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METHOD OF REMOVING A COATING

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ABSTRACT OF THE DISCLOSURE

A method of removing a layer of paint from an article comprising the steps of dipping the article in a paint penetrating liquid comprised of methylene chloride and a wetting agent until the penetrating liquid saturates the paint and then plunging the article into a bath comprised of two pounds of caustic soda and eight ounces of an antitackiness additive per gallon of water which is maintained at a rolling boil so that the penetrating liquid vaporizes rapidly and explodes the paint from the article.

This invention relates to the removal of coatings and more particularly to the removal of coating by mechanical processes.

In removing many types of paint coatings, it is often possible to immerse the coating in a hydrocarbon-based or other solvent that penetrates the coating and softens it and thus loosens its bond to the underlying surface of the coated article. The paint film then falls from the surface or can easily be wiped off of the surface. Some coatings—particularly those based upon phenolic or vinyl resins—resist such simple removal in that although the solvent may penetrate the coating to the underlying surface and soften it, this treatment does not adequately loosen the coating from the surface enough to permit removal by any but the most laborious mechanical methods.

Another method of removing paint or other coatings from the surface of an article is to immerse the article in a caustic-soda solution. The caustic solution oxidizes the coating and dissolves the coating away from the surface of the coated article. These caustic solutions have little effect upon paints or coatings which are based primarily upon phenolic and vinyl resins, but will attack these resins only after long periods of immersion.

It is an object of the present invention mechanically to remove coatings.

It is another object of the present invention to remove coatings from a surface without manual scraping of the surface.

Still another object of the present invention is to remove bonded coatings that resist solvent or caustic removal.

A further object of the present invention is to remove a coating from a surface without substantial chemical change in the nature of the coating.

In accordance with a broad embodiment, the present invention comprises a process for removing a coating from the surface of an article by the steps of impregnating the coating with a liquid and converting this liquid to a vapor more rapidly than the vapor can escape from the coating. This rapid gaseous expansion under the coating mechanically breaks the bond between the coating and the surface of the article.

According to the preferred embodiment of the present invention, a coating bonded to the surface of an article is first penetrated or saturated with a liquid having a relatively low boiling temperature. The coated article is then immersed in a caustic solution that is maintained at a rolling boil substantially above the boiling temperature of the penetrating liquid. This causes rapid vaporization of the penetrating liquid within the coating and at the interface between the coating and the surface of the article. The rapid expansion of the vaporizing liquid simulates the effect of a minor explosion between the coating and the surface of the article, breaks the bond between the coating and the surface and mechanically lifts the coating from the surface. The boiling action of the caustic solution then tears any remaining fragments of the coating from the surface of the article.

The present invention will be more fully understood by referring to the following detailed description.

Since the method of the present invention is mechanical and not chemical in nature, the chemical characteristics of the coatings sough to be removed are not significant. The method of the present invention is suitable for removing any coating that can be saturated by a liquid and is most useful for removing a phenolic-based or vinyl-based paint film or a coating that cannot readily be removed by either solvent action alone or by caustic action alone. Specific examples of such coatings are the primers designated P–322 and P–327 manufactured by John L. Armitage & Co. Inc., Newark, N.J., and the primers designated 235P–8220 and 235P–9193 manufactured by M & T Chemical Company, Carrollton, Ky. These primers are said by their manufacturers to have a basis of vinyl-modified phenolic.

To remove a coating by the method of the present invention, the surface of the coated article is first immersed in any liquid which penetrates or saturates the coating. The coating remains immersed in a bath of the penetrating liquid for a time that is long enough to permit penetration of the liquid through the total thickness of the coating to the surface to which it is bonded.

It has been noted that the size of the molecule of the penetrating liquid determines the facility with which it penetrates the coating. For example, a bath that is held at substantially room temperature and that comprises a major proportion of methylene chloride with additional wetting agents and organic acids was found to have penetrated adequately a .001-inch thick coating of any of the specific primers mentioned above after five to ten minutes of immersion. This methylene-chloride-based penetrating liquid is known by the trademark "Chlorostrip No. 5" and is manufactured by Whitfield Chemicals Company of Detroit, Mich.

Pure methylene chloride—which boils at approximately 104° F.—has been found to work just as well as "Chlorostrip No. 5" in the method of the present invention. The time required for full penetration of the coating is somewhat longer, however. Trichloroethylene—which has a larger molecule than methylene chloride and which boils at approximately 185° F.—has been found to penetrate these specific primer coatings even more slowly than pure methylene chloride.

