Dec. 8, 1959 R. KURZ 2,916,399

HEAT TREATMENT OF PROTECTIVE COATINGS

Filed July 14, 1955

Fig. 1

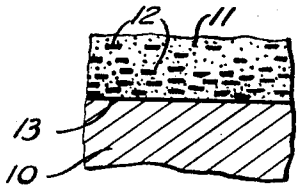


Fig. 2

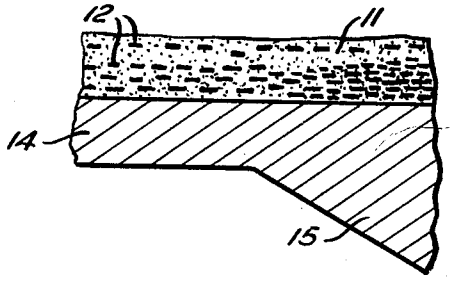


Fig. 3

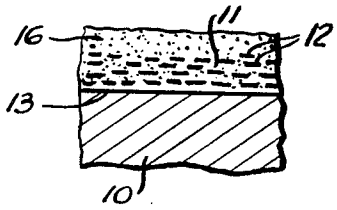


Fig. 4

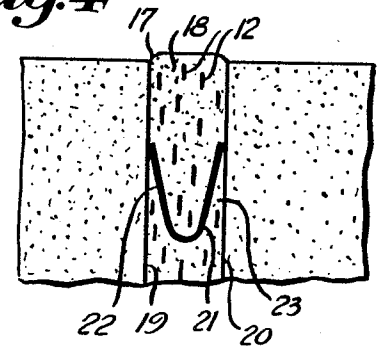


Fig. 5



Fig. 6

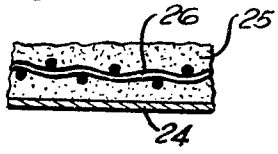
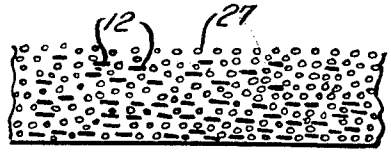


Fig. 7



INVENTOR.
RAINER KURZ
BY Richards & Geier
ATTORNEYS

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HEAT TREATMENT OF PROTECTIVE COATINGS

Rainer Kurz, Stuttgart-Stammheim, Germany, assignor to Firma Paul Lechler, Stuttgart, Germany

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8 Claims. (Cl. 117—93)

This invention relates to protective coatings and a method of treating them.

It is known to provide work pieces and other metal products such as tin cans with a protective coating and then dry this coating by subjecting it to high frequency alternating magnetic fields. In the course of this operation eddy currents are formed in the metallic base such as the metal sheet covered with the lacquer, and these eddy currents develop heat which is transmitted by conduction to the coating. The transmission of heat from the metal base to the lacquer coating always requires a certain amount of time and the required time is quite great when the film which is to be heated is comparatively thick, since heat is transmitted quite slowly through the coating materials which as a rule are poor conductors of heat.

It was found that these prior art methods present difficulties when it is desired to limit the duration of the heat process. By way of example if it is necessary to temper subsequently an anti-corrosion layer upon an iron structure having thick walls such as a bridge carrier or a weir, then it is of importance that the desired heating of the coating which is carried out by heat transmission from the electrically heated base, should be accomplished in the shortest possible time. If the heat is developed by the action of the eddy currents of an electromagnetic alternating field at the outer surface of the metallic base, then this heat development must be continued until the heat has penetrated sufficiently into the coating. However, the metallic base conducts the heat much faster than the protective film which usually has a base of bituman or synthetic resin. Then the metallic construction such as the bridge carrier must be heated throughout its entire thickness if those parts of the protective coating which are nearest to the metal are to be heated sufficiently. This consumes a great deal of time and of electrical energy and furthermore can produce undesirable and dangerous tensions in the metal base which can endanger the entire structure.

An object of the present invention is to eliminate these drawbacks and to provide a method by the use of which the lengthy heating time can be considerably shortened.

Another object is the provision of a protective coating which can be applied to the metal base with a great saving of time and electrical energy.

A further object is to develop a heating method by means of which the development of undesirable tensions in the metallic base can be effectively avoided.

Another drawback of prior art methods is that it was found to be quite difficult to distribute the necessary heat uniformly throughout all the parts of the coating. In cases wherein it was necessary to keep the heating as low as possible in view of the danger that tensions may develop in the metal base there was always the possibility that at locations where the base is comparatively thick the coating would be heated to a considerably lesser extent than at places where the base is of lesser thickness, due to the greater conductivity of the heat at

the thicker location. Furthermore the effect of the magnetic field and the formation of eddy currents depend to a certain extent on the form of the base and this also contributes to the lack of uniformity in the heating.

