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PROTECTIVE COATING OR LINING FOR METAL OBJECTS

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FIG. 1.

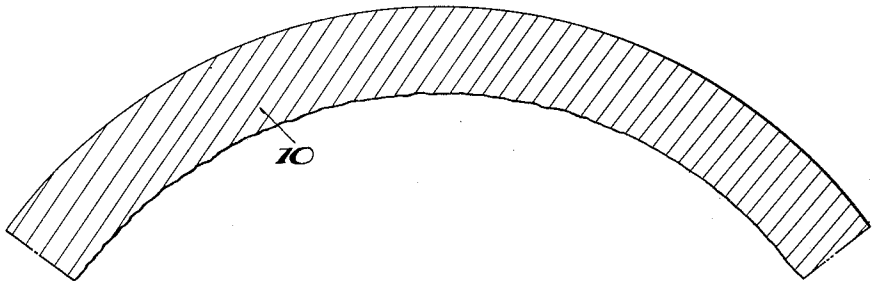


FIG. 2.

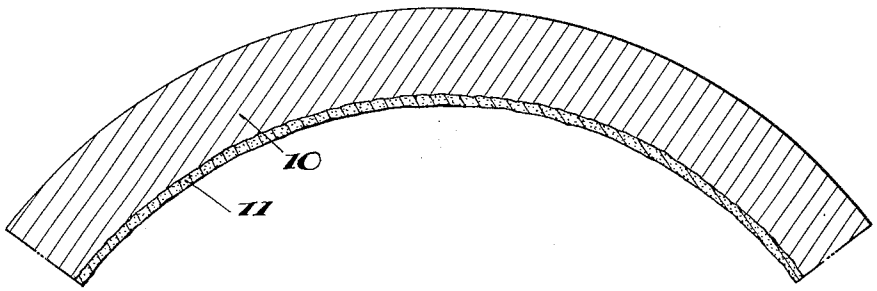
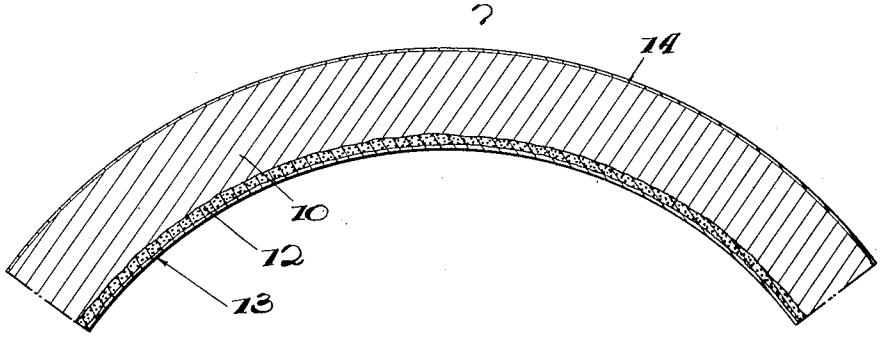


FIG. 3.



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UNITED STATES PATENT OFFICE

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PROTECTIVE COATING OR LINING FOR METAL OBJECTS

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7 Claims. (Cl. 117—30)

This invention relates to protective coatings for metal surfaces, and more particularly to the lining of cast-iron pipe, pipe fittings, and the like which are intended to be used for the conveyance of severely tuberculating water or fluids of a corrosive nature.

One of the principal objects of the invention is to provide an improved coating or lining for a metal object which is firmly bonded to the metal, free from pinholes, will not check-crack, run or sag materially when subjected to the temperatures ordinarily encountered in use, and will be fully protective to the metal.

Another object is to provide a novel, economical and efficient method for applying to metal surfaces protective coatings of the character described, which procedure is especially well adapted to the lining of cast-iron pipes and fittings.

A further object is to produce a tough, resilient coating for metal objects which is completely saturated with a bituminous substance, such as tar, and which can be readily formed and applied to the metal without the use of superatmospheric pressure or the necessity for relatively long periods of standing or storage to effect setting of the coating.

Still another object is to provide a novel composite coating for metal embodying both a granular material and a bitumen which, while relatively thin, will still completely cover and protect the surface of the metal and will firmly adhere thereto in a permanently tough, resilient condition.

A still further object is to provide an improved protective coating or lining for metal objects, and a novel method of producing such coatings, which is at least equal, if not superior, in its protective quality to the forms of coatings hitherto available, but which can be produced at substantially less cost and more rapidly than known coatings of comparable effectiveness.

