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3,343,603

WELLHEAD FOR MULTIPLE LOW-PRESSURE WELLS

Filed Aug. 2, 1965

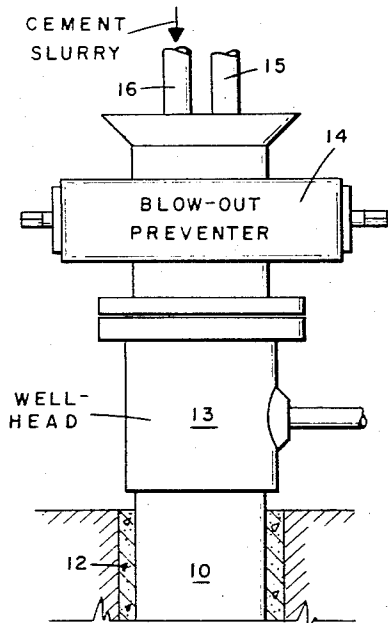


FIG. 1.

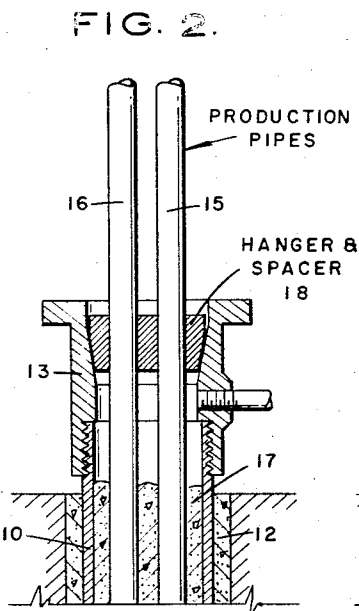


FIG. 2.

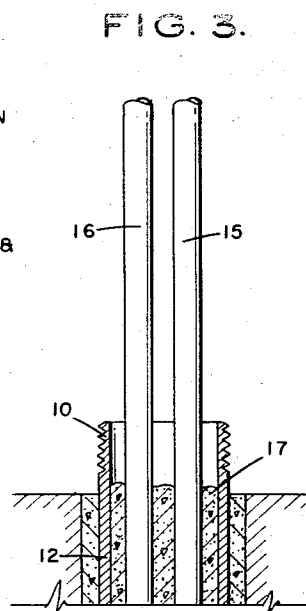


FIG. 3.

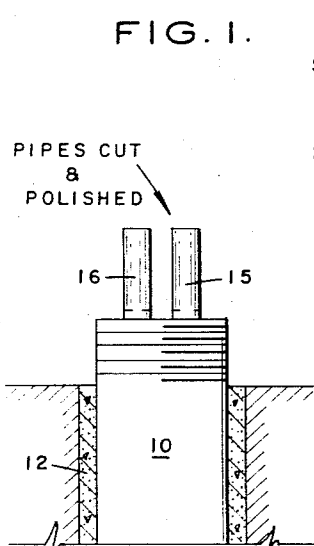


FIG. 4.

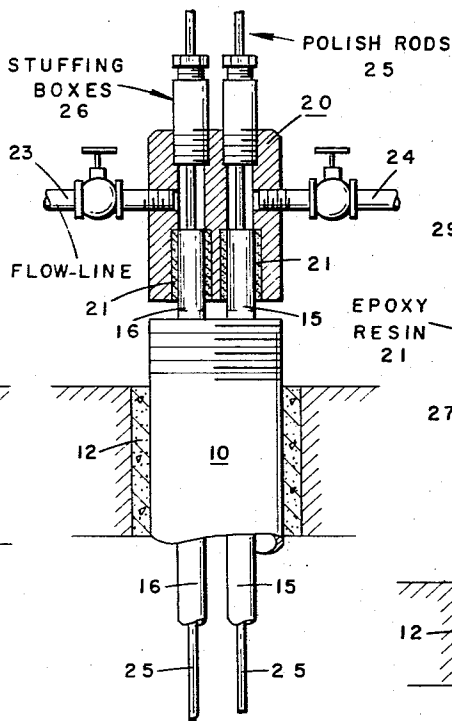


FIG. 5

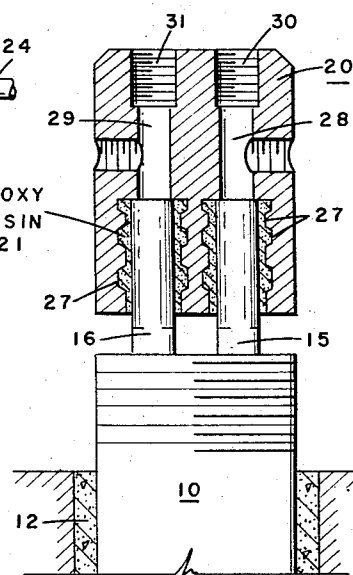


FIG. 6.

