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(54) **Protective internal coating for restoring underground metal tanks and process for its application.**

(57) The invention consists of a protective internal coating for restoring underground metal tanks or any other tank subject to attack of aggressive agents, said coating consisting of a structure of alternate layers of an epoxy resin paint and a fabric cloth of fiberglass or polymers with high elasticity modulus, on which a final overlay of vitrifying paint is applied, so as to form an internal shell having chemical and mechanical features independent from those of the tank, and eliminating leakage of the tank contents.

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"PROTECTIVE INTERNAL COATING FOR RESTORING UNDERGROUND METAL TANKS AND PROCESS FOR ITS APPLICATION"

The present invention relates to restoration or repair of underground metal tanks or reservoirs which were damaged by corrosion, and more particularly, but not exclusively, of tanks for combustible oils.

The protective coating according to the present invention is applied inside metal tanks undergoing the corrosive action of internal and/or external agents.

It is well known that the inner surface of a metal tank, used to contain combustible oils, undergoes the direct action of the various substances which are refining residues, said action being enhanced by condensate water normally formed in said tanks in summertime.

It is also known that the outer surface of the tank undergoes an intense action by stray currents and chemicals contained in the soil. The aggressivity of these chemicals is also considerably increased with time as for instance rain removes from atmosphere big amounts of acidic products which penetrate into the ground and then come in contact with the outer surface of said underground tanks.

Tarring normally used for the external protection of the tank, though of very

good quality, is not giving acceptable results against stray currents and undergoes a rapid decay with time.

The above mentioned corrosive actions began to appear in a very negative way. The occurrences of tanks showing damages due to metal corrosion are more and more frequent. Damaged or perforated tanks are causing loss of large quantities of fuel and consequently soil pollution. The leaking fuel penetrates underground, reaches water beds and spreads everywhere. Such occurrences now begin to awaken fear.

The most recent techniques for newly installed tanks provide for protective coatings consisting of epoxy products without solvents. One of the decisive factors for a good lifetime of these protective coatings is their thickness. Said techniques provide also for the application to existing underground tanks of bearing coating of sandwiched plastics which gave satisfactory results but are expensive and are subject to considerable difficulties of application.

The protective coating for underground tanks according to the present invention does not show the above mentioned drawbacks and it is advantageously used also for drinking water reservoirs, compartments of tankers for crude oil or water transportation (and ballast in the empty no-load trip) and the like.

The protective coating for underground tanks according to the present invention consists of a plurality of layers of two materials only, and more particularly, but not exclusively, of an epoxy paint and a fiberglass fabric.

The application of said coating is carried out according to a process comprising the following steps:

(a) internal cleaning of the tank and pickling of the inner sheet plate by one of the known mechanical, thermal or chemical methods;

(b) thorough cheking of the inner surface to ascertain its strength condition;

(c) if the sheet plate is still in a good condition, applying a first layer or primer of epoxy paint having the particular characteristic of penetrating into the eventual corrosion areas and holes so as to form a true seal of the holes and strengthening of the plate, said paint having a density between 1.6 and 1.8 of tixotropic viscosity;

(d) letting the layer stand for about two hours in order to allow optimal setting of the epoxy paint;

(e) applying fiberglass cloths of any known type, the choice of the epoxy paint and fiberglass being such as to constitute a composite product with an optimal elasticity modulus in respect of the metal of the tank;

(f) applying a second layer of epoxy paint;

(g) curing at room temperature the group comprised of epoxy resin + fiberglass cloth + epoxy resin;

(h) applying a final overlay of vitrifying epoxy paint;

(i) hardening the whole by means of hot air blow.

The so obtained coating, consisting of said combination of epoxy products and fiberglass fabric and having a thickness of 1500 - 4000 microns, has a very high mechanical strength and cannot be attacked by acids and stray currents. The coating consisting of such a combination warrants a good tank tightness even in presence of severe external corrosion.

The coating according to the present invention may also be formed by a greater number of layers of fiberglass cloth and epoxy resin, in case the conditions of the tank sheet plates require so. However, it is clear that protective coatings of greater thickness may be not suitable from both the technical and economical paint of view.

