Jan. 19, 1965 L. M. HUBBY 3,166,125

ADJUSTABLE CASING HEAD

Filed Nov. 20, 1961 2 Sheets-Sheet 1

Fig. 1.

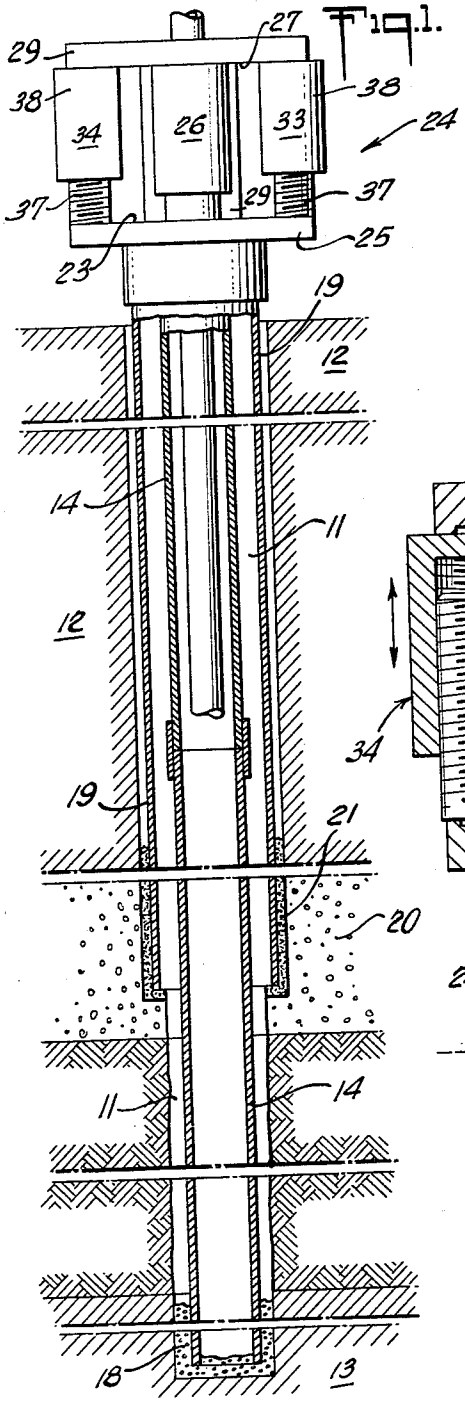
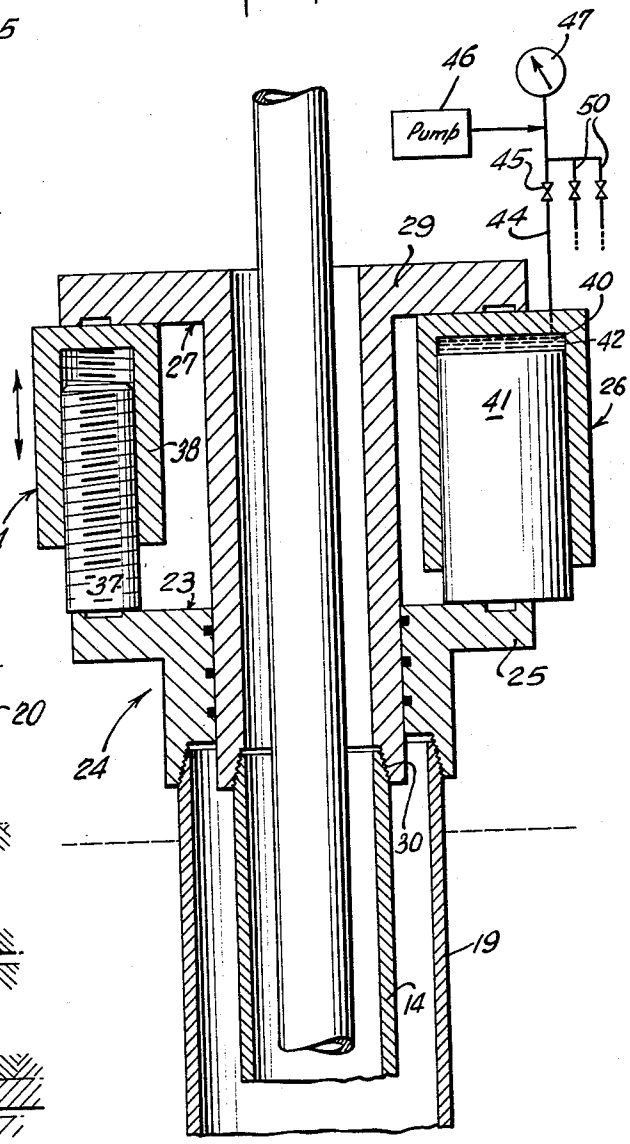


Fig. 2.

