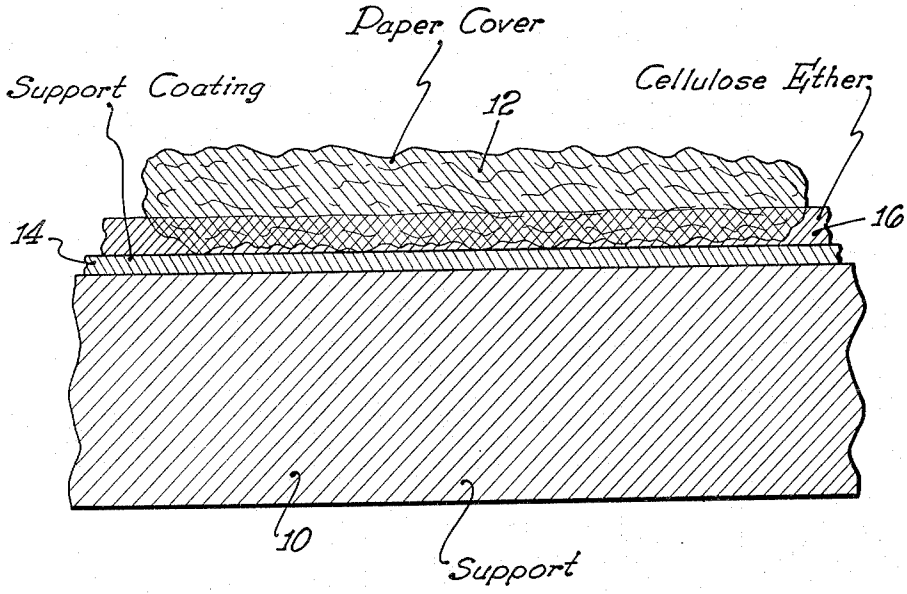
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METHOD OF STRIPPABLY MOUNTING PAPER ON WALL PANELS AND PRODUCTS

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METHOD OF STRIPPABLY MOUNTING PAPER ON A WALL PANEL AND PRODUCT

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This invention relates to the art of applying to a surface a sheet of relatively thin and flexible material for such purposes as decoration.

The invention is more particularly concerned with the problems that result when the decorative (or potentially decorative) material is relatively thin and delicate, as is true for example with wall-paper; and when that material is to be mounted on the surface only temporarily. Those conditions are present in a wide variety of commercially important situations, of which two representative examples are the mounting of advertising posters on billboards and the temporary decoration of sets used in the theatre, in making motion pictures, and the like. In both of those typical instances it is important that a decorative paper be held to the supporting surface firmly and uniformly, but that firm bond is required only for a limited time. For clarity of explanation, the invention will be explained primarily as it pertains to those two situations, but without implying any limitation upon the scope of the invention.

In situations of the type indicated, it is economically necessary that the same supporting element, here broadly characterized as a panel, be re-used an indefinite number of times, such re-use ordinarily involving removal of the old covering layer and application of a new one. In order to change the surface covering layer, it has customarily been necessary to remove the old paper by relatively laborious soaking and scraping procedures that frequently damaged the face of the supporting panel. That necessitated the additional expense of refinishing the surface of the support before applying a fresh covering layer.

An important object of the present invention is the solution of all those difficulties by providing means and procedure for mounting decorative coverings of the general type indicated in such a way that they are firmly supported in stable position for a reasonable period of time and under normal conditions of use, but that the covering is readily strippable from the support at any time without special techniques and without damage to the support surface.

A further object of the invention is the provision of the above novel and useful functions without extreme modification of the usual operational techniques by which such coverings have customarily been mounted. In other words, the previous laborious and expensive operation of removing an old covering layer is entirely avoided, but with a minimum change in the operation of mounting a new layer.

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An advantage of satisfying that latter condition is that the new method of the invention can be carried out immediately by the same personnel who are experienced and skillful in the art as it has previously been practiced. The desired saving in routine and tiresome labor of removing old coverings is accomplished without sacrifice of the very considerable skill that has been developed in the art of applying new coverings.