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WELLHEAD FOR MULTIPLE LOW-PRESSURE WELLS

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ABSTRACT OF THE DISCLOSURE

A wellhead bonnet for use on multiple casing string (tubingless) wells, said bonnet containing spaced-apart bores therethrough, one for each multiple casing string arranged in the well. The wellhead bonnet is secured to each casing string when said casing string is positioned in its respective bore with a thermosetting resin adhesive.

The present invention concerns a wellhead for use primarily in multiple tubingless low-pressure wells. More particularly, it concerns using thermosetting resins to attach a bonnet-type wellhead to the upper ends of tubing strings arranged in a well bore.

The improved wellhead is economical, safe, and easily installed. Among its advantages is the elimination of a flanged and threaded wellhead-surface casing connection.

Thus, a primary object of the present invention is to provide an improved wellhead installation in multiple completion wells.

The procedure for installing the wellhead is as follows. After the surface casing has been cemented in place, the conventional casing head and blowout preventors and other control equipment are installed on the surface casing. Then, the well is drilled and the tubing strings are run into the well and cemented in place, preferably to the surface casing. Then, the blowout preventors are removed by stripping over the tubing strings. Next, the casing head is removed from the surface casing and the tubing strings are cut off to a desired length above the surface casing and polished to insure a sealing contact with the resin glue to be applied. A wellhead bonnet, provided with openings for the tubing strings, is installed on the tubing strings with the resin glue engaging the tubing strings and inner walls of the openings in the bonnet. Then, sucker rod pumps and polish rods may be run in the tubing strings and stuffing box glands installed to seal around the rods. If desired, the stuffing boxes could be replaced with flow line connectors and valves.

The above object and advantages and other objects and other advantages of the invention will be apparent from a more detailed description thereof when taken with the drawing wherein:

FIGS. 1 to 5 are side views, partly in section, of the upper portion of a well illustrating the steps of the method of the invention; and

FIG. 6 is a side view, partly in section, showing the new wellhead connected to the tubing strings.

As seen in FIG. 1, a surface casing 10 is cemented in a well bore 11 by means of cement 12. A casing head 13 is attached to the upper end of surface casing 10 and blowout preventors 14 are positioned on casing head 13. Two tubing strings 15 and 16 extend into surface casing 10 through casing head 13 and blowout preventors 14, and are cemented in place by pumping cement down one or both of the tubing strings until the cement 17 preferably reaches the upper portion of the surface casing 10 as illustrated in FIG. 2. This figure also shows removal of blowout preventors 14 from tubing strings 15 and 16 and the hanger and spacer 18 in position on these tubing strings.

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FIG. 3 illustrates casing head 13 and hanger and spacer 18 removed from surface casing 10.

As seen in FIG. 4, tubing strings 15 and 16 have been cut off at a desired height and polished to insure a clean, smooth surface for contact with the resin.

In FIG. 5, a wellhead bonnet 20 is shown glued to the polished surfaces of tubing strings 15 and 16 by means of a thermosetting resin 21. If desired, polish rods 25 and stuffing box seals 26 may be attached to bonnet 20 to produce oil through the tubing strings. Valved flow lines 23 and 24 are connected to bonnet 20 and communicate with tubing strings 16 and 15, respectively, therethrough. A more detailed view of bonnet 20 is shown in FIG. 6, and as seen therein, the resin is preferably placed in grooves 27 formed on the inner walls of openings 28 and 29 in the bonnet, which openings receive the upper polished ends of tubing strings 15 and 16, respectively. The upper end of bonnet 20 may be provided with threaded openings 30 and 31 to receive and secure the stuffing box seals 26 and polish rods 25 or flow line connectors.

The particular resin material may vary with the conditions under which it is to be used. The shear strength and compressive strength needed, as well as the temperature at which it is to be used, are factors to be considered in the selection of the resin. Typical resins that may be used are described below:

Epoxy resins—Derived from bisphenol A (2,2 diphenol propane) and epichlorohydrin (3 chloropropylene oxide)

Other suitable phenols for epoxy resins are:

Bisphenol F—Diphenolmethane

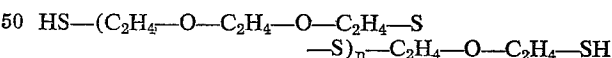
Bisphenol F gives flexible but lower softening point.

Cashew Phenol—1,8 diphenol-n-pentadecane (resins sold under trade name "Cardolite 7019")

Cashew phenol gives high impact strength but lower softening point.

