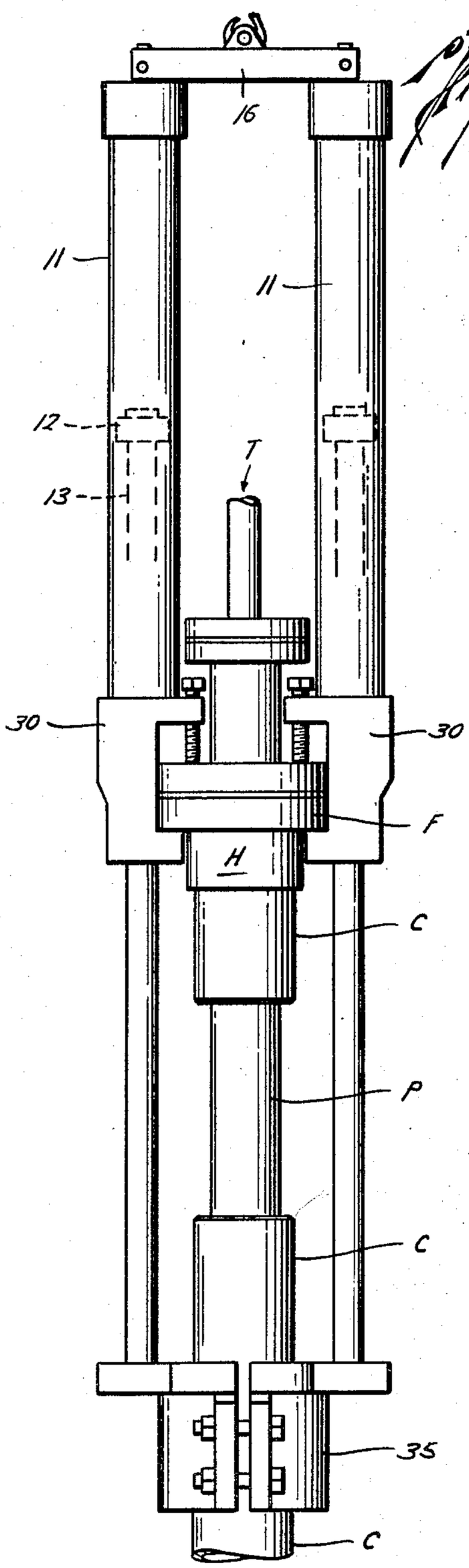
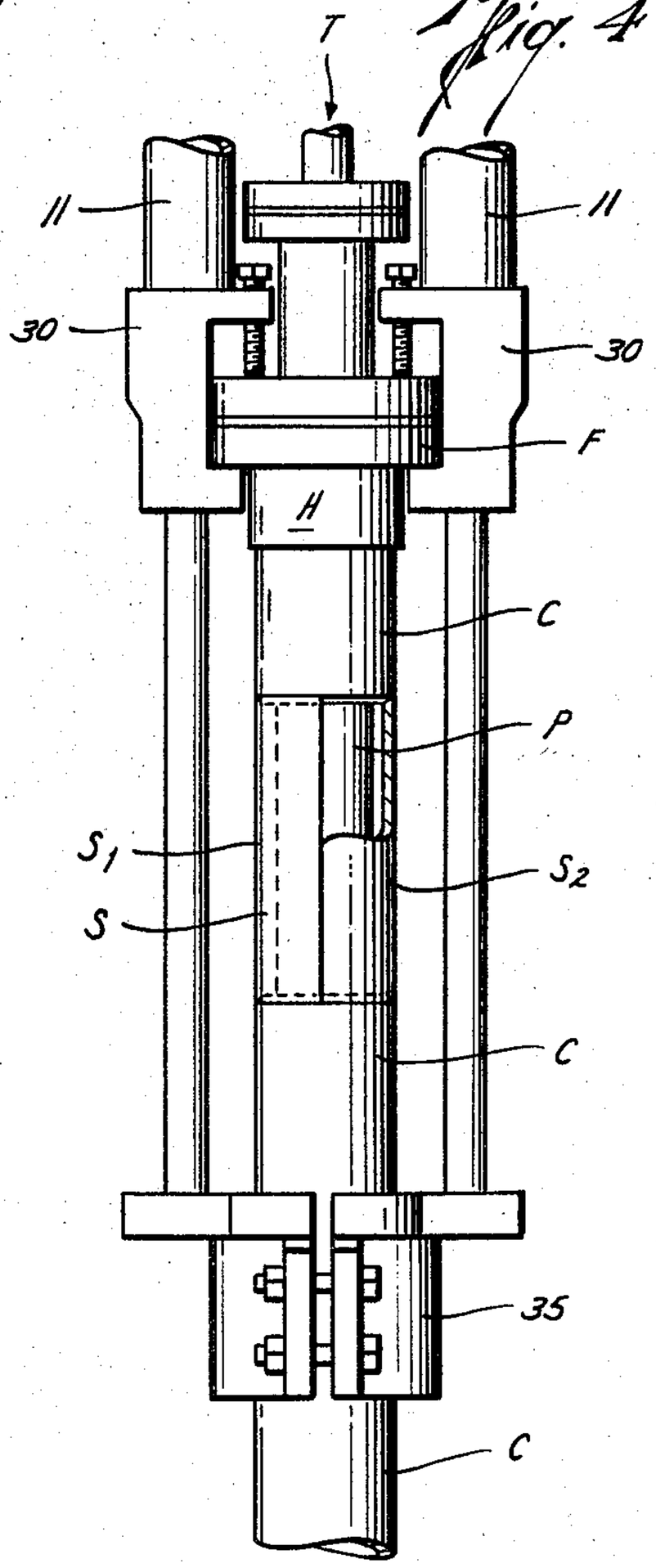


