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R. W. WHITE
PROCESS FOR VARNISHING EMPLOYING
STRIPPABLE PROTECTIVE COATINGS
Filed Feb. 19, 1944

2,476,937

Fig. 1.

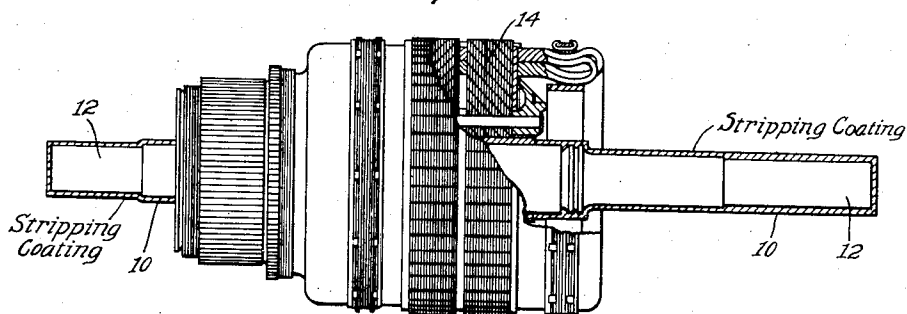


Fig. 2.

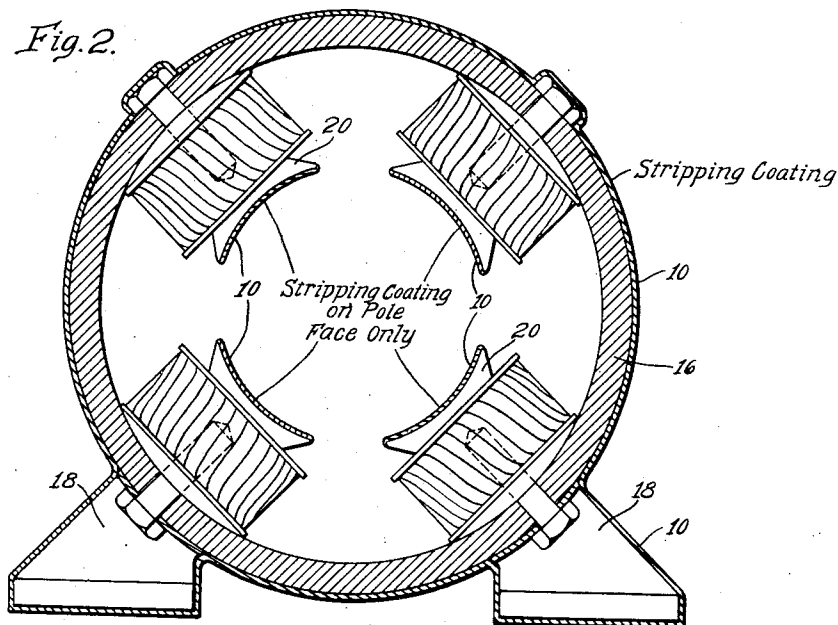
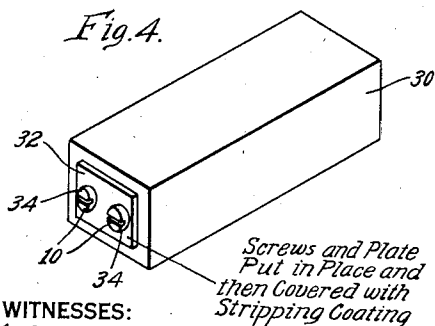


Fig. 4.

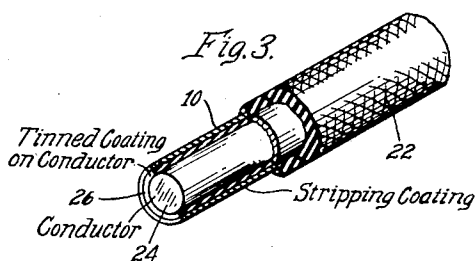


WITNESSES:

W. J. Weller.
J. Shapiro

Screws and Plate
Put in Place and
then Covered with
Stripping Coating

Fig. 3.



