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METHOD OF PRODUCING ACID-RESISTANT
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a corporation of DelawareNo Drawing. Application October 26, 1937,
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This invention relates to acid-resistant iron pipe and method of producing the same.

Iron pipe, either of wrought iron, mild steel, or cast iron, is rapidly corroded by dilute acids. The use of pipe is necessary in certain operations, for example, pumping acid mine waters, and corrosion by such acid waters has heretofore caused serious losses and inconvenience. No other metal than iron is available for such purposes, on account of the low cost of iron.

In an attempt to avoid or reduce such corrosion of iron, the interior of iron pipes has been coated with various paints, varnishes, and the like, without success. Also, iron pipe has been coated on the interior with concrete, but without substantial improvement when applied to the pumping of mine waters and the like.

An average mine water has corrosive properties comparable to water containing 5% sulfuric acid and 5% ferric sulfate. Consequently, such a solution is currently used for testing iron equipment used in mine waters, and is used in the tests hereinafter described.

I have found that cast iron pipe coated on the interior with concrete failed rapidly when exposed to the above synthetic mine water. I have also found that an application of various varnishes, including a chlorinated rubber varnish especially adapted to acid resistance, to the interior surface of such concrete-lined pipe, was unsatisfactory. I have furthermore found that the hot application to the interior of the concrete lining of a gasoline-insoluble pine wood resin made by extracting resinous wood by a coal tar hydrocarbon solvent, evaporating the solvent, extracting rosin from the residue by gasoline, and recovering a gasoline-insoluble resin, was not effective in resisting the action of mine waters, due to brittleness of the coating.

The above tests were made by taking lengths of concrete-lined pipe, sealed at the end by flat iron plates, and the interior of the pipe filled with the synthetic mine water above described and a small amount of sand, to simulate the abrasive carried by mine water. The sealed pipes were tumbled end over end on a revolving frame, revolving at 40 R. P. M., for a suitable period, opened, the contents removed, and the linings examined. Since all tests were run simultaneously, for the same period, the results were comparative.

Now I have found that iron pipe resistant to the action of mine waters, may be produced in accordance with my invention, which improved pipe resists the above-described test for three to

four months, and is essentially unaffected at the end of this period, as compared to coated pipes heretofore coated with concrete or varnish lasting from one to three days in the above-described test, or compared to pipe heretofore coated with coal tar or asphalt which resists the test from one to one and one-half months.

More particularly I have found that I may produce iron pipe resistant to the action of mine waters by applying to the interior of said pipe a molten composition consisting essentially of a reaction product of an unsaturated oil, as hereinafter defined, and a gasoline-insoluble pine wood resin. This composition will preferably be applied to an iron pipe which has received a priming coat, applied in any suitable manner, for instance, by means of a solution, as more fully described below, although if desired it may also be applied directly to iron pipe, containing no primer.

The unsaturated oils, suitable for use according to my invention, comprise either drying or semi-drying glyceride oils. Examples of these oils are linseed oil, perilla oil, corn oil, soya bean oil and menhaden oil.

In producing the coated pipe in accordance with one form of my invention, I prepare first a solution of the above identified gasoline-insoluble pine wood resin in a suitable solvent or solvent-diluent mixture therefor and then give the interior of the pipe a priming coat of the above solution by dipping or flushing. The proportions of resin, solvent or solvent mixture are not critical, and depend merely on the particular working conditions. As a general rule it will, of course, be desirable, from an economic standpoint, to have as much resin present in the solution as is consistent with ease of manipulation of the coating.

I then cook together a mixture of an unsaturated oil and the above described gasoline-insoluble pine wood resin until the components are compatible. While still molten, I then apply this mixture to the interior of the pipe, preliminarily given a priming coat as above described, by flowing such molten mixture around the interior of the pipe by any of the methods known to the art, drain off the excess and allow the coated pipe to cool.

I may, if desired, add alkaline condensing agents such as, for example, hydrated lime, zinc oxide, or mixtures thereof, to the molten mixture prior to coating, in order to accelerate the formation of the reaction product. However, where longer times of cooking may be employed, I have

found that I may omit the addition of the alkaline condensing agents.

Furthermore, I have found that where my coated pipe is to be subjected to elevated temperatures in actual use, I may add short fiber asbestos to the molten mixture and then apply it to the interior of the pipe.

As I have already indicated above, various drying or semi-drying glyceride oils of either vegetable or animal origin may be used in preparing the product according to my invention.