Heat distortion temperatures of epoxy resins vary from about 75° C. to over 200° C.

Resins from bisphenol A are highly cross-linked with high tensile strength. In some instances it may be desired to increase the toughness of the resin by use of flexibilizing modifiers to provide more stretch without too great a decrease of tensile strength. These flexibilizers are commonly thiokol polymers (Thiokol Corp., trade name). Thiokol is a liquid polysulfide polymer of the usual formula:



where n is an integer from 3 to about 24.

Curing of the epoxy resin may be done by a catalyst or a reactive hardener. Catalysts may be strong bases such as tertiary amines: DMP-30 is preferred [tris(dimethylaminomethyl)phenol], diethylaminopropylamine, dimethylaminopropylamine, piperidine, diethylenetriamine, etc.; primary and secondary amines: ethylenediamine, diethylenetriamine, triethylenetetramine, tetraethylenepentamine, etc. Curing agents may be acid anhydrides: phthalic anhydride, maleic, pyromellitic, dodecylsuccinic, etc. For air temperature curing the tertiary amines, and especially DMP-30, are preferred.

Reinforcements, such as mineral fibers (glass or asbestos), synthetic fibers (nylon, orlon, dacron) or metallic (iron, aluminum, copper) may be used to improve tensile, compressive, flexural and impact strengths. Fillers and thixotropes may also be used to improve the strengths and also the working properties of the resin. Suitable materials are aluminum, iron, copper powders, glass flakes, bentonite clay, talc, or amorphous silica (Cab-o-sil).

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Because of the epoxy, hydroxy, amine, and other polar groups present, the epoxy resins have a high adhesion to the metal and the cohesive strength is such that the break or failure often occurs in the joined material rather than in the resin. The low shrinkage avoids strain in the joint which also improves the joint strength.

Typical compositions suitable for use are:

I

- (A) 100 parts epoxy resin (uncured liquid)
50 parts filler or reinforcement
(B) 50 parts thiokol (LP-30, molecular wt. 1,000)
10 parts DMP-30

Equal parts of A and B are mixed when the resin is ready to be used.

II

- 100 parts epoxy resin (liquid)
35 parts Versamid
5 parts DMP-30

Filler as required or desired.

III

- 100 parts epoxy resin (liquid)
50 parts iron or aluminum powder
3 parts amorphous silica (Cab-O-Sil)
80 parts polyamine (Lancast A)

Other well-known resins suitable for use as a bonding adhesive to glue the well bonnet to the well pipe include phenolic-polyamides, phenolic-vinyl acetates, and phenolic elastomers.

Having fully described the method, apparatus, objects, and advantages of my invention, I claim:

1. A method for installing a wellhead bonnet on a well containing surface casing and multiple casing strings cemented in place, said wellhead bonnet having spaced-apart bores therethrough, one for each multiple casing string arranged in said well, comprising the steps of:

positioning said wellhead bonnet on said casing strings in a manner such that the upper end of each casing string is arranged in a different one of the bores in said wellhead bonnet; and

gluing each casing string to its respective bore with a resin adhesive.

2. A method as recited in claim 1 in which following running and cementing of said surface casing and prior to positioning said wellhead bonnet on said casing strings, the steps of installing conventional casing head, blowout preventors and other control equipment on said surface casing;

drilling said well;

running and cementing said casing strings in place;

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stripping said blowout preventors and other control equipment over the upper ends of said casing strings to remove such equipment from said well; removing said conventional casing head from said surface casing;

cutting off said casing strings to a desired length above the upper end of said surface casing; and polishing the upper ends of said casing strings prior to positioning each in its respective bore.

3. A method as recited in claim 2 including the steps of running sucker rods, pump and polish rods into each casing string and installing stuffing box glands to seal around said rods.

4. A method as recited in claim 3 including the step of securing flow line connectors and valves to the upper ends of said casing strings through said wellhead bonnet.

5. A method as recited in claim 4 in which said resin adhesive is a thermosetting epoxy resin.

6. A wellhead bonnet capable of attachment to the upper ends of multiple casing strings extending in a well comprising:

a cylindrical member provided with a plurality of spaced-apart bores therethrough, each bore being adapted to engage a different one of said casing strings;

an adhesive resin arranged in each bore adapted to connect each casing string to the wall of its respective bore;

a separate conduit connected to each of said bores, each conduit fluidly communicating with a different casing string; and

valve means arranged on each conduit adapted to control flow of fluids therethrough.

7. A wellhead bonnet as recited in claim 6 in which said adhesive resin is a thermosetting epoxy resin.

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