These and other objects of the invention will appear more clearly upon consideration of the following description and of the accompanying drawing wherein is illustrated, but by way of example only, how the invention may be applied to the lining of a metallic object, such as a cast-iron pipe. Although the disclosure is thus directed primarily to one specific embodiment of the invention, it is to be expressly understood that the invention is not limited to the production of a pipe lining or coating of the particular character described, but may have a relatively wide application to the coating of metals generally.

In the ordinary method of tar coating cast-iron pipe, the pipe is first heated to the desired temperature, usually 300° F., and then immersed once or twice in a hot bath of molten tar. If the pipe is at a relatively high temperature when dipped in the tar bath, the resulting coating is sufficiently adherent, but will be discontinuous due to the presence of pinholes and too thin, particularly at the crests of irregularities in the metal surface, to give complete protection thereto. If, on the other hand, the pipe is at a relatively low temperature when dipped, the coating will be relatively thicker than in the first instance, but will tend to be less adherent and subject to melting and sagging at only moderately high temperatures, as on the order of 150° F. In either event the procedure is time consuming because it is necessary for the pipe to stand long enough to become cooled to approximately atmospheric temperature. This usually requires considerable time.

It has heretofore been proposed to remedy the defects of the conventional coating of bitumen or bituminous material by providing pipe with a cement or enamel lining, either with or without a surface painting of bitumen or bituminous material, but such linings are of necessity relatively thick, being on the order of $\frac{1}{16}$ to $\frac{1}{4}$ inch in thickness, and also relatively expensive to produce. It has also been proposed to first coat a layer of bitumen or bituminous material on the pipe and then apply a second coating of bitumen or bituminous material thereto, but this procedure is also expensive to apply, requires the use of relatively high temperatures and is otherwise unsatisfactory in certain respects from a plant operation standpoint.

It has been now found, in accordance with the present invention, that a sufficiently thick, continuous and adherent protective coating or lining for metal objects can be produced by first applying to the surface of the metal a primer coat of granular material containing a suitable bonding agent which renders the coating highly porous, then drying the primer coat sufficiently to eliminate all moisture therefrom while bonding it firmly to the metal, and then saturating the pores of the primer coat with a bitumen or a bituminous material, such as tar. If desired the exposed surface of the saturated primer coat may thereafter be provided with a finish coat of bitumen or bituminous material.

The granular substance which constitutes the base of the porous primer coat may be either an alkaline material that will offer chemical protection to the metal, such as a material containing an alkaline carbonate, crushed or powdered, either of the limestone type consisting mainly of calcium carbonate or of the dolomitic type consisting of a mixture of calcium and magnesium carbonates, or a siliceous material may be used that will be resistant to acids, such as crushed sand or the like. In forming the primer coat, the granular material is mixed with a small amount of a suitable binder that will give strength in

both the wet and dry states, such as a combination of bentonite clay and rosin, and with sufficient water to form a slurry or emulsion of a pasty consistency suitable for application to the metal surface to be protected. The primer coat may be applied in any suitable manner so as to result in a relatively smooth, even coating, and is then dried by the application of heat until substantially all of the moisture has been expelled and the primer coat left in a highly porous condition firmly bonded to the metal. The primer coat is then impregnated or saturated with tar, or any other suitable bituminous material, by any desired procedure, such as dipping, spraying or brushing. The finish coat of bitumen or bituminous material may be provided by distribution of an excess amount of the bituminous material applied during the saturation step, or by a subsequent spraying, brushing or painting operation.

As one example of the practical application of the invention, the following procedure has been found quite satisfactory in providing cast-iron pipe with a protective lining of the character described.

The pipe is first thoroughly cleaned in the usual manner employed in the conventional hot coal tar dip process, but the extent of grinding heretofore employed is no longer necessary, and, if desired, may be preliminarily heated to a temperature of approximately 150° F. This preliminary heating step, however, is not essential, and may be omitted. The pipe is then rotated about its longitudinal axis while the primer coat is painted onto the interior surface thereof in the form of a slurry or emulsion of pasty consistency, the coat being applied in any desired manner, as by the use of a 360° spray, a whirling nozzle, or an open tube through which the slurry is forced either under pressure or by means of a screw conveyor. To assist in distribution of the primer coat, a trowel or brush, or both, may be attached to the distributing head, the trowelling or brushing action, combined with the centrifugal force created by spinning of the pipe, distributing the coat evenly and smoothly over the relatively rough interior surface of the pipe. In order to ensure complete coverage of the irregularities which normally exist in the surface of the metal, if grinding is to be greatly reduced as may be done by reason of the present invention, the primer coat is preferably applied to a depth or thickness of approximately $\frac{1}{32}$ inch.