Therefore, a further object of the present invention is to eliminate these drawbacks and to provide for a distribution of heat which should be as uniformed as possible throughout the various sections of the protective coating.

Other objects of the present invention will be apparent in the course of the following specification.

In accomplishing the objects of the present invention the coatings applied to work pieces or structural parts and consisting of poor conductors of heat are subjected to a heat treatment by means of a high frequency magnetic alternating field in such manner that the magnetic field heats conducting elements which in accordance with the present invention are added to the protective coating. These conducting elements can consist of inserts, foils or nets or amounts of metal shavings or spangles or the like, and have a coefficient of heat conductivity greater than 0.05. A part of the electromagnetic energy is changed into heat within these conducting elements so that the heating of the protective coating takes place in a much shorter time.

This short heating period has the further advantage that coatings which are capable of being molten can be melted without the danger that the entire layer will flow off or drop off. Thus by the present invention it is possible to limit the melting to that portion of the coating which is located in the closest proximity of the outer surface of the metal base.

The lack of uniformity in the distribution of heat also can be effectively avoided by the suitable combination of the conducting particles.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings shown by way of example only preferred embodiments of the inventive idea.

In the drawings:

Figure 1 is a section through a base provided with a protective coating of the present invention.

Figure 2 illustrates a somewhat different arrangement of the conducting particles in the protective coating.

Figure 3 is a section through a protective coating and illustrates a different arrangement of the conducting particles.

Figure 4 is a section illustrating the application of the present invention to structural walls.

Figure 5 is a section illustrating the application of the coating to a metal foil.

Figures 6 and 7 are sections illustrating other applications of the inventive idea.

Figure 1 shows a metal base **10** provided with a protective coating **11**. In accordance with the present invention metal shavings **12** are distributed within the layer **11** close to the outer surface **13** of the metal base **10**.

Figure 2 illustrates an arrangement wherein the lack of uniform heating is compensated to a certain extent by the metal particles. The metal support shown in Fig. ure 2 has a thinner portion **14** and a thicker portion **15**. It is apparent that under usual conditions that portion of the coating **11** which is located upon the part **15** would be heated to a much lesser extent than the portion of the coating **11** which is located upon the part **14**. In accordance with the present invention a compensation is accomplished by concentrating a comparatively large amount of conducting particles **12** close to the metal

part 15. On the other hand the portion of the coating 11 located opposite the metal part 14 will have a smaller amount of these particles. Thus a prearranged non-uniformed distribution of conducting particles 12 throughout the coating 11 can eliminate the drawbacks of non-uniformed heating existing in prior art and can provide the heating which is distributed in the desired way throughout the metal base and the protective coating 11.

Obviously the size and the form of the particles 12 may vary depending upon the requirements. The important feature is that the particles should consist of conductors which develop heat in an electromagnetic alternating field. These particles 12 can consist of metal shavings and spangles, they may be formed of iron oxide and other metal alloys as well as graphite and other scale like half conductors.

An advantage of the process of the present invention is that the danger that the coating will melt away and fall off during the heat treatment is considerably diminished. In prior art this danger was caused primarily by the fact that due to the long duration of the heat treatment and the unavoidable thorough heating of the base the latter serves as a source of considerable heat. This delays the cooling of the coating and facilitates the flowing of the coating. In accordance with the present invention the prior art methods are further improved by the fact that as shown in Figure 3 the coating 11 receives conducting particles 12 solely close to the outer surface 13 of the base 10 while the layers 16 of the coating which are located away from the surface 13 do not contain at all any particles 12 or only very few of these particles. Due to this arrangement the coating is heated very quickly close to the surface 13 of the base while the upper layers 16 of the coating remain cool. This prevents the complete melting and flow of the coating.

The conducting particles 12 serve to some extent as a screen for the magnetic alternating field in relation to the base. When larger particles are added, it is possible to provide an arrangement whereby the heating takes place practically solely in the coating. On the other hand, when the particles are used moderately the heating of the coating and the base take place simultaneously.

In order to further facilitate the intimate connection of the coating with the base, it is advantageous to provide for a heating of the metallic base simultaneously with the heating of those layers of the coating which are located close to the contacting surface. This procedure can be developed in accordance with the present invention when an electrically conducting preferably metallic base is used by regulating the type, amount and distribution of the heat developing particles in the coating in such a manner that when the high frequency field is applied those sections of the coating and the base which are located close to each other will be heated substantially uniformly or in a desired predetermined ratio.