Tinned Coating
on Conductor

Conductor

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2,476,937

PROCESS FOR VARNISHING EMPLOYING
STRIPPABLE PROTECTIVE COATINGSRobert W. White, Pittsburgh, Pa., assignor to
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2 Claims. (Cl. 117—6)

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This invention relates to protective coatings of a temporary nature which are applied to metal surfaces, in particular, to protect the metal surfaces in various ways, and the coatings being readily mechanically strippable. The strippable protective coatings of this invention are particularly advantageous for use in processes for protecting portions of metal surfaces of members which are to be dipped in hot varnish and baked, the strippable coatings and any overlying varnish being readily peeled off from such protected portions, while the untreated surfaces are coated with baked varnish.

In applying organic finishes to predetermined portions of the surface of members as in impregnating electrical apparatus with insulating varnishes in order to insulate the electrical conductors, it is frequently desirable to cover or to immerse the entire member or piece of apparatus in the coating composition or insulating varnish in order to secure a good penetration and covering. It has been a considerable problem heretofore to remove the organic finish or insulating varnish from those portions of the apparatus upon which such varnish or finish is not desired. A large amount of hand labor is frequently required to remove insulating varnish or paint from those portions of members upon which such composition is not desired. For instance, in order to remove insulating varnish from a motor frame which has been impregnated, most types of impregnating varnish must be scraped off when the frame is quite hot; otherwise, when cold, the varnish is so adherent that it would be extremely difficult to remove. As much as fifteen hours of labor may be required to remove the undesired varnish present on the machined surfaces of a large motor frame.

The object of this invention is to provide for applying a protective varnish and baking resistant coating for use on metal surfaces, which coating is readily stripped.

A further object of the invention is to provide a process for applying to metal surfaces plasticized acyl esters of cellulose to form on the metal surfaces protective coatings which, after they have served their purpose, may be readily stripped off in sheets.

A still further object of the invention is to provide for applying on metal surfaces protective coatings having predetermined corrosion resistant properties, the coatings being readily removable by stripping.

Other objects of the invention will, in part, be obvious and will, in part, appear hereinafter.

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For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description and drawing, in which:

Figure 1 is a view in elevation, partly in section, of a member to which the coatings of the invention have been applied;

Fig. 2 is a vertical cross-section through a motor stator showing a further application of the invention;

Fig. 3 is a perspective view, partly in section, showing the application of the invention to conductor leads; and

Fig. 4 is a perspective of a square coil showing a further application of the coatings of the invention.

According to the present invention, it has been discovered that acyl cellulose esters when suitably plasticized may be applied to metal surfaces to produce thereon coatings or films of a tough resinous nature that will protect the applied surfaces from the action of the subsequently applied organic finishes either hot or cold and subsequent baking operations. While exhibiting outstanding protective properties, the plasticized cellulose esters are only weakly bonded to the metal surfaces, and when cut or slit in various places, the coatings or films may be peeled off in sheets, thus removing any superimposed layers of organic finish. The bright uncorroded metal is uncovered by a simple stripping action.

The outstanding advantage of protective coatings of plasticized acyl cellulose esters is apparent in hot vacuum or pressure impregnation. Other coatings that may be ample to prevent varnish adhesion during spray painting operations, for example, will be found to be ineffective under vacuum impregnation condition. Small pinholes and cracks will permit the entry of varnish below such coatings with resulting failure. Cellulose ester coatings give complete protection to metal even under vacuum impregnation of varnish.

