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PIPE JOINTING COMPOSITION

Raymond B. Seymour, Allentown, and Walter R. Pascoe, Reading, Pa., assignors to The Atlas Mineral Products Company of Pennsylvania, Mertztown, Pa., a corporation of Pennsylvania

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1 Claim. (Cl. 106—14)

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This invention relates to an improved sulfur pipe jointing composition adapted for use in pipe joints of the poured type.

Molten sulfur alone and with admixtures has been used for some time for jointing various materials. These compositions have been used throughout the world under various proprietary names and have been successfully used in this country for 50 years. One of the most successful compositions is that having a composition as follows: 58.8% sulfur, 38% graded silica aggregate of which 90% passes through a 325 mesh screen, 2% carbon black and 1.2% Thiokol. This composition has been used successfully for 15 years in jointing cast iron watermains. This composition greatly reduces initial leakage and has a great resistance to vibration and thermal shock.

The sealing of this type of joint presumably depends upon a reaction between sulfur and iron in the presence of water, possibly to form iron sulfide. In properly constructed joints, a thin ring of black material is observed at the iron-sulfur interface and there is no noticeable progression in the depth of this thin ring during years of service. However, if the joint is not properly poured or if there is settling of the ground, leaking of the joint will take place until sufficient action between the sulfur and the iron has ensued to cause a resealing of the joint. This type of action is generally not detrimental to the life of the pipe but if there is continued settling of the ground or vibration so that the resealing process must take place at frequent intervals, enough iron may be used up in the reaction to decrease the length of service of the pipe. Further, if corrosives such as sodium chloride are present in the water or in the sulfur compound, severe corrosion will take place at the joint.

An object of this invention is to provide an improved sulfur composition for jointing pipes in which corrosion of the pipe at the interface between the sulfur compound and the pipe is eliminated.

Another object of this invention is to provide an improved sulfur composition for jointing pipes in which the iron sulfide ring usually formed in this type of a joint is eliminated.

A laboratory method has been developed which gives a good insight into the performance of sulfur jointing compositions in cast iron pipes. In these tests, a piece of cast iron such as a nail is inserted in a figure eight briquette filled with a sulfur jointing composition and the time for

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corrosion to take place at the interface between the cast iron piece and the sulfur composition when the figure eight briquette is immersed in various solutions is measured. The figure eight briquette employed is identical with that used in the A. S. T. M. standard method for determining tensile strength of hydraulic cement mortars. The briquette-gang mold is disclosed on pages 144–146 of the A. S. T. M. Standards 1949.

When the briquette filled with sulfur jointing composition and having a cast iron piece inserted therein is immersed in a corrosive solution, there are generally two effects; either the cast iron piece is completely corroded off at the interface or the sulfur compound is split open at this point. It is believed that the latter phenomenon is the result of excessive corrosion. Using this method, it was found that standard salt-free sulfur jointing compounds would last 150–200 days at a pH of 6–8 before the nail would be completely corroded off or before any cracking would take place. However, if 5% sodium chloride is added to the sulfur compound, the time for cracking is reduced to 40 days. Since it is a well established fact that corrosion with sulfur compounds is accelerated in the presence of sodium chloride, it was reasoned that if a material could be found to extend the time of complete corrosion or cracking, that such a material would have a similar effect in sulfur jointing compositions. This is particularly important since due to the shortages of lead, it is essential to use sulfur jointing compositions wherever possible and to ascertain that such materials will outlast the cast iron pipe.

In the series of experiments to be described, many compounds were tested but only a few proved to be of interest using the criterion previously cited. Metallic powders such as aluminum, lead, iron and zinc, as well as most of the salts of these materials, did not decrease corrosion in any way. For example, the addition of 5% aluminum oleate allowed the material to crack in a shorter time as 40 days. Similar effects were noted with aluminum phosphate, aluminum stearate and calcium stearate. Well known inhibitors such as dibutyl thiourea and diethyl thiourea appeared to lengthen the time somewhat but these products decreased the strength of the sulfur compound to the point where it was not of practical value. Likewise, sodium benzoate which is also a well known corrosion inhibitor was without effect, regardless of concentration. Sodium benzoate appeared to inhibit rust formation but greatly accelerated the formation of a black ring which is presumably iron sulfide.

