Oil well cement and method of making the same

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ABSTRACT available in

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DESCRIPTION (OCR text may contain errors)

CLAIMS available in

EXA #2" toe-L's United States Patent 3,414,420 OIL WELL CEMENT AND METHOD OF MAKING THE SAME Sam Maravilla, Lansing, 111., and Joseph E. Kopanda,

3,414,420 Patented Dec. 3, 1968 tends to degrade the starch and dextrine so as to develop erratic retarding functions. Because the retarding action was not uniform, it was ditficult to determine the amount of retarder necessary before grinding the clinker and Crown Point, Ind., assignors to United States Steel Cor- 5 retarder into cement. Also, the hot cement when stored poration, a corporation of Delaware in silos continued to degrade the starch and dextrine. N0 Drawing Fi|ed Jal1- 1965, 423,851 There was also an unpredictable but progressive short- 2 clalms- 106-92) ening of thickening-time with freshly ground cement during the first 72 hours of storage.

It is therefore an object of our invention to produce ABSTRACT OF THE DISCLOSURE a cement which is relatively free of the above objec- A retarded oil well cement including an oil well porttionable features. land cement, and a retarder present in an amount equal Another object is to provide such a cement which 0.08 to 0.13% by weight of the cement. The retarder requires the addition of less retarder than in the previ- [gmsists of 1 to 8 parts by weight of a modified starch ous cement.

to 1 part of dextrine. The starch has a cold water solu- Still another object is to provide a method of making bilit'y range of to and the dextrine a cold water such a cement. solubility range of 12 to The cement is made by These and other objects will be made apparent after grinding the modified starch at a maximum temperature referring to the following specification. of 100 F. to such fineness that it will pass a 200 mesh 20 According to our invention, we provide an oil well sieve, and then mixing the three ingredients at a maxicement clinker and a small amount of gypsum which mum temperature of 140 F. are ground together in a ball mill usually below 220 F. and then passed through cement coolers until the cement temperature is below 165 F., and preferably This invention relates to an oil well cement and to 25 below 140 F. The resulting product is hereinafter re a method of making the same, and more particularly fered to as oil well basic cement. This, like the cement relates to retarded oil well cements for use at the relaof the Andes patent, is a hydraulic portland cement and tively high temperatures and pressures present in the may contain other additives which are normally used. depth range of 6,000 to 14,000 ft. One cement of this In a spec c emb iment 0 our invention, the cement type is shown in Andes et al. Patent No. 2,429,211, dated 30 is an ASTM Type II moderate sulfate-resistant cement Oct. 21, 1947. However, the cement of this patent has as defined in the American Petroleum Institute Specifinot performed in accordance with all current American cation for Oil-Well Cements and Cement Additives Petroleum Institute specifications and field practices. In (API Std 10A), of March 1964. A modified starch as order that a modifier of oil well cement slurries will described in the Andes patent is ground to such fineness function properly, it is extremely important for the modithat it will pass a 200-mesh sieve w ile limiting it to tier to positively control the thickening-time within a a maximum temperature of 100 fie term modified prescribed condition, and to control the viscosity of the starch as used hereinafter in the s or cation and claims slurry to a value consistent with normal oil field pump is limited to modified starch as described in the Andes ing practices during the greater part of this thickeningpatent. As therein described, the modified starch is of time. Also, the rate of set and concurrent strength de- 40 the group consisting of oxidized starches and hydrolyzed velopment of this cement must occur within prescribed starches which are subs an ly nonge ling when added time limits so that drilling operations may be continued. to water and cement-water mixtures and which form All these functions must take place smoothly within a a solution in water that responds to the iodine test for definite range limit of temperature (80 to 290 F.) under starch to show a blue to violet color. The modified pressure (atmospheric to 14,000 p.s.i.) and in combistarch, together with dextrine as defined above, are comnation with other chemically active additives. bined in a ratio of between 1 and 8 parts by weight of Prior to our invention and as described in

the Andes starch to 1 part by weight of dextrine to form a repatent, the modifier was mixed and ground with the tarder which is used in cement in an amount not excement clinker to produce the desired cement. ceeding 0.13% by weight and at least .08%. The com- Powdered dextrine, which is a starch produced by ponents of the retarder may the mixed together and dry roasting raw starch at approximately 250 to 350 then added to the basic cement or the individual re- F. in the presence of an atomized catalytic agent such as tarders and the cement may be blended at one time. HCl or HNO has also been used with the modified In any event, a maximum temperature of 140 F. is starch of Andes in order to make the oil well cement maintained during the blending period. It preferred more compatible with field additives, such as bentonite. a that the temperature be considerably lower. The cement clinker, gypsum, modified starch and dex- In the preferred practice of our invention, the basic trine were interground in ball mills to produce the oil cement is placed in a storage bin or silo and at least three well cement. The ideal properties for retarded oil well samples thereof are obtained. A different percentage of cement are considered to be substantially indicated by total retarder is added to each sample and each of the equal and consistent thickening-times in the temperasamples is tested in a Pan American Thickening-Time ture range of 140 to 200 F. However, the cement pro- Tester at a given API schedule as found in API Recomduced according to this method was not always uniform mended Practice for Testing Oil-Well Cements and in producing equal and consistent thickening-time results Cement Additives (API RP 10B) of March 1964. The in this temperature range. The behavior of the cement time resulting thickening-times are plotted on a graph to often underwent objectionable changes after its manuestablish the characteristics of this particular basic cement facture and during storage. Thus, even though the cement as to its performance with this retarder. The desired as tested shortly after its manufacture by an established thickening-time with its corresponding amount of total procedure was satisfactory, there was no assurance that retarder is determined from this graph. Using these rethe cement, when it reached the customer, would have 7 sults, a precise amount of retarder is added to the basic this same performance.