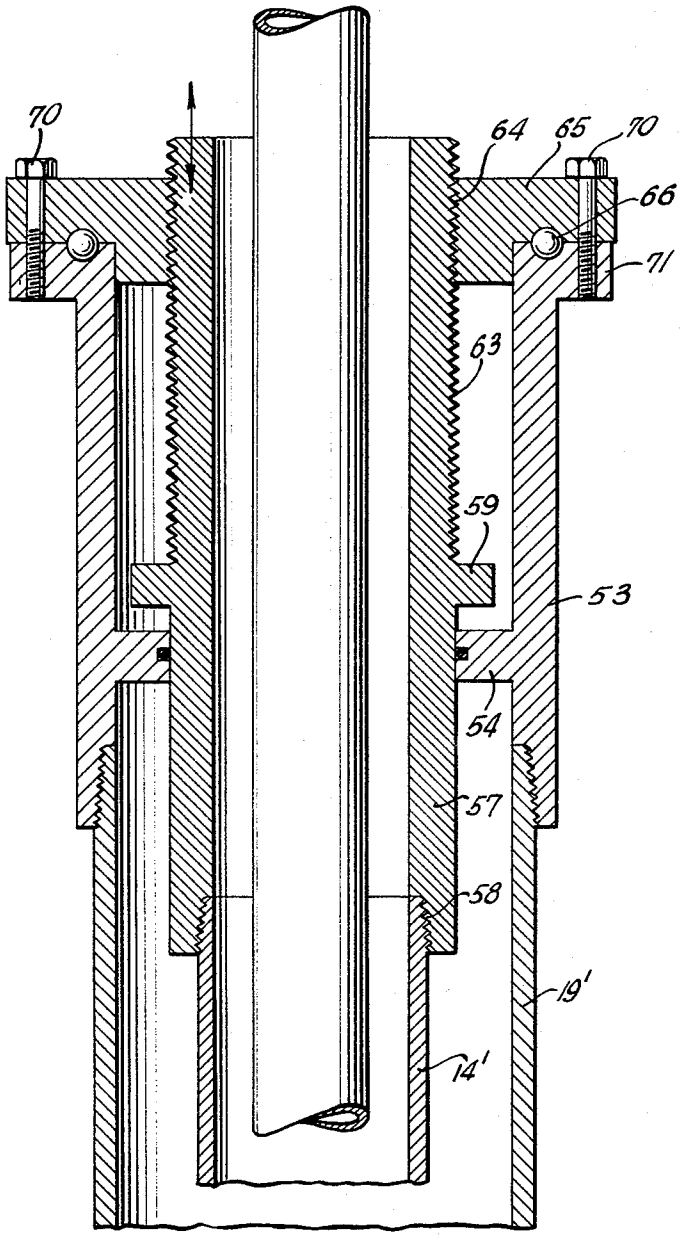


Jan. 19, 1965 L. M. HUBBY 3,166,125

ADJUSTABLE CASING HEAD

Filed Nov. 20, 1961 2 Sheets-Sheet 2

Fig. 3.



United States Patent Office 3,166,125 Patented Jan. 19, 1965

3,166,125

ADJUSTABLE CASING HEAD

Laurence M. Hubby, Bellaire, Tex., assignor to Texaco Inc., New York, N.Y., a corporation of Delaware

Filed Nov. 20, 1961, Ser. No. 153,303
3 Claims. (Cl. 166—67)

This invention is concerned with deep wells and more particularly such wells having a long string of casing therein. More specifically, the invention concerns an adjustable casing head member for providing adjustment between the upper end of a long casing string and the surface support therefor.

Heretofore in situations where deep wells were provided with long strings of production casing, the procedure for placing each such casing in the hole required some care so as to avoid failure of the casing string by reason of buckling or otherwise failing under the high loads involved. This was particularly true following a cementing of the lower end of such casing to the formation, down in the hole. Thus the procedure heretofore followed was known as "landing" the casing, and it involved the adjustment of the tension which was applied at the upper end of the casing string following the cementing of the lowermost end down near the bottom of the hole. Such tension adjustment would be made with the rig equipment, and at that time the desired tension would be set and remain fixed after removal of the well rig. Experience has proven, however, that there have been many casing failures following removal of the rig which were due to changes in the temperatures and pressures applied to the casing string. Such temperature changes included those created by different rates of producing a given fluid, as well as changes in the temperature itself of fluids flowing through the casing. Other changing conditions may have included mud density, etc.

