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METHOD OF RENDERING CONCRETE GAS TIGHT

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This invention relates to the treatment of concrete pipe to eliminate porosity, and particularly to render it gas tight.

Concrete pipe is not susceptible to severe soil corrosion, nor to electrolysis, it is cheaper than metallic pipe, and the sections may be built and installed in the field, or closely adjacent to the point of use. This eliminates the freight and transportation charges which attend the use of metallic pipe. For these and other reasons it is used widely for purposes which do not require impermeability to gases.

The foregoing and other advantages would render it desirable for transmission of gases, e. g. in natural gas lines. But up to the present time it has not been possible satisfactorily to use concrete pipe for this purpose because as made commercially it is highly permeable by gases. Means have been proposed to overcome this difficulty, to render the pipe proof against gas leakage, but as far as I am aware no satisfactory solution of this problem was available prior to this invention. For instance, it has been proposed to paint the exterior or interior, or both, surfaces of the pipe. The continuity of paint films may be destroyed readily under the conditions of use, and in any event paint films do not adequately resist to gas leakage. It has been suggested also to impregnate concrete pipe with various materials, such as emulsions of various kinds, for instance asphalt emulsions. Impregnation of concrete pipe with such materials may render it waterproof, because the asphalt or the like is water-repellant. But the materials proposed heretofore for this purpose do not render the pipe impervious to gas, and even if they did make the pipe adequately gas tight such pipe could not be used for many purposes. Thus if used in gas lines the drips would dissolve the asphalt and open the pores to escape of gas.

It is among the objects of this invention to provide concrete pipe which is satisfactorily impervious to gas under pressure, and a simple, effective, readily practiced and inexpensive method of making such gas-tight pipe.

I have discovered that the failure of prior treatments to render concrete pipe adequately gas tight has been due to the fact that when the treated pipe is cooled and dried the asphalt, or other impregnating material, shrinks. Thus it has been characteristic of the methods applied prior to my invention that the pores are not in fact closed, and gas under pressure leaks through the pipe.

This invention is predicated upon my discovery that the disadvantages of prior procedures may be eliminated and concrete pipe may be rendered satisfactorily tight to gas under pressure by impregnating it with a drying fatty oil, and oxidizing, or "drying", the oil in the pores of the pipe. In this manner the pores are filled with oxidation product of drying fatty oils, and I have found that the pores are thereby permanently closed to gas, even under relatively high pressures.

Upon being exposed to oxidation the fatty oils contemplated herein are converted to more or less hard and somewhat resilient products, depending upon the mass of the dried material. An important feature from which major benefits flow is that this pore-filling material does not shrink within the pores, and does not crack upon exposure of the pipe. In fact, I now believe that upon drying these fatty oils expand somewhat, so that, unlike previously used materials, exposure after impregnation increases the resistance to gas penetration. Whether or not they do expand, however, the dried oil does close the pores effectively and permanently.

In the practice of the invention any suitable fatty drying oils may be used. For instance, satisfactory results have been obtained by impregnating the pipe with linseed oil, drying types of fish oils, and Chinese wood, or tung, oil, as well as with a by-product obtained in the refining of linseed oil and known in the trade as "Black Oil." This latter is a dark colored oil having drying properties. and it is cheap and readily available because its impurities and color render it unfit for use in paints.

These oils generally have a content of free fatty acid, e. g. linoleic and related acids, which is removed to prepare them for use in paints and varnishes. Such refined oils may be used in the practice of the invention, but the most satisfactory results are had by using the crude oils containing such free fatty acid. This is due in part to the lesser cost of such unrefined material. But primarily it results from the fact that the free acid may slowly combine chemically with alkaline constituents of the cement, to form salts which act to bond the dried oil firmly in the pores. Thus the lime of the cement may react to form calcium salts. Such reactions occurring with drying of the oil form salts between its surfaces contacting with the pore walls, and thus lock the dried oil in place.