The advantages of the cellulose esters for the practice of this invention reside in the unusual combination of properties present therein. Plasticized cellulose esters bond only weakly to metal and this characteristic provides for easy mechanical stripping. However, the adherence of the plasticized cellulose ester film to the metal has been found to be sufficient to prevent cracking, flaking, lifting at the edges or other mechanical failure. The cellulose esters also are poorly soluble in most of the common organic solvents that are employed in organic finishes such as in-

insulating varnishes or the like. The acyl cellulose esters form tough homogenous protective coatings which will withstand ordinary shop abuse.

In practicing the invention, the acyl cellulose esters which have given best results are cellulose acetate, cellulose acetate butyrate, and cellulose acetate propionate.

Where protective coatings of a cellulose ester, such, for example, as cellulose acetate, are to be applied to a member to be subsequently dipped in hot varnish and baked, the cellulose acetate should carry from 50% to 115% of its weight of a compatible plasticizer. For use to protect metal from varnishes to be applied and dried at room temperature as by spraying or brushing, about 5% by weight of plasticizer in the cellulose acetate will be generally sufficient. Examples of plasticizers which have been found to be quite satisfactory are triacetin, dimethyl phthalate, diethyl phthalate, tripropionin, and p-toluene sulfonamide. The plasticizer should be selected on the basis of producing a tough plastic film which will promote adhesion to the metal surfaces, reduce cellulose ester shrinkage, and will resist the action of the common finish solvents.

In producing a suitable composition that may be applied to metal surfaces in the form of a paint, it is desirable that the cellulose ester, such, for example, as cellulose acetate, be selected to provide a solution of high solids content and low viscosity. Cellulose acetates of a grade suitable for lacquer uses are suggested as a convenient form of the ester. However, cellulose acetates of a viscosity of from 2 to 4 seconds to a range of 150 to 250 seconds have been employed with success. The acetic acid content is not critical since cellulose acetates having 52½% acetic acid equivalence have been employed with as good results as have the triacetates. Similar considerations have been found to apply with cellulose acetate butyrate.

Numerous solvents are available, as is well known to those skilled in the art, for the preparation of solutions of the cellulose esters. Acetone has characteristics as a solvent for cellulose acetate that render it particularly desirable for the purpose of this invention. The cost is low and coatings produced therewith dry rapidly. Methyl acetate, methylene chloride-ethanol solutions, and other solvent mixtures are suitable for practicing the invention. A typical solution comprises 100 parts by weight of acetone, 20 parts by weight of 2 to 4 second viscosity cellulose acetate, and 20 parts by weight of dimethyl phthalate. This solution gave excellent results in practice.

It will be apparent to those skilled in the art that other resinous materials may be admixed in minor amounts with the acyl cellulose esters, that various other plasticizers and small amounts of non-drying oils may be added, and that many solvents may be made use of in preparing the cellulose ester solutions. Such additions should be made only to the extent that adhesion to metal surfaces be not increased to the extent that the cellulose acetate or other ester cannot be peeled off readily. Various rosin and abietic acid compounds and related derivatives, for instance, if added in amounts of up to 25%, improve the friable nature of the coatings so that they may be more readily removed. On the other hand plastics that have good metal adhesion properties such as cellulose nitrate may not be tolerated in any appreciable quantity.

In plasticizing cellulose acetate solutions, con-

sideration must be given to the physical shape of the metal surface to which the cellulose ester solution is to be applied. When cellulose acetate is applied to a portion of a large flat metal sheet, the films must carry relatively large amounts of plasticizers, for example, 20%, to reduce undue shrinkage. For instance, an unplasticized cellulose acetate film on drying will break loose and fail to serve its intended purpose. Where the applied cellulose ester film can secure an anchor around edges of the metal, films with lesser amounts of plasticizer may hold adequately for many purposes. Coatings applied about shafts and small members where a continuous circumferential band or the like is produced will adhere tenaciously due to the slight shrinkage of the cellulose acetate as drying of the solvent takes place.