Fig. 4



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WELLHEAD ELEVATING DEVICE

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17 Claims. (Cl. 254—30)

This invention relates to well servicing devices and more particularly to wellhead elevating devices for oil and gas wells.

In the production of oil and gas, the removal from the sub-surface formations of oil, gas, and water which commonly accompanies the hydrocarbon fluids, will, in frequent instances, produce subsidence of the earth formations overlying the producing formations, the subsidence frequently extending all the way to the surface.

Ordinarily, the well equipment includes a relatively short string of relatively large diameter surface casing which is commonly rigidly cemented to the bore wall and projects above the ground surface, the wellhead equipment being mounted on the upper end of the surface casing. One or more strings of smaller pipe will extend through the surface casing to the producing horizons and will project through the casing-head and be connected with the various fittings comprising the so-called "Christmas Tree." These inner pipe strings will normally be secured at their lower ends in the well bore and as they are also secured to the top of the surface casing, these inner strings will be subjected to severe compression forces when subsidence occurs in the earth in which the surface casing is rigidly cemented. In many instances, these compression forces will be sufficiently great to cause severe leakage from the inner pipe strings, particularly at the collars connecting the sections, and may cause breakage of the pipe strings, with consequent serious damage to the well.

To overcome the described difficulty produced by subsidence of the earth about the wellhead, it is necessary to effectively lengthen the inner strings of pipe to again place them in tension. In view of the fact that they are secured to the surface casing and the latter is cemented in place, it becomes necessary in order to accomplish the desired result to extend, or lengthen the surface casing by the appropriate amount. In order to reduce the amount of servicing required to accomplish the desired objective, it has been proposed to sever the surface casing at a point below the wellhead and to then elevate the wellhead and the attached strings of pipe to the desired degree necessary to return the pipe strings to their proper length and place them in tension, after which a section of pipe is welded into the surface casing between the severed ends in order to thereby effectively lengthen it in the amount desired to obviate the subsidence.

It is a primary object of this invention to provide an efficient device for elevating the wellhead in place to accomplish the desired objective.

An important object is the provision of a hydraulic jacking structure, including a plurality of jack elements suitably arranged about the wellhead, in which one member of the several jack elements is secured to the wellhead, while the other member of the jack elements is secured to the surface casing at a point below the wellhead, so that upon severing of the surface pipe between the wellhead and the point of connection of the jack elements to the surface pipe, the wellhead may be bodily elevated to whatever height is desired, so that an extension of the surface casing may be welded into place between the severed ends thereof.

