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MANUFACTURE OF COATED PIPES

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This invention relates to manufacture of coated pipes; and it comprises a process wherein the inside of a metal pipe is coated with an artificial resin of the phenol-formaldehyde type by introducing into the pipe a fluent mixture containing a solvent-free resin of this type, an inert filler and a hardening agent, the hardening agent being advantageously mixed with the resin just prior to the introduction of the mixture into said pipe, the pipe being rotated rapidly on its axis to uniformly distribute the resin mixture on the inner wall, rotation being continued until said resin solidifies on the pipe wall, the temperature of the pipe being advantageously maintained at a temperature not substantially exceeding room temperature and the quantity of resin applied being at least about 0.8 kilogram per square meter, producing a minimum coating thickness of 0.5 mm., the inner wall of the pipe being precoated, if desired, with a ground coat of benzyl cellulose with or without the admixture of a pigment; all as more fully hereinafter set forth and as claimed.

Pipes, made of different materials and according to different processes, are used extensively for conducting hot liquids, such as hot water. The choice of the kind of pipe to be used depends upon the chemical and mechanical properties of the material to be conducted. Iron pipes, unprotected or galvanized can only be use for liquids which do not attack iron. However, it is known that liquids which do not attack iron in the cold state can assume aggressive properties on being heated. Consequently, most domestic hot waters must be regarded as having aggressive properties, which becomes apparent by the signs of destruction, such as the formation of rust, reduction in cross sectional area, pitting and incrustation. This is the case to an increased extent with hot water derived from condensation, such as collects in condensation conduits. Boiling water can also cause damage. A technically satisfactory solution has hitherto been found by using copper pipes in such cases. It is however desirable and even necessary in many cases to refrain from using copper tubes; the same applies to tinned pipes. Lead pipes must likewise be avoided, and furthermore no satisfactory result is attained therewith for hygienic and technical reasons.

It has been proposed, to protect iron against the action in question by coating. The well known fire galvanizing has not led to any satisfactory result. Pitting and incrustation cannot be permanently prevented thereby. Other metal coatings such as chromium, cannot come into question as they are electropositive to iron and accelerate corrosion at damaged and defective points. The employment of double pipes, for example copper inside and steel outside, also presents technical difficulties in the production and machining.

Hitherto the employment of non-metallic coatings has likewise met with little success. Enameling or glazing has been proposed but the process is complicated, expensive and unsatisfactory from a technical point of view. It must be borne in mind that, in long and sometimes thin pipes, for example 10 meters in length and down to 10 millimeters in diameter, quite different drying conditions prevail in the middle than at the ends, as in the middle the air is always saturated with water vapor, which considerably retards the drying. For this reason the coatings are irregular and insufficiently dense at certain points. Repeated application is almost impossible, for example in the case of enameling. The same difficulty arises to an even greater extent with lacquers and the like, that is with substances which dry physically by separating out solvents. The removal of the solvent entails considerable difficulties. Furthermore all lacquers hitherto placed on the market became unstable in the course of time. The same applies to coats produced using drying oils.

Attention must always be paid to the special conditions in the pipe. There can be no question of renewing the coating.

In the case of cold water good results have been obtained with bituminous substances. These substances, however, fail at higher water temperatures.

No proposal has as yet given satisfactory results, so that at present the hot water is treated, for example by adding sodium sulfite for binding the oxygen or by the addition of sodium phosphate and the like, and black iron pipes are used. Although these methods are good, yet they are expensive and complicated so that a perfect protection for iron pipes is very seriously desired.

The present invention solves the problem in technical and economical respect. According to the present invention resistant coatings are applied which take into consideration the particular conditions in the pipe and which are applied by an advantageous method. The substances employed according to the invention are stable. The formation of the protective film is based on chemical reactions and is not dependent on the removal of solvents for the film forming substance. It is possible by means of these substances to apply in a single operation layers of sufficient thickness. Liquid, solvent-free artificial resins serve as a basis for the coating materials which are used in the method according to the present invention, said artificial resins being phenol-aldehyde resins formed from phenols, such as phenol itself, meta- or para- cresol and the like, and from aldehydes, such as formaldehyde, paraformaldehyde and the like, in known manner.

In one process within the scope of this invention, which represents a practical embodiment thereof, a soluble, fusible liquid resin is produced in known manner from a phenol, such as metracresol, and formaldehyde. A known softening agent such as tricresylphosphate can be added to this liquid resin in a quantity of 5 to 35 per cent, if desired. The liquid artificial resin is now mixed with an inorganic filling material, such as finely ground quartz dust, whereupon a few percent of a hardening agent, such as paratoluene sulfochloride or toluene sulphochloramide, is added. This hardening agent may also be added in known manner to the filling material. The resulting mass is stirred to a paste with distinctly fluid properties and employed in this condition. The hardening of the coating is effected by the condensation between the phenol employed and the formaldehyde. It has been found, that extraordinarily stable and rapidly hardening and comparatively thick protective layers can be produced in this manner.

The fluent coating mass may be filled in an excess amount from one side into a pipe to be coated and distributed on the inside wall, the excess flowing out through a suitably shaped stopper. The amount remaining in the pipe results from the difference between the inside diameter of the pipe and the inner diameter of the stopper. The stopper is preferably so proportioned that about 2.5 kilograms of the coating mass can be applied per square meter, the result being a layer thickness of about 1.5 millimeters after the hardening.

The mass which is thus introduced and distributed in the pipe is uniformly further distributed on the inner wall of the pipe by a rapid rotation thereof. This rotation of the pipe is maintained until the mass has become at least partly set, that is to say, so that it no longer runs off under the action of gravity, a result which, if desired can be accelerated by heating the pipe. The final hardening takes place in the course of time and can also be accelerated by heating.

The said amount of 2.5 kilograms per square meter of coating mass is only given by way of example. If necessary smaller or larger amounts may be applied but with the restriction that the minimum amount required to produce satisfactory results is about 0.8 kilograms per square meter with a layer thickness of 0.5 millimeters, this thickness being critical.

Before the protective mass is filled in the pipes, the pipes can be provided with a known priming, coat of benzyl cellulose, with or without pigment addition for better adhesion. This priming coat may be applied by coating, filling and allowing the excess to flow out or by immersion. It is not necessary that the first coat be absolutely resistant to hot water.

Pipes made according to the method of the present invention are resistant to hot and to boiling water and the coating is even sufficiently steam proof. They also show high resistance to hot water in which acids, bases and salts are dissolved.

While I have described what I consider to be the best embodiments of my process, it is evident that many modifications can be made in the specific procedures described without departing from the purview of this invention. The resins used can be prepared using either aqueous formaldehyde or by the so-called "dry-process". For example, any of the known phenol-aldehyde artificial resins can be used in my coating process, provided these resins, when mixed with an inert filler and hardening agent, are capable of withstanding hot water and steam. The filler to be employed must be inert towards the resin and towards water; it must be non-hygroscopic and dense rather than porous. Any of the usual inert inorganic fillers, such as asbestos, quartz, pumice, emery, etc., in finely divided form, are suitable. And any of the known hardening agents can be employed which are capable of producing hardening of the phenol-aldehyde resin within a reasonable short time in the absence of solvents. The coating procedure can be varied in accordance with the length and size of the pipe to be coated. With large pipes brushing procedures are practical but with smaller pipes it is usually best to flush the resin into the pipe in excess and then to permit or cause the excess to drain off before or during the rotating step. If necessary a double coating can be used to produce the minimum thickness of 0.5 mm. required to produce satisfactory results.

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