As stated previously, about 5% of plasticizer based on the weight of the cellulose ester is the minimum for use, and this is only satisfactory where the member is not exposed to temperatures above 35° C. Where the member to which the cellulose ester is applied is to be treated in hot varnish and baked, the minimum plasticizer content is from 50% and higher, up to 115%. At temperatures of about 120 to 145° C., the best compositions for service contain 105 to 115 parts by weight of plasticizer to 100 parts of cellulose ester. Temperatures of over 150° C. are detrimental to any cellulose ester film, and it is preferred that the temperatures be maintained somewhat below this limit for successful results.

Referring to Fig. 1 of the drawing, there is illustrated a motor rotor 14 in the making of which this invention is applied. A coating of plasticized cellulose acetate 16 has been applied to the shaft ends 12 to prevent the sticking of hot varnish thereto when the rotor is dipped in insulating varnish and baked. The coating 16 may be applied by brushing, spraying or dipping. After the solution of cellulose ester is applied the coating is dried to cause the solvent to be removed. A cellulose ester film 3 to 5 mils thick will be produced by this procedure. The cellulose ester coating will be found to be sufficiently adherent for subsequent use. The coating 16 is sufficiently tough and resilient to withstand the ordinary abuse that will be met in the shop. The entire rotor 14 may be dipped any desired number of times in hot varnish with or without vacuum impregnation and baked at temperatures of 120 to 140° C., as required in practice. A coating of the insulating varnish will build up over the protective cellulose ester coating 16 during these operations. After the rotor has been otherwise completed, the cellulose ester coating 16 may be stripped by making a pair of oppositely disposed axial cuts along the shaft. The coating may be peeled off in two pieces. It is not necessary to brush or otherwise work on the shaft since the coating strips completely and readily.

Another application of the invention is illustrated in Fig. 2 of the drawing. The motor stator 18 provided with feet 18 and assembled with the pole faces 20 is commonly impregnated with an insulating varnish. It is not desirable to have the insulating varnish present on the outside surface of the motor frame 16, the legs 18, or on the pole faces 20. The poles 20 must be fitted with a very small clearance to the rotor cooperating therewith and even a small layer of varnish on the pole faces may interfere with the operation of the apparatus.

In applying the invention to the stator 18, the outside of the frame 16 is coated with a solu-

tion of plasticized cellulose acetate as described above. The legs 18 may be dipped or otherwise coated with the same solution, and the pole faces coated by brushing or spraying. After drying, an adherent coating 10 of cellulose acetate will be present. The entire stator 16 may be dipped into the insulating varnish as required and baked. The cellulose acetate coating 10 may be readily and rapidly removed by making thin slits, after which the cellulose acetate may be stripped off in relatively large sheets. Only a fraction of a minute may be required in many cases to remove the cellulose acetate and the insulating varnish which has been superimposed therein during the previous operations. Clean metal is exposed by this operation.

Another advantageous application of the invention is illustrated in Fig. 3 of the drawing where the conductor lead 24 of the conductor 22 previously provided with a tin coating 26 is provided with a plasticized cellulose acetate coating 10 previous to varnish impregnation of the conductor or coil 22. The coating 10 may be cut with a knife or other edged tool and peeled to expose a clean varnish-free surface. It is unnecessary to re-tin the conductor lead 24 after stripping as heretofore required. Plasticized cellulose acetate with rosin or rosin derivatives forms good protective coatings on leads since it flakes off readily when cut. The ease of stripping the plasticized cellulose esters of the present has rendered it possible to attain numerous manufacturing savings. For example, the square coil assembly 30 of Fig. 4 is provided with a supporting plate 32 at each end. It is necessary to drill and tap the supporting plate 32 before the coil is impregnated with an insulating composition. However, the insulating composition will fill the drilled and tapped holes, and the plates 32 must be subjected to redrilling and retapping to remove the composition therein. Though the second drilling and tapping operation is not difficult, it does take time and increases the cost of manufacture. The strippable protective composition of the present invention obviates this duplicated work. The coil 30, before being impregnated, has the screws 34 inserted into the drilled and tapped holes in the plate 32, and plasticized cellulose acetate is brushed over the plate and screws 34. A coating 10 of the plasticized cellulose acetate is produced on drying. The coil may now be safely impregnated without the threads being affected. After the insulating varnish has been baked, the protective coating 10 may be peeled off, generally in one motion, and the coil is ready for installation.