As is well known in the art, liquids of the type described may advantageously include wetting and dispersing agents, although these are not essential. In lowering the surface tension of the solution, the wetting agent promotes penetration of the paint film. Since the action of the wetting agent is physical in nature rather than chemical, any of the common wetting agents may be used.

After the coating has been impregnated or saturated with the penetrating liquid, the coating is immediately heated very rapidly in order to vaporize the liquid faster than the vapor can escape from the coating. This expanding vapor mechanically tears the coating from the surface of the article, breaks the bond between the coating and that underlying surface, and lifts the coating from the surface. Small shreds of the coating may continue to ad-

here lightly to the surface, but these can readily be removed.

It has been found that the saturated coating can best be heated by immersing the coated article in a second liquid maintained at a temperature that is substantially higher than the boiling temperature of the penetrating liquid. When the penetrating liquid vaporizes and boils away, it is replaced within the coating by the second, heating liquid.

Boiling water has been found to work adequately as a second, heating liquid to vaporize penetrating liquids having a lower boiling temperature, but many common coatings toughen in the presence of water. When water is used as the second, heating liquid, the shreds of the coating that adhere to the surface of the article, therefore, toughen after immersion in the boiling water; but the bond between these shreds and the surface of the article has been weakened by the expansion incident to the vaporization of the penetrating liquid. Although these toughened shreds still adhere to the surface, they can be removed far more readily by scraping than was possible with the use of solvent or caustic solutions alone.

It has been found that adding at least one pound of caustic soda (NaOH) to each gallon of boiling water prevents the shreds of coating from toughening. This permits the natural agitation of the boiling second, heating liquid to completely remove the shreds of coating from the surface of the article without the need for mechanical scraping flat, continuous surfaces of the article. A slightly better softening of the shreds of the coating was found to result from adding to each gallon of boiling water at least two pounds of a caustic-soda-based mixture known by the trademark "Stripper No. Q–5" manufactured by Oakite Products, Inc. of Chicago, Ill.

Caustic soda solutions tend to make many coatings develop a tackiness which causes them occasionally to readhere lightly to the surface of the article. Two to eight ounces of an anti-tackiness additive known by the trademark "Oakite Stripper Additive" also manufactured by Oakite Products, Inc. may be added to each gallon of the caustic soda to keep the shreds of the coating from becoming gummy or tacky.

Example I

In the preferred embodiment of the present invention, an article having a .001-inch thick coating of one of the specific primers mentioned above was immersed for at least ten minutes in a bath of "Chlorostrip No. 5" that was maintained at substantially room temperature. As soon as the article was removed from the "Chlorostrip No. 5," it was immersed in an aqueous solution containing approximately two pounds of "Stripper No. Q–5" and two to eight ounces of "Oakite Stripper Additive" per gallon of water that was maintained at a rolling boil at approximately 220° F. The rapidly-vaporizing "Chlorostrip No. 5" exploded the coating from the surface of the article, and the article was kept in the boiling solution only long enough for the natural agitation of the boiling solution to separate the shreds of coating from the surface of the article.

Another article with a like coating was immersed for at least ten minutes in the bath of "Chlorostrip No. 5" and was removed from the bath and immediately immersed in the same aqueous solution but maintained at less than 104° F. Since the aqueous solution was maintained at less than the boiling temperature of methylene chloride, the major ingredient of "Chlorostrip No. 5," the "Chlorostrip No. 5" slowly left the coating in much the same way that it had entered, and the coating continued to adhere tightly to the surface of the article.

Example II

In another embodiment of the present invention, an article coated with a vinyl or phenolic-based paint was immersed in a room-temperature bath of pure methylene chloride for a time that was long enough to completely saturate the paint with methylene chloride. The article was then removed from the methylene chloride and was immediately plunged into a caustic soda solution made by adding at least one pound of sodium hydroxide to each gallon of water and that was maintained at a rolling boil at approximately 220° F. The expansion of the rapidly-vaporizing methylene chloride broke the bond between the paint and the surface of the article, and the article was held in the boiling caustic solution only long enough for the agitation of the boiling caustic solution to remove the shreds of the coating from the surface of the atricle.