It is apparent that this arrangement is of substantial advantage. If the coating is heated exclusively its combination with the base will not take place properly due to the tempering effect of the cold base. On the other hand, when solely the base is heated the above described drawbacks of prior art methods occur. The present invention, however, by heating adjacent layers of the coating and the base makes it possible to provide a particularly thorough connection between them.

Figure 4 illustrates an important application of the present invention for the closing of joints in walls particularly in concrete structures. As shown in Figure 4 the joint 17 contains a mass 18 used for the purpose of closing the joint. In accordance with the present invention this mass 18 contains heat developing particles 12. Thus in accordance with the present invention it is possible to melt subsequently the mass 18 poured in the joint 17 so that the mass 18 will form a perfect coating upon the walls 19 and 20 of the joint and would be thoroughly united with these walls. In this case also there is a danger that the mass 18 will become liquid and will flow away when molten. In accordance with the present invention the process may be improved by utilizing so called joint sheets 21 which usually have the form of a V or the like and which are often used in the castings to improve the closure. According to the present invention these joints 21 consist of an electrically conducting material so that they will develop heat when subjected to a magnetic field. This heat developed by the joints 21 is transmitted by them to the layers 22 and 23 of the mass 18 which are located between the sheet 21 on the one hand and the surfaces 19 and 20 on the other hand. Thus an excellent connection between the sheet 21 and the front surfaces of the construction is attained.

As already stated the coating 11 usually consists of materials capable of melting such as bitumen, tar pitch or synthetic resins having a coefficient of heat conductivity less than 0.01 while metal shavings as well as graphite particles were found quite suitable as heat developing particles or elements 12.

It is also possible to apply the coatings upon sheets which do not heat well. Figure 5 shows a sheet 24 provided with a coating 25 containing heat developing particles 12. The sheet 24 can be applied then to a base in the usual manner. As shown in Figure 6 it is also possible to press into the layer 25 carried upon a sheet 24 a metal foil or metal net 26 which can be located closer to the outer surfaces of the coating 25 and will provide a source of heat in a magnetic alternating field.

Figure 7 illustrates the use of the described process for the melting of a pulverulent or grain like coating material 27 which is mixed with the heat developing particles 12. This arrangement makes it possible to heat the mass quickly and thoroughly. Furthermore this process eliminates the drawbacks of prior art methods. For example, heating by means of a flame was found to be most unsatisfactory since local overheating is practically unavoidable.

It is apparent that the examples shown above have been given solely by way of illustration and not by way of limitation and that they are subject to many variations and modifications within the scope of the present invention. All such variations and modifications are to be included within the scope of the present invention.

What is claimed is:

1. The process which comprises distributing magnetically heat developing particles in a non-conducting coating having a coefficient of heat conductivity of less than 0.01, applying said coating over an outer surface of a metal base capable of developing eddy currents by induction, and subjecting simultaneously said base, said coating and said particles to a high frequency magnetic alternating field to produce said eddy currents and to quickly heat said coating by the combined effect of said eddy currents and said heat developing particles.

2. The process which comprises non-uniformly distributing magnetically heat developing particles in a non-conducting coating having a coefficient of heat conductivity of less than 0.01, applying said coating over an outer surface of a metal base of varying thickness and capable of developing eddy currents by induction with a greater concentration of said heat developing particles being located over the thicker portion of said metal base, and subjecting simultaneously said base, said coating and said particles to a high frequency magnetic alternating field to produce said eddy currents and to quickly heat said coating by the combined effect of said eddy currents and said heat developing particles.

3. The process which comprises non-uniformly distributing magnetically heat developing particles in a non-conducting coating having a coefficient of heat conductivity of less than 0.01, applying said coating over an outer surface of a metal base capable of developing eddy currents by induction with a greater concentration of said

heat developing particles being located closer to said outer surface, and subjecting simultaneously said base, said coating and said particles to a high frequency magnetic alternating field to produce said eddy currents and to quickly heat said coating by the combined effect of said eddy currents and said heat developing particles.

4. The combination of a heat conducting metallic base with a coating for said base, said coating having a coefficient of heat conductivity of less than 0.01 and containing dispersed therein magnetically heat developing particles.

5. A coating in accordance with claim 4, wherein said particles are non-uniformly dispersed to vary the extent of heating of various sections of the coating.

6. A coating in accordance with claim 4, wherein said particles are located in the vicinity of the base.

7. A construction joint, comprising in combination with two spaced construction blocks, a meltable joint mass between said blocks and an electrically conducting V-shaped joint sheet in said mass.

8. The combination of a heat conducting metallic base

with a coating for said base, said coating comprising a meltable binder and magnetically-heat developing particles located within said binder.

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