Another important object of this invention is to provide a wellhead elevating device which will permit extending the surface casing of a well without requiring the breaking-down or dis-assembly of the Christmas Tree and wellhead connections.

Still another object of this invention is to provide a wellhead elevating device employing a hydraulic pressure jacking device comprising a plurality of jack elements arranged to be swung apart for placement about the wellhead and surface casing, and then clamped together to secure the jack elements to the respective parts of the wellhead structure and surface casing.

A further important object is the provision of a system for elevating a wellhead in place on top of a surface casing which includes a plurality of fluid pressure actuated jacks arranged to be disposed about the wellhead, each of the jacks including a cylinder which is connectible to the wellhead and a piston slidable in the cylinder and carrying means connectible to the well pipe below the wellhead, means for severing the well pipe between the points of connection between the cylinder and the pistons, and means for supplying pressure fluid to the cylinders to elevate the wellhead relative to the well pipe after the latter has been severed.

A more specific object is the provision of a wellhead elevating device which includes a set of four hydraulic jacks, the upper ends of which are connected to a head frame and arranged to permit the jacks to swing radially with respect to the frame, the lower ends of the cylinders carrying means for securing the cylinders to the wellhead, and the pistons carrying a slip bowl and pipe-gripping slips for securing the pistons about the surface pipe below the wellhead, means being provided to swing the jacks apart so that they may be placed about the wellhead structure, and the slip bowl being of segmental form so that it may be swung apart with the jacks for placement about the surface casing and then connected together in pipe-gripping engagement with the latter.

Other and more specific objects and advantages of this invention will become more readily apparent from the following detailed description when read in conjunction with the accompanying drawing which illustrates a useful embodiment in accordance with this invention.

In the drawing:

FIG. 1 is a perspective elevational view showing the elevating device in open position preparatory for placement about the wellhead and the surface casing;

FIG. 2 is a side elevation showing the elevating device in place about the wellhead and well casing, and showing a cutting device disposed about the casing below the wellhead for purposes of severing the casing;

FIG. 3 is a view similar to FIG. 2, but showing the device in its elevated position after the casing has been severed; and

FIG. 4 is a view similar to FIGS. 2 and 3, showing an extension sleeve welded in place between the severed ends of the casing.

Referring to the drawing, the elevating device, in accordance with one embodiment of this invention, includes a set of four fluid pressure-actuated jacks, each designated generally by the numeral **10**, arranged to constitute the corners of a square. Each of the jacks comprises a cylinder **11** and a piston **12** slidable in the cylinder and connected to a piston rod **13** which extends through the lower end of the cylinder. The upper ends of the cylinders are closed by caps **14** which are secured to a square head frame, designated generally by the numeral **15**, and comprising a pair of spaced, parallel side bars **16—16** and a pair of parallel end bars **17—17**. The ends of end bars **17—17** are journalled in the ends of side bars **16—16** by means of the pivot pins **18**. Two of the cylinders are connected to each of the end bars **17—17**, with the result that an arrangement is provided comprising two pairs of jacks which are swingable toward and away from each other. Suitable means are provided for swinging the

pairs of jacks apart and toward each other, and one convenient arrangement for this purpose may be a turn-buckle connection 20 of conventional design, the opposite ends of which are connected by means of collars 21—21 to one of the jacks of each pair. A ratchet collar 22 is mounted about the ends of the turn-buckle bolts and connected to a handle 23 by which the turn-buckle may be lengthened and shortened, as required, in order to expand and retract the pairs of jacks. A hoisting bar 24 is secured across the top of frame 15 and provides means by which the whole structure may be moved into place about a wellhead by means of a conventional hoisting structure, designated by the letter D. A flexible hose 25 connects the upper ends of the several cylinders to a hose 26, which serves both as an inlet as well as an exhaust conduit for pressure fluid introduced into the upper ends of the cylinders. A second flexible hose connection 27 is in communication with the lower ends of the several cylinders and a common conduit 28 provides both inlet and exhaust passage for the lower ends of the cylinders.