While the above examples are mainly directed toward use in the electrical industry, numerous applications in other industries are available for the easily strippable protective coating described above. The advantages of good protection and easy removal will render it desirable to make use of the invention in many instances where a temporary protective coating is required.

Suggestive of the advantages of the invention in places where the application of insulating varnishes is not involved is the application of the coating of plasticized cellulose ester as a temporary protective covering on machine metal surfaces during shipment, storage, and like applications. For corrodible metals, such as iron or steel, an anti-corrosion agent may be incorporated in the solution of cellulose ester. Thus, zinc chromate, lead chromate or zinc phosphate in a finely divided state may be distributed in the

cellulose acetate solution which is then applied to the metal surfaces to be protected. Shafts of motors, machined surfaces of lathes, and other machine tools and similar surfaces may be coated with the plasticized cellulose ester to produce an adherent protective coating. The use of a chromate or phosphate compound will prevent corrosion of the underlying metal for prolonged periods of time. When it is desired to place the apparatus in condition for use, a few slits in the cellulose ester coating may be made, and the coating peeled off in large sheets to expose an uncorroded metal surface.

Since certain changes in carrying out the above process and certain modifications in the composition which embodies the invention may be made without departing from its scope, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In the process of applying a permanent adherent coating of an insulating varnish to predetermined portions of a member having other portions with metallic surfaces to be kept free of the varnish, the steps comprising applying to the metallic surfaces on said other portions a coating of a solution composed of a volatile organic solvent and a solute consisting of from 10% to 30% of the weight of the solution of a cellulose ester selected from the group consisting of cellulose acetate, cellulose acetate butyrate, and cellulose acetate propionate, and a plasticizer for the cellulose ester in an amount of from 50% to 115% of the weight of the cellulose ester, the plasticizer selected from the group consisting of triacetin, dimethyl phthalate, diethyl phthalate, tripropionin and p-toluene sulfonamide, drying the applied coating to evaporate the organic solvent thereby leaving a tough solid film of plasticized cellulose ester on the metallic surfaces, applying a solution of the varnish to the member, the varnish overlapping the cellulose ester film without penetrating to the underlying metallic surfaces, baking the member with the applied varnish at temperatures of up to 145° C. to cure and harden the varnish into a solid, adherent film, and mechanically stripping from said protected metallic surfaces the film of cellulose ester and any varnish film superimposed thereon.

2. In the process of applying a permanent adherent coating of a varnish to predetermined portions of a member having other portions with metallic surfaces to be kept free of the varnish, the steps comprising applying to the metallic surfaces on said other portions a coating of a solution composed of a volatile organic solvent and a solute consisting of from 10% to 30% of the weight of the solution of a cellulose ester selected from the group consisting of cellulose acetate, cellulose acetate butyrate, and cellulose acetate propionate, and plasticizer for the cellulose ester in an amount of from 25% to 115% of the weight of the cellulose ester, the plasticizer selected from the group consisting of triacetin, dimethyl phthalate, diethyl phthalate, tripropionin and p-toluene sulfonamide, drying the applied coating to evaporate the organic solvent thereby leaving a tough solid film of plasticized cellulose ester on the metallic surfaces, applying a solution of the varnish to the member, the varnish overlapping the cellulose ester film without penetrating to the underlying metallic surfaces, baking the member with the applied varnish at temperatures of up to 145° C. to cure and harden the varnish into a solid,

adherent film, and mechanically stripping from said protected metallic surfaces the film of cellulose ester and any varnish film superimposed thereon.

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