For these reasons it is presently preferred to use a coating consisting of four layers, namely two layers of epoxy paint, one of fiberglass cloth and a final vitrifying

overlay coat.

The epoxy paint used in the protective coating according to the present invention may be any one of the known paints of this kind, i.e. having a high adhesive power in respect of both the metal and the fiberglass fabric used, a high resistance to the attack of chemicals to the found in the field of use, an expansion compatible with that of metal and it must be miscible with suitable hardeners, whose properties are to be dictated by the field and product of use. It could also be possible to use polymeric fabrics having a high elasticity modulus.

The coatings according to the present invention, consisting of four or more layers, were applied on sheet plate samples and subjected to tests of resistance to stray currents, to aggressive chemicals and of mechanical strength at room temperature.

The results were totally satisfactory and showed that the combination of epoxy paint and fiberglass fabric increases the properties of the combination in view of the similar and complementary character of the components. The resistance to chemicals is of more than 24 months for almost all aggressive substances, the mechanical strength is from 16 atm. up to 30 atm. and more of pressure of the punch of the INTRON electronic dynamometer according to the test conditions (it is to be pointed out that the actual maximum pressures undergoing an underground tank are of 1 atm inside and 0.5 atm outside) and a sheet plate covered with this coating results to be insulated against currents of high value.

The internal coating for underground tanks according to the present invention is prepared in situ and therefore has a simple and quick application, so as to form by itself an alternative structure to the tank.

The components, i.e. paints and fiberglass cloths, may be prepared when required

and their preparation requires only common and direct operations. Other materials could be considered as components by a man skilled in the art but they would be equivalent as to properties and processing operations, so that their use falls in the scope of the present invention. The internal coating for underground is mainly characterized by the combination of two materials such as epoxy resins and fiberglass cloth, to be applied in situ as layers with simple known, methods of the relevant technique.

Another valuable characteristic of the application in situ of the coating of the present invention is its reliability as to lack of toxicity and development of explosive gases.

A further valuable characteristic of the application in situ of the coating of the present invention for restoring old underground tanks is the formation of an inner shell having autonomous chemical and mechanical features in respect of those of the tank, and therefore of a structure which is not influenced by the tank conditions.

CLAIMS

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1) Protective internal coating for restoring underground metal tanks characterized by the fact of consisting of a structure of alternate layers of an epoxy paint and a fabric cloth of fiberglass or polymers with high elasticity modulus.

2) Protective internal coating according to Claim 1, further characterized by the fact of having a final overlay of vitrifying paint.

3) Protective internal coating according to Claim 2, characterized by the fact of consisting of four superposed layers, of which the first or lower layer is an epoxy resin or paint adhering to the tank inner surface, the second intermediate layer is a fiberglass fabric cloth, the third layer is again an epoxy resin and the fourth or upper layer is a further paint overlay having hardening and vitrifying properties.

4) Protective internal coating according to Claim 3, characterized by the fact of having a total thickness of 1500 - 4000 microns.

5) Protective internal coating according to one or more of the preceding claims, characterized by the fact that the epoxy resin has a density between 1.6 and 1.8 of tixotropic viscosity.

6) Process for applying in situ a protective internal coating for underground metal tanks according to any of the preceding claims, characterized by the following steps:

(a) cleaning and pickling of the inner sheet plate of the tank;

(b) checking the pickled inner surface of the tank;

(a) applying a first layer or primer of sealing epoxy resin;

(d) letting the layer stand to allow optimal setting of the epoxy resin;

(e) applying a fiberglass or polymeric fabric cloth on said first layer of epoxy resin;

(f) applying a second layer of epoxy resin;

(g) curing at room temperature the combination comprised of epoxy resin + fiberglass cloth + epoxy resin;

(h) applying a final overlay of a vitrifying epoxy paint;

(i) hardening the whole by means of hot air blow.

7) Process according to Claim 6, characterized by the fact that the steps of applying the layers of epoxy resin and fabric cloth are repeated so as to form a structure consisting of several alternate layers before applying the final overlay of vitrifying paint.