As seen in FIG. 1, the elevating device is shown being positioned about the head of a well, such as an oil well, which includes a surface casing C to the upper end of which is secured a casinghead H provided with the usual annular bolt flange F. A conventional Christmas tree structure, designated generally by the letter T, consisting of a number of pipe fittings, valves, and the like, is mounted on casinghead H and equipped with a flange F_1 for connection to flange F of the casinghead. It will be understood that the form of the Christmas tree or other wellhead fittings may vary in design in accordance with completion practices in various oil and gas fields. By providing the hinged connection between the pairs of jacks and the head frame, it will be seen that the jacks may be spread apart sufficiently to allow the structure to be placed about the Christmas tree and the wellhead, and then by operation of ratchet collar 22, the jacks may be pulled together into position about the wellhead. The lower ends of cylinders 11 carry elevator blocks 30, each of which has in its inner surface a recess 31 of sufficient width and vertical height to receive the flanged connection F, F_1 between the Christmas tree and the wellhead, recess 31 being defined by inwardly extending upper and lower shoulders or flanges 33 and 32, respectively. Set screws 34 extend through upper flanges 33 and are positioned to engage the upper surface of flange F_1, to thereby clamp the elevator blocks securely to the wellhead, lower flange 32 being thereby pulled upwardly in direct supporting engagement against the lower face of flange F.

The lower ends of the several piston rods 13 carry a pipe-gripping fixture consisting of a slip bowl 35 which is split diametrically to form the two complementary segments 35*a* and 35*b*, each of the segments being secured to the lower ends of one of the pairs of piston rods 13 by means of lugs 36 into which the lower ends of the piston rods are secured, as by threaded or other suitable connection. The vertical edges of each of the slip bowl segments are provided with mating, laterally extending flanges 37 which are adapted to be bolted together when the segments of the slip bowl are moved into place about casing C, as seen in FIG. 2, the flanges being secured to each other by means of bolts 38 which extend through suitable openings in the flanges.

Slip bowl 35 is provided with an axial bore 40 defined by upper and lower frusto-conical portions 40*a* and 40*b*, respectively, which taper oppositely inwardly toward the opposite ends of the slip bowl. A set of segmental internally toothed pipe-gripping slips 41 are mounted in the bore of the slip bowl and are provided on their outer faces with tapering surfaces 41*a* and 41*b* complementary to the corresponding surfaces 40*a* and 40*b* of the slip bowl. The slips are held in place in the slip bowl by means of keys 42 which are received in correspondingly shaped grooves 43 provided in the exterior surfaces of the slip segments.

Piston rods 13 are made to such a length that when in their fully retracted position and with the structure in place about the wellhead, as shown in FIG. 2, the slip bowl and pipe-gripping slips will be disposed a sufficient distance below casinghead H to provide working space for severing casing C between the wellhead and the point of attachment of the slips. Cylinders 11 will be made to such a length as to permit a "stroke" of the jacks sufficient to elevate the wellhead to the height necessary to enable re-extending the inner pipe strings to their initial length, so as to again place them in tension.

In operation, the elevating device, supported by hoisting mechanism D, and with the jacks swung apart, as shown in FIG. 1, will be suspended over the wellhead in position to be secured thereto. By manipulation of turn-buckle 20, the pairs of jacks and the slip bowl segments will be retracted to place elevator blocks 30 in position about the casinghead so that flanges 32 will be in supporting engagement beneath flange F of the casinghead. Set screws 34 will be screwed down until the elevator blocks are tightly secured to the casinghead and bolts 38 will be put in place to draw the segments of the slip bowl toward each other sufficiently to cause slips 41 to tightly grip casing C. FIG. 2 shows the elevating device in place ready for use.