As one example of the composition of primer coats falling within the scope of the present invention, a slurry of the following materials and proportions (by weight) has been found well suited for the application to cast-iron pipe of coatings approximately $\frac{1}{32}$ inch in thickness:

Crushed dolomite	Per cent	98
Bentonite clay	do	1
Powdered pine rosin (M. P. about 200° F.)	do	1
Water	Sufficient to provide desired consistency.	

The dolomite in this particular mixture should be of such fineness that all of it will pass a 20 mesh screen, about 20% will stay on a 40 mesh screen, and about 75% on a 140 mesh screen. While the proportions of the various ingredients may be varied somewhat from the percentages above stated, enough bentonite clay should be used to bind the primer coat together and make it sticky when in a wet or plastic state, while the amount of rosin should be sufficient to furnish the additional bond required after the primer coat has dried and before application of the bitumen or bituminous material.

After the primer coat has been applied, it is dried, preferably by a moderate heat applied to the pipe on the order of 300° F. or lower. During the drying, uniform heating is desirable, and it is essential that sufficient heat be applied to eliminate substantially all of the moisture contained in the primer coat and to activate the rosin binder, which melts and increases the porosity of the lining under the effect of the applied heat, whereby the primer coat is converted into a dry porous coating that is firmly adherent and bonded to the metal surface of the pipe. A temperature of approximately 250° to 300° F., maintained for about three minutes, has been found adequate for thorough drying and bonding of a primer coat of the character represented by the foregoing example, and the term "moderate heat" is herein used to mean heating at a temperature which expels the moisture and melts the rosin without effecting the coking or baking temperatures heretofore proposed.

The heating operation, which may be performed by the use of hot air applied directly to the interior of the pipe, is continued sufficiently to raise the temperature of the lining to approximately 250° to 300° F., preferably to about 300° F., whereupon the pipe is dipped in a molten bath of bitumen or bituminous material of a temperature substantially the same as that of the pipe. The dipping step may be carried out in accordance with the standard practice followed in tar dipping pipe, the hot pipe being maintained immersed in the both of hot tar for a sufficient length of time to accomplish complete saturation and filling of the pores of the primer coat with bitumen or bituminous material. Experience has shown that the tar completely permeates the porous lining and establishes a firm bond with the metal. In practice, it has been found that immersion of the primer coated pipe in tar at 300 F. for two minutes under atmospheric pressure is sufficient to effect the desired result.

A finish coat of bitumen or bituminous material may be applied if a gloss finish is desired. Such a coat may be formed by leaving an excess of bitumen or bituminous material in the pipe when it is withdrawn from the dipping tank, and then distributing the excess by rolling the pipe for a sufficient length of time to permit the material to set, or alternatively, the finish coat may be applied by spraying or brushing bitumen or bituminous material on the hot pipe as it comes from the drain rack, or by applying a coat of tar paint after the pipe has cooled to normal temperature.

When coating flat surfaces or objects which cannot be revolved, the primer coat may be applied by painting, as by spraying or brushing the same on the surface to be coated, or the object may be dipped in the primer coat slurry, prior to heating and dipping in the molten bath of bitumen or bituminous material.

Although the nature of the coating or lining provided by the present invention, and the procedure by which the same is formed, should be clearly understandable by those skilled in the art from the foregoing description, reference may be had to the accompanying drawing for a pictorial representation of both the method and the product. In the drawing, Figs. 1, 2 and 3 are fragmentary cross-sectional views, on an en-

larged scale and with somewhat exaggerated depiction of surface irregularities, illustrating successive steps in the method of providing a metal object, such as a cast-iron pipe, with a protective coating or lining in accordance with the invention.