This procedure accomplished substantially the same result as the method described in Example I. The coated article was immersed in the pure methylene chloride for a longer time than would have been necessary if a wetting agent had been added to the methylene chloride. A wetting agent would enable the methylene chloride to penetrate the coating more quickly.

The fragmentary shreds of coating that initially clung to the article after immersion into the boiling caustic solution were soft and pliable and were removed from the surface of the article by the agitation of the boiling solution. These shreds were somewhat tacky and a few shreds lightly readhered to the article as it was removed from the caustic solution. These readhered shreds were easily removed manually.

Example III

In yet another embodiment of the present invention, an article coated with a film of any paint that could be penetrated by trichloroethylene was immersed in a room-temperature bath of trichloroethylene for a time that was long enough to completely saturate the paint with trichloroethylene. The article was then removed from the bath and was immediately plunged into boiling water.

When the high-temperature environment provided by the boiling water vaporized the trichloroethylene, the vapor separated the paint film from the surface of the article. This vaporization of trichloroethylene in boiling water was not nearly so violent and effective as methylene chloride in a boiling caustic solution because there was a greater temperature difference between the boiling points of methylene chloride and an aqueous custic solution than there was between the boiling points of trichloroethylene and water.

Since trichloroethylene has a larger molecule than methylene chloride, the article had to be immersed longer in trichloroethylene than would have been necessary had the smaller molecule methylene chloride been used. Water caused the shreds of paint to toughen again after the trichloroethylene had been evaporated. These shreds did not adhere to the surface of the article as tightly as the original film, and they were removed by gently scraping them from the surface of the article.

Although the invention has been described in connection with only three specific embodiments, it will be apparent that modifications and changes may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A method of removing a coating from an article comprising:

impregnating the coating with a first liquid having a predetermined boiling temperature, and

immersing the coating in a second liquid having a temperature above the boiling temperature of the first liquid.

2. A method according to claim **1** wherein the second liquid is a caustic solution having a boiling temperature substantially above the boiling temperature of the first liquid.

3. A method according to claim **2** wherein the caustic solution is maintained at its boiling temperature.

4. A method according to claim **2** wherein the caustic

solution is maintained in a vigorously boiling condition for scouring fragments of the coating.

5. A method of stripping a layer of paint from an article comprising the steps of:

saturating the layer of paint with a paint penetrating liquid, and

vaporizing the paint penetrating liquid more rapidly than said liquid can escape from the layer of paint thereby exploding the layer of paint from the article.

6. The method according to claim 5 wherein the paint penetrating liquid is comprised principally of a paint solvent combined with a wetting agent.

7. The method according to claim 5 wherein the step of vaporizing the penetrating liquid includes the steps of maintaining a bath of liquid at an elevated temperature higher than the vaporization temperature of the penetrating liquid and plunging the article into the heated liquid when the layer of paint is saturated with the penetrating liquid.

8. The method according to claim 5 wherein:

the step of saturating the layer of paint is carried out by immersing the article in a bath of paint penetrating liquid, and

the step of vaporizing the paint penetrating liquid is carried out by withdrawing the article from the bath of paint penetrating liquid and immediately plunging the article into a bath of a boiling solution of caustic soda and water.

9. A method of removing a coating from a surface comprising the steps of:

soaking the coating with a liquid until the liquid has penetrated the coating and is in contact with the surface, and

rapidly heating the liquid thereby exploding the coating from the surface.

10. The method of removing a coating according to claim 9 wherein the liquid is comprised at least partially of a wetting agent.

11. The method of removing a coating according to claim 9 wherein the step of soaking the coating is carried out by dipping the surface and the coating in a quantity of the liquid.

12. The method of removing a coating according to claim 9 wherein the step of heating the liquid is carried out by raising the temperature of a second liquid to a temperature higher than the boiling point of the liquid and soaking the coating with the heated second liquid.

13. The method of removing a coating according to claim 9 wherein the step of heating the liquid is carried out by dipping the liquid penetrated coating and the surface in a boiling bath of a second liquid.

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Disclaimer

3,455,737.—*Thomas M. Seibert*, Chicago, Ill. METHOD OF REMOVING A COATING. Patent dated July 15, 1969. Disclaimer filed Nov. 3, 1969, by the assignee, *Teletype Corporation.*

Hereby enters this disclaimer to claims 5, 6, 9, 10 and 11 of said patent.

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