A well-severing device, such as a rotary cutter mechanism, designated generally by the letter R, of any suitable design, is then applied to the surface casing at a point between the points of attachment of the jack elements to sever the pipe. It will be understood that any type of severing device may be employed, such as a conventional flame-cutting torch. When casing C has been severed, pressure fluid will be introduced through conduit 26 into the upper ends of cylinders 11 above pistons 12. The pressure of this fluid will elevate these cylinders relative to the pistons and piston rods, the latter being secured to casing C by means of slips 41. The elevation of cylinders 11 will, of course, act through the engagement of flanges 32 beneath flange F of the casing to elevate the entire wellhead structure and the upper portion of casing C, which has been severed from the lower portion of casing C by the cutting device R. This position of the elevating device is best seen in FIG. 3, wherein the wellhead has been elevated above the bottom portion of the well casing, exposing an inner string of pipe P which is connected into the wellhead, and which it is desired to stretch or lengthen. With the wellhead elevated, as shown in FIG. 2, a casing extension sleeve S may be installed between the separated ends of casing C. Sleeve S may be split longitudinally to form two semi-circular sections S_1 and S_2 so that they can be placed about pipe P between the ends of casing C and thereupon welded along the longitudinal edges of the segments and between the ends of the sleeve and adjacent ends of casing C, as best seen in FIG. 4.

After surface casing C has been lengthened, as described, bolts 38 may be released and set screws 34 loosened in order to release the jack structure from the wellhead. Contemporaneously or subsequently, pressure fluid may be introduced through conduit 28 into the lower ends of the several cylinders in order to retract the pistons and return the structure to its original condition. Any pressure fluid in the upper ends of the cylinders will be exhausted through conduit 26.

While the illustrative embodiment shows an assemblage employing four jacks arranged generally to form the corners of a square and employs two semi-circular slip bowl segments, each connected to one pair of pistons, it will be understood that various modifications of this arrangement may be employed. For example, as few as two jacks may be employed in some cases, although for greater stability in applying the necessary pull or lift of the wellhead, a larger number will be preferred. In any event, the number of jacks will be two or more. Finally slip bowl 35 may be constructed in more than two complementary segments, depending upon the num-

ber of jacks and their arrangement as may suit the preference of the designers.

The opposed double taper configuration provided in the bore of the slip bowl, cooperates with the correspondingly tapered slips to assure that gripping of the casing will be effective to prevent slippage in either direction between the casing and the jacks.

It will be understood that various other alterations and changes may be made in the details of the illustrative embodiments within the scope of the appended claims but without departing from the spirit of this invention.

What I claim and desire to secure by Letters Patent is:

1. A wellhead elevating device, comprising, a plurality of fluid pressure-actuated jacks arranged to be vertically disposed in circumferentially spaced relation about a wellhead connected to a well pipe, each of said jacks including a cylinder connectible to the wellhead and a piston connectible to the well pipe below the wellhead, means for supplying pressure fluid to said cylinders to elevate the same relative to the pistons, and means hingedly connecting the upper ends of said jacks to each other to enable the same to be swung apart for placement about the wellhead and well pipe.

2. A wellhead elevating device, comprising, a plurality of pressure fluid-actuated jacks arranged to be vertically disposed in circumferentially spaced relation about a wellhead connected to a well pipe, each of said jacks comprising telescopically connected cylinder and piston members, means carried by one of said members for securing the same to the wellhead, means carried by the other of said members for securing the same to the well pipe below the wellhead, means for directing actuating pressure fluid into said cylinders at points operative to move the jack members secured to the wellhead upwardly relative to the jack members secured to the well pipe, and means hingedly connecting the upper ends of said jacks to each other to enable the same to be swung apart for placement about the wellhead and well pipe.

3. A system for elevating a wellhead in place on top of a well pipe, comprising, a jack assembly including a plurality of fluid pressure-actuated jacks arranged to be vertically disposed about the wellhead, each of said jacks including a cylinder connectible to the wellhead and a piston connectible to the well pipe at a point spaced below the wellhead, means for severing the well pipe between the wellhead and the point of connection of the pistons to the well pipe, and means for supplying pressure fluid to said cylinders to elevate them relative to said pistons whereby to elevate said wellhead after the well pipe has been severed, and means hingedly connecting the upper ends of said jacks to each other to enable the same to be swung apart for placement about the wellhead and well pipe.

4. An elevating device, comprising, a plurality of vertically disposed spaced apart fluid pressure-actuated jacks, each of said jacks including a cylinder and a piston slidable therein secured to a piston rod extending through the lower end of the cylinder, means pivotally securing the upper ends of the several cylinders to each other for relative lateral swinging movement, elevator blocks carried by said cylinders, an annular segmented pipe-gripping member carried by the lower ends of the pistons, the segments being movable laterally relative to each other by the swinging of the cylinders, means for securing the segments together, and means for supplying pressure fluid to said cylinders to elevate the same relative to the pistons.