Many types of strippable covering layers are well known. For example, non-drying adhesive materials are successfully used in such products as surgical adhesive plaster and strippable masking tape. However, such materials are not suitable for use on large areas, since they allow no appreciable lateral shifting of the covering layer after it has touched the support. In mounting wallpaper or any similar material, such lateral freedom of movement is necessary in practice in obtaining accurate relative location of adjoining sections of material. Moreover, non-drying adhesives tend to flow under the steady force of gravity or of paper shrinkage, and do not provide the necessary stability. The required stability of the covering layer under the conditions of use contemplated by the invention can be obtained only with a mounting material that becomes dry and effectively rigid.

A number of chemical compositions are known which can be applied in solution to a suitable surface, and which solidify upon evaporation of the solvent to form a film of appreciable thickness which can be stripped from the support as a so-called "free film." However, it is to be noted that such an operation is quite distinct from the present problem. In particular, the conditions to be satisfied in forming such a strippable free film are far less exacting. For example, the tensile strength of such free films is typically quite high, so that a relatively great unit force may safely be applied, if necessary, to strip the film from the support, without danger of tearing it. Also, the bond between the film and the support may be relatively weak without much danger of its becoming ruptured prematurely.

The situation with which the present invention is concerned requires a relatively strong bonding to the support on the one hand, and, on the other hand, makes available a relatively small unit force with which to accomplish the stripping operation. The stripping force is limited by the very moderate tensile strength of the surface coverings most frequently used, ordinary wallpaper being perhaps an extreme but significant example. And the bond that is broken in the

stripping operation must be strong enough not only to withstand such forces on the paper as may be exerted by gravity and by normal use of the covered surface (whatever that may be), but also to resist the very considerable shearing force that results from the tendency of the paper to shrink when it dries.

Such shrinkage necessarily takes place during installation if a drying type of adhesive is used that employs water as a vehicle. And in any case, after installation, such shrinkage may well result from other causes. For example, the covering may become wet from the application of a water-base paint, or if the support is exposed to the weather, from rainfall. To be satisfactory for general use, the adhesive bond must be capable of withstanding the shearing force that results from drying of a water saturated paper covering layer. That force is relatively large in comparison with forces involved in the production of "free films." That fact, in combination with the relative fragility of a typical paper covering layer, clearly presents a particularly critical problem, and one which cannot be solved by direct application of any teaching that is based on "free film" techniques. In fact, from any experience that does not directly involve the shrinkage phenomena and other factors peculiar to paper, it cannot even be predicted whether a solution to the present problem is theoretically possible.

However, a relatively simple and remarkably satisfactory solution has been discovered. That solution involves two primary elements that must be used in combination and with appropriate correlation as to certain details of technique, as is set out below. A full understanding of the invention and of its further objects and advantages will be had from the following account of certain typical manners in which it may be carried out. That description, of which the accompanying drawing forms a part, is intended to be illustrative of the invention, and not limitative of its scope.

The drawing represents, partly schematically, an enlarged transverse section of a typical panel support with a temporarily mounted covering layer in accordance with the invention.

In the drawing, the numeral **10** represents a supporting structure which may be of any desired form, but is typically a relatively thin sheet of slightly flexible material, such, for example, as plywood, wall board, plaster board or sheet metal. Support **10** will be referred to herein for convenience of description as a panel, but without intending thereby to limit its form. Panel **10** may be more or less permanently mounted in a definite position, or, more typically, it may be a portable element capable of being assembled in various arrangements with other similar elements. The facing of a permanently erected billboard, and the plaster covering of a building wall are examples of the former condition; while the so-called "flats" employed for set construction in the motion picture industry typify the latter condition.

In the drawing a typical covering layer is represented at **12**, temporarily mounted on panel **10**. That layer comprises a relatively thin sheet of porous material, preferably having a fibrous structure similar to that of cloth or paper. Such fibrous character is indicated in the drawing, which may be considered to represent a paper covering layer as a specific and typical example. Reference to covering layer **12** as decorative is intended to imply only that it changes the appearance of the surface to which it is applied. The covering layer may, for example, be plain paper, to which color may or may not be applied later without permanently affecting the supporting panel.