We have found that the inter-grinding in the ball mills cement. Under the conditions set forth above, we have found that the resulting retarded oil well cement as a cold water solubility of 22%. The

shipped will have a thickening-time very close to the laboratory results.

hould have a cold water solubility and it is preferred to use starch with dextrine should have a cold water solubility of 12 to 35%, although it is preferred to use a dextrine having a cold water solubility of 20:2%. In order to determine the thickening-time of the cement, the amount of total retarder is varied while holding the retarder ratio constant. The time required to predict accurately the thickening-time slurry properties of the blended cement product produced according to our method is less than 24 hr. as compared to 72 hr. or longer for the old method. Uniformity of thickening-time for various well conditions can be controlled by modifying the ratio between the modified starch and dextrine and by varying the total retarder.

The percentage of total retarder and ratio of starch to dextrine may be varied within the limits set forth above, in order to change the characteristics of the cement. For example, when using an ASTM Type 11 basic cement and adding 0.08% total retarder, the API Schedule 6 thickening-time can be varied from 3 hours and minutes when the ratio of starch to dextrine is 2:1 to 2 hours and 48 minutes when the ratio of starch to dextrine is 3.25:1. With the same cement, the thickening-time can be changed to 4 hours and 45 minutes by adding 0.10% of retarder in which the ratio of starch to dextrine is 3.25:1.

While several embodiments of our invention have been described it will be apparent that other modifications and adaptations can be made without departing from the scope of the following claims.

We claim:

1. A retarded oil well cement of consistent retarding behavior comprising an oil well portland cement, and a retarder present in an amount equal to 0.08 to 0.13% by weight of said portland cement, said retarder consisting of 1 to 8 parts by weight of a modified starch to 1 part by range of 0 to 3% weight of dextrine, said starch being of the group consisting of oxidized starches and hydrolyzed starches which are substantially non-gelling when added to water and cement-water mixtures and which form a solution in water that responds to the iodine test for starch to show a blue to violet color, said starch having a cold water solubility range of 20 to 30% and the dextrine a cold water solubility range of 12 to 35%.

2. The method of making a retarded oil well cement which includes an oil well portland cement and a retarder present in an amount equal to 0.08 to 0.13% by weight of said portland cement, said retarder consisting of 1 to 8 parts by weight of a modified starch to 1 part by weight of dextrine, said starch being of the group consisting of oxidized starches and hydrolyzed starches which are substantially non-gelling when added to water and cementwater mixtures and which form a solution in water that responds to the iodine test for starch to show a blue to violet color, said starch having a cold water solubility range of 20 to 30% and the dextrine a cold water solubility range of 12 to 35%; which method comprises providing an oil well portland cement, grinding said modified starch at a maximum temperature of F. to such fineness that it will pass a 200 mesh sieve, providing powdered dextrine, and then mixing said starch, dextrine and oil well portland cement at a maximum temperature of F.

References Cited UNITED STATES PATENTS 2,374,628 4/1945 Swayze 10692 2,429,211 10/1947 Andes 106-92 2,576,955 12/1951 Ludwig l06-92 2,648,645 8/1953 Boris et al 106-92 TOBIAS E. LEVOW, Primary Examiner.

SAMUEL E. MOTT, Assistant Examiner.

PATENT CITATIONS

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US2374628 *	May 14, 1940	Apr 24, 1945	Lone Star Cement Corp	Portland cement and method of retarding the setting rate thereof
US2429211 *	Feb 7, 1944	Oct 21, 1947	Charles Ludwig Norman	High-temperature cement modifier

US2576955 *	Oct 18, 1946	Dec 4, 1951	Universal Atlas Cement Company	Low-water-loss cement
US2648645 *	Jan 24, 1951	Aug 11, 1953	Universal Atlas Cement Company	Cement composition with additive to reduce water loss from a slurry thereof

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US3503768 *	Mar 22, 1967	Mar 31, 1970	Grace W R & Co	Dialdehyde starch hydraulic cement composition additive
US3663287 *	Sep 4, 1970	May 16, 1972	Denki Kagaku Kogyo Kk	Cement additive comprising calcium sulfo-aluminate, an organic adhesive, a foaming agent, and a dispersing agent
US3861467 *	Dec 28, 1973	Jan 21, 1975	Texaco Inc	Permeable cementing method
US4073658 *	Jan 26, 1977	Feb 14, 1978	Kao Soap Co., Ltd.	Hydraulic cement composition
US4302251 *	Nov 26, 1979	Nov 24, 1981	Denki Kagaku Kogyo Kabushiki Kaisha	Cement composition containing dextrin
US8703659 *	Jan 19, 2006	Apr 22, 2014	Halliburton Energy Services, Inc.	Sealant composition comprising a gel system and a reduced amount of cement for a permeable zone downhole
US20060234871 *	Jan 19, 2006	Oct 19, 2006	Halliburton Energy Services, Inc.	Sealant composition comprising a gel system and a reduced amount of cement for a permeable zone downhole
CN103395114B *	Jul 19, 2013	Jun 17, 2015	嘉华特种水泥股份有限公司	一种油井水泥养护方法

* Cited by examiner

CLASSIFICATIONS

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Cooperative Classification	C09K8/46, C04B24/383, C09K8/42
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