5. An elevating device according to claim 4 which includes four of said jacks symmetrically arranged about a central axis.

6. An elevating device according to claim 4 wherein said segmented pipe-gripping member comprises two complementary generally semi-circular segments, each secured to two of said piston rods.

7. An elevating device according to claim 4 wherein said segmented pipe-gripping member comprises two complementary generally semi-circular segments, and includes a slip bowl having a bore defined by frusto-conical portions tapering oppositely inwardly toward the ends of the bowl, and pipe-gripping slips having outer surfaces complementing both said frusto-conical portions seated therein.

8. An elevating device, comprising, a plurality of vertically disposed spaced apart fluid pressure-actuated jacks, each of said jacks including a cylinder and a piston slidable therein secured to a piston rod extending through the lower end of the cylinder, a head frame, means pivotally securing the upper ends of the several cylinders to the head frame for lateral swinging movement relative thereto, elevator blocks carried by said cylinders, an annular segmented pipe-gripping member carried by the lower ends of the pistons, the segments being movable laterally relative to each other by the swinging of the cylinders, means for securing the segments together, and means for supplying pressure fluid to said cylinders to elevate the same relative to the pistons.

9. An elevating device according to claim 8 including expansible means mounted between said jacks operable to swing the free ends of said jacks toward and away from each other.

10. An elevating device according to claim 8 wherein said jacks comprise two pairs thereof arranged to define a square, each pair being pivotally secured to said head frame.

11. An elevating device according to claim 10 wherein said segmented pipe-gripping member comprises two complementary generally semi-circular segments each secured to the piston rods of one of said pairs of jacks.

12. An elevating device according to claim 11 wherein said pipe-gripping member includes a slip bowl having a bore defined by frusto-conical portions tapering oppositely inwardly toward the ends of the bowl and pipe-gripping slips having outer surfaces complementing both said frusto-conical portions seated therein.

13. A wellhead elevating device, comprising, a plurality of fluid pressure-actuated jacks aranged to be vertically disposed in circumferentially spaced relation about a wellhead connected to a well pipe, each of jacks including a cylinder and a piston slidable therein secured to a piston rod extending through the lower end of the cylinder, a head frame, means pivotally securing the upper ends of the several cylinders to the head frame for lateral swinging movement thereon relative to the wellhead, elevator blocks carried by the lower ends of said cylinders for attachment to said wellhead, an annular segmented pipe-gripping member carried by the lower ends of the pistons, the segments being movable laterally into and out of gripping engagement about the well pipe below the wellhead by the swinging of the cylinders, means for securing the segments in place about the well pipe, and means for supplying pressure fluid to said cylinders to elevate the same relative to the pistons.

14. A wellhead elevating device according to claim 13 including expansible means mounted between said jacks operable to swing the free ends of said jacks toward and away from each other.

15. A wellhead elevating device according to claim 13 wherein said head frame is of generally square configuration comprising a pair of spaced parallel side members and a pair of cross members having their ends journalled in the ends of said side members.

16. A wellhead elevating device according to claim 15 wherein said jacks comprise two pairs, each pair being secured to one of said cross members.

17. A system for elevating a wellhead in place on top of a well pipe, comprising, a jack assembly including a plurality of fluid pressure-actuated jacks arranged to be vertically disposed about the wellhead, each of said jacks comprising telescopically connected cylinder and piston

members, means carried by one of said members for securing the same to the wellhead, means carried by the other of said members for securing the same to the well pipe below the wellhead, means for severing the well pipe between the wellhead and the point of connection of said other of said members to the well pipe, means hingedly connecting the upper ends of said jacks to each other to enable the same to be swung apart for placement about the wellhead and well pipe, and means for directing pressure fluid into said cylinders at points operative to move the jack members secured to the wellhead upwardly relative to the jack members secured to the well pipe.

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DONLEY J. STOCKING, *Primary Examiner.*