Consequently it is an object of this invention to provide a casing head supporting member that is adjustable, so as to be able to make changes in the tension being applied to the upper end of a casing string as desired. In this manner adjustment of the well head casing tension may be made periodically, or continuously, to take care of conditions such that the casing string tends to expand or contract cumulatively along the free length thereof between the cemented lower end and the surface.

Yet another object of the invention is to provide an adjustable casing head employing non-hydraulic mechanical thread type supporting structure for enabling adjustment as desired.

Briefly the invention may be described as one that is applicable in combination with elements of a deep well which has surface pipe for bearing the load of a casing string in said well. The invention comprises a first collar attached to the upper end of said casing string, and a second collar attached to said surface pipe. The invention also comprises means for supportably connecting the said first collar to said second collar and including continuously adjustable means for varying the load applied to said surface pipe.

The foregoing and other objects and benefits of the invention will be more fully appreciated in connection with preferred embodiments that are set forth below in greater detail and are illustrated in the drawing, in which:

FIGURE 1 is a schematic showing partly in cross section, illustrating a string of casing in a deep well having an adjustable casing head element according to the invention attached thereto;

FIGURE 2 is an enlarged cross sectional view of the adjustable casing head structure illustrated in FIGURE 1; and

FIGURE 3 is a schematic cross sectional illustration

of casing head structure according to another embodiment of the invention.

Referring to FIGURE 1, it is pointed out that there is illustrated a deep well 11 that extends down from a surface layer 12 to various subsurface formations, including a formation 13 where it is desired to cement the lower end of a production casing string 14. It will be observed that there is shown a quantity of cement 18 that has been applied at the lower end of the casing string 14 in order to anchor the casing at the level of the formation 13.

It is pointed out that in accordance with the foregoing indication it is the usual practice for a casing string, e.g. string 14, to be "landed" in the hole after cementing at the lower end thereof. This involves application of a predetermined amount of lifting force or tension at the upper end of the casing string, where the downward reaction to such lifting force is transferred to a surface pipe 19 that has been cemented in place at a shallow but solid formation, e.g. a formation 20, to which the surface pipe 19 is cemented, as by means of a predetermined quantity of cement 21.

Since the well under consideration is one that has been completed, or is a so-called production well, there may be tubing set in the well inside of the casing (as illustrated). However, such tubing has no connection with the subject matter of the invention.

In order to provide for adjustability of the supporting load or tension force applied to the upper end of the casing string 14, there is an adjustable casing head unit 24 employed which comprises a load bearing collar 25 that is threadably attached to the upper end of the surface pipe 19 (FIGURE 2). Carried on an upper surface 23 of collar 25 there are a plurality of hydraulic cylinder and piston units 26 that extend between surface 23 of the collar 25 and a parallel radial surface 27 located on another collar 29. Collar 29 is attached to the upper end of the casing string 14 in any convenient manner, such as by having a pipe threaded joint 30 (FIGURE 2).

By means of the above described arrangement, the load that is carried by collar 25 (as it supports the casing string 14 and applies tension thereto via the collar 29) may be adjusted as desired by regulating the hydraulic pressure within the cylinder and piston units 26. It is pointed out that although there appears in the illustrations only one hydraulic unit 26, it is contemplated that all of the units may be of this type. Furthermore it is expected that eight to twelve of these units 26 will be actually employed instead of the four schematically indicated.

It will be observed that in FIGURE 1 there is shown a pair of thread type coupling elements 33 and 34. These are each in the nature of a jack having as one element a threaded shaft 37 while the other element is a cylindrical member 38 that has internal threads for meshing with the threads on shaft 37. In this manner a relative rotation between shaft 37 and the cylindrical unit 38 will in each case provide for longitudinal adjustment of the length from the free end of shaft 37 to the opposite or closed end of cylinder 38. Thus, the load on collar 25 or the tension applied via collar 29, by each of the elements 33 and 34 (and others, as indicated below) may be adjusted as desired.

It is to be noted that when an adjustable casing head unit is first set up after removal of the well rig (following landing of the casing string) preferably there would be employed all hydraulic units, like cylinder and piston unit 26, for ease in making the first adjustment of the load desired. Thereafter, for a more permanent arrangement, the hydraulic units 26 might be replaced one at a time with mechanical type jacks such as the threaded coupling

elements 33 or 34. As indicated above, there will be provided as many as eight to twelve of the adjustable coupling units, i.e. units 26 or 33 and 34, to provide for more even application of the load involved.