The ratio of old resin, the time and temperature of cooking are not critical factors and will depend on the composition of the reaction product and the purpose for which it is intended.

Having now described in a general way, the process according to my invention, I will now proceed with a more detailed description thereof.

In producing the coated pipe in accordance with my invention, for example, I prepare a solution of the above identified, gasoline-insoluble pine wood resin, 40 parts by weight, in 60 parts by weight of a solvent composed of 70% denatured alcohol and 30% toluene, and then give the interior of an iron pipe a priming coat of the above solution, for example, by dipping or flushing.

I then cook together for 20 minutes at a temperature of 572° F. a mixture of 30 parts by weight of sardine oil, 70 parts by weight of the above identified gasoline-insoluble pine wood resin, or until the mixture becomes compatible. To 250 parts by weight of the above oil/resin composition, I then add 12.5 parts by weight of short fiber asbestos (grade F shorts). I then apply this molten mixture to the interior of the iron pipe preliminarily given a priming coat as above described, by flowing such molten mixture around the interior of the pipe, then draining off the excess and allowing the coated pipe to cool.

In the above composition, I may, if desired, omit the asbestos, but I prefer to use asbestos when my coated pipe is to be subjected to elevated temperatures in actual use. I may also alter the ratio of resin to oil to suit various conditions, and I may, if desired, use other vegetable or animal oils, for example, menhaden oil, soya bean oil, corn oil, linseed oil, or perilla oil.

As a further example of my invention, I mix 50 parts by weight of linseed oil, boiled at 575° F. to a viscosity of S on the Gardner-Holdt Standard scale, and 50 parts by weight of the above described resin, heat the mixture to 575° F. for 3 hours, then add 0.1% of hydrated lime and 0.2% of zinc oxide forming a slightly sticky plastic, flexible at temperatures as low as 32° F. While still molten, I apply this mixture to the interior of iron pipe which has already been given a priming coat as hereinbefore described. I may use, instead of the heat-bodied linseed oil, other vegetable or animal oils, such as, menhaden oil, sardine oil, soya bean oil or corn oil.

As another example of my invention, I mix 50 parts by weight of menhaden oil boiled at 575° F. to a viscosity of S on the Gardner-Holdt Stand-

ard scale and 50 parts by weight of the above described resin and heat the mixture at about 575° F. for four hours. Then while still molten, I apply this mixture to the interior of iron pipe which has already been given a priming coat as hereinbefore described.

I may coat pipe as described above, or I may apply my plasticized resin coating to the interior of concrete-lined pipe. However, I find it, in general, satisfactory to dispense with the cost and inconvenience of the concrete lining and apply my coating directly to the metal pipe interior, as described.

Where in the claims I refer to a gasoline-insoluble resin derived from pine wood, I refer to a resin obtained by extracting pine wood with a coal tar hydrocarbon, removing the volatile substances from the extract obtained, and then extracting the nonvolatile residue with gasoline, thereby removing rosin from the extract and recovering the gasoline-insoluble resin.

What I claim and desire to protect by Letters Patent is:

1. A method of coating iron pipe to render said pipe resistant to dilute acids which includes applying to said pipe a priming coat comprising a solution of a gasoline-insoluble resin derived from pine wood, then applying a molten composition comprising the reaction product of an unsaturated oil and a gasoline-insoluble resin derived from pine wood, and cooling.

2. A method of coating pipe to render the pipe resistant to dilute acids which includes applying to the pipe a priming coat comprising a solution of a gasoline-insoluble resin derived from pine wood, then applying a molten composition comprising the reaction product of linseed oil and a gasoline-insoluble resin derived from pine wood, and cooling.

3. A method of coating iron pipe to render said pipe resistant to dilute acids which includes applying to said pipe a priming coat comprising a solution of a gasoline-insoluble resin derived from pine wood, then applying a molten composition comprising the reaction product of menhaden oil and a gasoline-insoluble resin derived from pine wood, and cooling.

4. A method of coating pipe to render the pipe resistant to dilute acids which includes applying to the pipe a priming coat comprising a solution of gasoline-insoluble resin derived from pine wood, then applying a molten composition comprising the reaction product of an unsaturated oil and a gasoline-insoluble resin derived from pine wood, and cooling.

5. A method of coating pipe to render the pipe resistant to dilute acids which includes applying to the pipe a priming coat comprising a solution of a gasoline-insoluble resin derived from pine wood, then applying a molten composition comprising the reaction product of an unsaturated oil and a gasoline-insoluble resin derived from pine wood to which an alkaline condensing agent has been added, and cooling.

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