In accordance with the invention the oil is not applied merely to the surfaces of the pipe, but on the contrary the pipe is impregnated with it, preferably as deeply as possible. This may be ac-

complished by various procedures known in the art, for example according to the vacuum procedures used in the impregnation of wood with preservatives. For instance, the pipe may be subjected to a relatively high vacuum in a closed chamber, after which the drying fatty oil is then run into the tank and pressure applied. Preferably the oil is heated to reduce its viscosity, to effect ready penetration. This and other procedures and their characteristic apparatus are so well known as to require no further detailed description. The initial vacuum and the subsequent application of pressure combine to cause a deep, thorough penetration of the oil into the pipe. Pressures of 20 to 50 pounds per square inch have been found to accomplish satisfactory results. The excess oil is then drained off, and the oil remaining in the pores is then oxidized, as by exposing the pipe to air. Thereupon it is ready for use.

The advantages of the invention may be understood best by tests which have been carried out on pipe treated in accordance with it. For instance, concrete pipe was impregnated with drying fatty oil and dried. The dried pipe was immersed in water and an air pressure of thirty pounds was applied to its interior. After twenty-four hours there was no evidence of bubbling, nor of any drop in pressure in the pipe. An identical specimen tested before being impregnated bubbled profusely under water, and it was impossible to maintain one ounce of pressure for five minutes.

The invention, therefore, is adapted to the production of pipe suitable for use in transportation of gases, and particular benefit arises from its ability to withstand relatively high pressures. The pores are permanently closed, and the pipe is not subject to the disadvantages of materials previously used for this purpose. In the preferred embodiment, furthermore, the pore-filling material is locked in place, which adds to its resistance to gas pressures. Moreover, the oxidation products of these oils are stable to the substances with which they may be required to contact, so that the integrity of the pore filler is not affected in use.

According to the provisions of the patent statutes, I have explained the principle and mode of practicing my invention, and have described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

I claim:

1. A method of rendering concrete pipe impervious to gas, comprising impregnating the pores of the pipe with a drying fatty oil, and subjecting the impregnated pipe to an oxidizing atmosphere to thereby cause said pores to be filled with solidified oil oxidation product bonded therein by reaction between the oil and an alkaline constituent of the concrete, and thereby rendering the pipe tight to gas under pressure.

2. A method of rendering concrete pipe impervious to gas under pressure, comprising subjecting the pipe to vacuum in a closed chamber and while vacuumized introducing drying fatty oil into the chamber, applying pressure to the oil in the chamber to thereby impregnate the pores of the pipe with said oil, removing excess oil from the pipe, and subjecting the oil-impregnated pipe to an oxidizing atmosphere to thereby cause said pores to be filled with solidified oil oxidation product expanded in the pores and bonded therein by reaction of constituents of the oil and concrete, and thereby rendering the pipe tight to gas under pressure.

3. A method of rendering concrete pipe impervious to gas under pressure, comprising subjecting the pipe to vacuum in a closed chamber and while vacuumized introducing heated drying fatty oil into the chamber, applying about 20 to 50 pounds per square inch pressure to the oil in the chamber to thereby impregnate the pores of the pipe with said oil, removing excess oil from the pipe, and subjecting the oil-impregnated pipe to an oxidizing atmosphere to thereby cause said pores to become filled with solidified expanded oil oxidation product bonded therein by reaction of constituents of the oil and the concrete, and thereby rendering the pipe tight to gas under pressure.

4. A method of rendering concrete pipe impervious to gas, comprising impregnating the pores of the pipe with drying fatty oil containing free fatty acid, and oxidizing the oil in the pores, said oil being converted to solidified oxidation product and said fatty acid uniting chemically with a constituent of the concrete to bond said oxidation product in the pores, whereby the pipe is rendered tight to gas under pressure.

5. A method of rendering concrete pipe impervious to gas, comprising vacuumizing the pipe in a closed chamber and admitting heated drying fatty oil containing free fatty acid, applying pressure to the oil in said chamber, whereby to cause deep penetration of said oil into the pores of the pipe, removing excess oil, and oxidizing residual oil in the pores, said oil being converted to solidified oxidation product and said fatty acid uniting chemically with a constituent of the concrete to bond said oxidation product in the pores, whereby the pipe is rendered tight to gas under pressure.

6. Concrete pipe impervious to gas under pressure, the pores of said pipe being closed by fatty drying oil oxidation product formed by drying of such oil in the pores.

7. Concrete pipe impervious to gas under pressure, the pores of said pipe being closed by fatty drying oil oxidation product formed by drying of such oil in the pores, and said oxidation product being bonded in the pores by reaction product of free fatty acid of the oil and a constituent of the concrete.

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