In Fig. 1 there is shown, prior to being processed, a fragment of cast-iron pipe 10 having a relatively rough interior surface which is to be provided with a protective coating or lining. Fig. 2 illustrates the intermediate stage of the procedure after application of the primer coat, the reference character 11 indicating a primer coat of porous granular material firmly bound to the interior surface of the pipe 10. Fig. 3 is intended to represent the pipe after dipping and with or without a finish coat of tar or other suitable bituminous material, the reference character 12 being used to designate the primer coat impregnated with tar or bituminous material, the finish coat or covering of the lining being indicated at 13, while the reference character 14 indicates an outer coating of bituminous material which may be deposited on the exterior of the pipe 10 during the dipping operation.

A lining formed as above described is not brittle but is tough and elastic in texture. It will not chip off because it is firmly bonded to the metal throughout both by the character of the granular layer with its bonding material and by the impregnated tar or bituminous material. It is nonporous and fully protective because the pores are completely filled under capillary action by the hot tar or bituminous material during immersion therein.

It will be apparent from the foregoing disclosure that the present invention provides a new, simple and inexpensive method of providing the surfaces of metal objects with coatings or linings, also of novel character, which effectively protect the metal against rust, corrosion and the like, which remain firmly bonded thereto in a permanently tough, resilient condition, and which will not crack, run, sag, or blister even when exposed to relatively rigorous temperature conditions. The method is particularly useful because it can be readily carried out as a continuous, straight-line procedure, and by the use of machinery of the character already available for forming similar, but less advantageous, coatings. In the lining of pipe, for which the invention is especially well adapted, the present procedure produces a coating of characteristics markedly superior to those of the conventional tar coating process, and which compares favorably with the cement, enamel and other special linings which are more expensive and more difficult to produce. These and other features of the present invention are such as to endow both the product and its method of production with substantial advantages over the protective coatings hitherto known, and characterize the invention as a widely useful improvement in the metal coating art.

While only one specific embodiment of the invention has been described herein in detail, comprising a preferred procedure and formula for use in the lining of cast-iron pipe, it will be apparent that the invention is not limited to the method and product expressly set forth, but is capable of various modifications both as to its field of use and as to the specific materials, proportions, temperatures, etc., employed. It should also be obvious that the procedure and apparatus by which the various steps of the method are performed may be suitably varied; for example, it is clear that the bitumen with which the primer coat is impregnated may be applied thereto by a spraying or brushing operation, as well as by the dipping procedure described. Various other changes, which will now suggest themselves to those skilled in the art, may be made in the procedural steps of the method, and in the specific composition of the resulting product, without departing from the spirit of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A method of protectively coating a metal surface comprising the steps of coating said surface with a water slurry of finely divided alkaline earth carbonate free of bituminous material but containing a relatively small amount of bentonite as a binder and a relatively small amount of rosin as a bonding agent to produce a primer coat on the order of a thirty second inch in thickness, applying a moderate heat to the coating to melt the rosin and produce temporary adhesion of the coating to said surface and to expel water from said coating thereby rendering the coating highly porous, and then completing the bonding of the coating to the metal by introducing fluid bituminous material into and through said pores to effect adhesion to the metal.

2. A method of protectively coating a metal surface comprising the steps of coating said surface with a water slurry of approximately 98% finely divided material containing calcium carbonate, 1% bentonite clay and 1% powdered rosin to produce a primer coat on the order of a thirty second inch in thickness, applying a moderate heat to the coating to melt the rosin and produce temporary adhesion of the coating to said surface and to expel water from said coating thereby rendering the coating highly porous, and then completing the bonding of the coating to the metal by introducing fluid bituminous material into and through said pores to effect adhesion to the metal.

3. A method according to claim 1 wherein the metal surface is heated prior to the application of the primer coat to a temperature on the order of 150° F.

4. A method according to claim 1 wherein the primer coat is heated to a temperature on the order of 250° to 300° F. prior to impregnating the pores of said primer coat with said bituminous material.

5. A method according to claim 1 wherein said bituminous material is introduced into the pores of said primer coat at a temperature on the order of 300° F.

6. A metal object having a tough resilient protective coating consisting predominantly of a porous layer of finely divided alkaline earth carbonate containing a small percentage of rosin and a small percentage of bentonite and adhered to the metal surface between the pores by fused rosin with the pores of said layer filled with a bituminous material that is bonded to the metal at said pores.

7. A metal object having a tough resilient protective coating consisting predominantly of a porous layer containing approximately 98% finely divided material containing calcium carbonate, 1% bentonite clay and 1% rosin and adhered to the metal surface between the pores by fused rosin with the pores of said layer filled with a bituminous material that is bonded to the metal at said pores.

WILLIAM D. MOORE.