Among the many other materials tried were various clays, triethanol amine, and phosphoric acid but none of these materials decreased the corrosion. For example, the addition of as little as 3% Bentonite caused the briquette to crack in tap water in 35 days. In this case, the cracking was very violent and caused the briquette to shatter. However, the addition of chromium compounds accomplished the object of this invention. Various chromium compounds may be employed, examples of which are chromic oxide which may react with water to give chromic acid, zinc chromate, lead chromate, barium chromate, sodium chromate and sodium dichromate.

The utility of this invention cannot be explained completely since in actual pipe joints, it would take from 40 to 50 years to prove success or failure. However, if the tests previously described are significant, it can be predicted that the life of sulfur joints has been increased by at least several hundred percent.

To prove that the corrosion resistant effect obtained by the addition of chromic acid or chromates to the sulfur compound was permanent and not due to a leaching out of soluble chromates, the test using the figure eight briquette was conducted in running water. By analyzing the water it was shown that no chromates were being extracted.

The quantity of chromic acid or chromates which may be added to the sulfur composition is variable and the range of 0.5 to 5% by weight of the sulfur composition is preferred.

The invention will be further illustrated by the following examples.

Example 1

A mixture of 58.8% sulfur, 38.8% graded silica aggregate, 2% carbon and 1.2% Thiokol was heated and poured in a figure eight briquette. While this material was still molten, a cast iron piece was inserted and allowed to be exposed above the surface. When this was placed in water at a pH of 6, the briquette cracked in 157 days. When this was repeated at a pH of 9, the briquette cracked in 15 days.

Example 2

Example 1 was repeated except that 2% sodium chloride was added to the sulfur composition. In this test the briquette cracked in 46 days at a pH of 6.

Example 3

Example 1 was repeated except that 1% lead chromate was added to the sulfur composition. In this test no cracking took place and the cast iron piece was not corroded off after 250 days.

Example 4

Example 1 was repeated except that 5% zinc chromate was added to the sulfur composition. In this test the briquette was unchanged after 300 days.

Example 5

Example 1 was repeated except that 3% chromic acid was added to the sulfur composition. In this test no noticeable change had taken place after 250 days. Similar effects were had with 1 and 5% chromic acid.

Example 6

Example 1 was repeated except that 3% sodium chromate was added to the sulfur composition. In this test no change had taken place after 200 days in tap water even in the presence of sodium chloride.

Example 7

A sulfur composition similar to that employed in Example 1 to which 3% chromic acid was added was used to pour a pipe joint in the usual manner. This joint was immediately put under pressure and there was a small amount of water lost during the first few hours but the pipe joint sealed completely within 2 days. There was no black iron sulfide ring observable when the joint was cut apart and inspected.

Example 8

To the sulfur composition employed in Example 1 was added 2% chromic acid and 1% lead chromate and a joint was poured in a 4'' cast iron watermain in the usual manner. This joint showed no leakage after 2 days under a pressure of 125 p. s. i. This joint was subjected to a 5' head of water for 18 months and showed no leakage. At this time, the joint was cut apart and no pitting or any corrosion of any kind was noted at the interface between the sulfur compound and the pipe.

It will be apparent to those skilled in the art that this invention is subject to wide application and the scope thereof is to be restricted only in accordance with the appended claim.

What is claimed is:

A pipe jointing composition which consists essentially of a major proportion of sulfur, a silica aggregate and a compound of chromium selected from the group consisting of chromic acid, zinc chromate, lead chromate, barium chromate, sodium chromate and sodium dichromate, said compound of chromium being in the range of from about 0.5 to about 5% of the total weight of the sulfur and the aggregate.

RAYMOND B. SEYMOUR.
WALTER R. PASCOE.

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