Referring to FIGURE 2, it will be observed that in connection with the hydraulic units, e.g. unit 26, there is provided a hydraulic system such as that schematically indicated. Such hydraulic system is arranged so that hydraulic fluid 40 may be introduced above a piston 41 and within a cylinder 42 that together make up the main elements of the cylinder and piston unit 26. Such hydraulic fluid, e.g. fluid 40, will be introduced into the cylinder by any convenient structure, such as that schematically indicated by a line 44 that leads to the fluid body 40 through the closed end of the cylinder 42 as indicated by the dashed line. Fluid line 44 may have a control valve 45 included therein for use in cutting off hydraulic fluid pressure from the source. This is necessary in each case as individual ones of the hydraulic units 26 are removed for replacement by threaded coupling elements. There will be included also in the hydraulic fluid system, a pump 46 for building the hydraulic fluid pressure needed and a gauge 47 for determining the amount of pressure being applied. It will be understood by anyone skilled in the art that there will be additional hydraulic lines, such as lines 50 shown, to carry the hydraulic fluid to each of the plurality of hydraulic units. There will be as many as eight to twelve of such units in accordance with the foregoing indications.

Referring to FIGURE 3 it is pointed out that a modified form of the invention is illustrated. Where the casing string and surface pipe are shown, the same reference numbers, but with prime marks, are employed. Thus, the upper end of the casing string 14' is adjustably supported in tension with the support resting on the upper end of the surface pipe 19'.

In this case there is employed as the load bearing element a collar 53 that may have an inner flange 54 integrally formed therewith to act as a stop for one limiting adjustment involved. Inside of flange 54 there is another collar 57 that is fastened to the upper end of the casing string 14' in any convenient manner, such as by means of a pipe thread joint 58. The collar 57 may have a stop flange 59 thereon that will act to rest against the flange 54 as a limiting condition. Above the flange 59 there are machine threads 63 formed on the outer surface of the collar 57 and with which there are meshing threads 64 that are formed on the inner surface of a support ring 65. Ring 65 is constructed with sufficient outside diameter to extend over the upper face of the top of collar 53. Also, ring 65 may have included therewith the required structure for including ball bearings 66 between the under side of ring 65 and the upper face of the collar 53. There may be a series of bolts 70 that will pass vertically through the ring 65 and screw into threaded holes around the periphery of the collar 53 located in a flange 71 formed at the upper edge of the collar 53.

Bolts 70 are employed after adjustment has been completed for holding the casing head in a desired position. Thus it will be clear that when adjustments are to be made for varying the tension applied to collar 57 and thus to the upper end of the casing string 14', rotation of the

ring 65 may be made (with bolts 70 removed or loosened) and the action of the meshing threads 63 and 64 will create an increase or a decrease in the load on the collar 53, which load is the counter force of the tension being applied via the collar 57 to the top of the casing string 14. It is to be observed that a direct indication of the weight or load of casing string 14' may be had by rotating the ring 65 in both directions while noting the difference in torque in each case. Such difference in torque is a direct indication of the load or lifting force being applied at the collar 57.

It will be understood that other adjustable structures (not shown) for connecting the surface pipe with the upper end of the casing string may be employed. For example, so-called expansion supports might be employed in place of the mechanical jacks 33, 34 or in place of the hydraulic cylinder and piston elements 26, with the purpose being that of automatically compensating for changes in temperature so as to hold essentially constant the load applied to the casing string. Similarly, an automatic system (not shown) for adjusting the hydraulic pressure applied to the hydraulic cylinder and piston elements 26 might be used so as to change the load as determined by the hydraulic pressure. This would be done under direct control of changing conditions, such as rate of flow of the production fluid within the casing string.

While particular embodiments of the invention have been described in considerable detail in accordance with the applicable statutes this is not to be taken as in any way limiting the invention but merely as being descriptive thereof.

I claim:

1. In combination with a deep well having surface pipe set therein for bearing the load of a long casing string set in said well, said casing string being cemented near the lower extremity thereof into said well, first collar means attached to the upper end of said casing string, second collar means attached to the upper end of said surface pipe adjacent to said first collar means, and means for adjustably supporting said first collar means on said second collar means, said supporting means comprising screw threads on said first collar means, an annular load bearing member having complementary threads meshing with said screw threads, and means for rotatably supporting said annular member on said second collar means.

2. The invention according to claim 1 wherein said means for rotatably supporting said annular member comprises an anti-friction type bearing.

3. The invention according to claim 2 further including means for securing said annular member against rotation with respect to said second collar means after a given adjustment has been made.

References Cited in the file of this patent

UNITED STATES PATENTS

197,538	Baum et al.	Nov. 27, 1877
1,627,945	Wigle	May 10, 1927
1,825,774	Boynton	Oct. 6, 1931
1,888,550	Church	Nov. 22, 1932
1,898,649	Wheeler et al.	Feb. 21, 1933
2,262,490	Crake	Nov. 11, 1941