The layer **14** represents a substantially permanent surface coating applied to, or produced on, a face of panel **10**. It is an important feature of the invention that the coating **14** presents to the covering layer **12** a surface having certain characteristics. That surface must be water impermeable and must have a uniform and closely controlled degree of smoothness. Coating **14** may be formed in a variety of ways. The generally preferred procedure is to coat panel **10** with shellac, or with a varnish, lacquer or paint that gives a surface having physical characteristics generally similar to those of shellac. Such layer is preferably applied after suitable priming of the panel surface, and is preferably of such thickness that the final outer surface is fully characteristic of the coating material used and substantially independent of the particular material of which panel **10** is constructed.

The preferred type of surface for coating **14** is one which is relatively smooth, but not optically so. For example, the surface preferably has a hard glossy appearance, reflecting a large fraction of the incident light generally specularly; but yet scatters a considerable portion of the incident light, and therefore does not give a well-defined mirror image. Such a surface may be defined as relatively smooth but optically irregular. That general type of surface is typically produced, for example, when a water-insoluble resinous or plastic material is deposited on the surface from a solution in a volatile solvent by evaporation of the solvent. It is believed that the escape of the solvent vapor through the surface as the solution dries and sets produces small irregeularities in the final surface without actually rendering it porous. Whatever the detailed mechanism of such a process, layers thus deposited from solution appear to be generally useful for the present purpose, whereas polymerization of a liquid monomer, for example, frequently leads to a surface that may be absolutely or nearly optically perfect. The optical irregularity of the hard and relatively smooth surface that is typically produced by evaporation of solvent from a solution of water insoluble material has been found to provide a sufficient bond with the adhesive layer (to be described) to provide a stable anchor for the covering layer; but does not prevent clean and effective stripping when the covering layer must be removed.

At **16** in the drawing is indicated a film of suitable strippable adhesive, which in accordance with the invention comprises a dried water soluble cellulose ether, impregnating at least the inner portion of covering layer **12**, and forming a releasable bond with the outer surface of coating **14**. In the drawing, fibers of paper covering **12** are indicated as extending substantially throughout adhesive layer **16** and directly contacting the face of panel coating **14**. While that is believed to be typical of actual practice, the closeness of approach of the main body of the paper to coating **14** is probably somewhat variable, depending upon the thickness of the adhesive layer **16** used, and upon other similar factors. The thickness of layer **16** is somewhat exaggerated in the drawing for clarity of illustration. In actual practice, the adhesive layer, after drying, is believed

to be of the order of half a thousandth of an inch thick, from which it may be seen that the phenomena here involved are quite different from those controlling the production of typical free films.

Adhesive layer **16** is deposited from an aqueous solution of a water soluble cellulose ether by evaporation of the solvent. Such water soluble cellulose ethers are generally available commercially in solution form or as dry powdery or fibrous material that is reducible to aqueous solution of readily controllable viscosity. Methyl cellulose, for example, is available in various forms that differ, for example, in the viscosity of the resulting solutions of uniform concentration. Such types are customarily specified in terms of the viscosity in centipoises of a 2% solution at 20° C. A solution of relatively high viscosity may be made up as a stock solution, and diluted for use as required. The solution as used is preferably of a soft paste-like consistency, having a viscosity represented by the range from about 1000 to about 6000 centipoises. For example, a 2% solution of methyl cellulose rated as 4000 centipoises has a viscosity of approximately 4000 centipoises, and is found to be satisfactory.

The paste-like cellulose ether solution is applied, as with a soft brush, to the back of the paper or other covering layer in substantially the same manner that is customarily employed in the use of flour paste. The paper may then be set aside for a reasonable period to permit the water of the solution to penetrate the paper and fully swell it. The paper is then applied to the previously coated and thoroughly dry and tack-free face of the panel, the layer of wet paste permitting the paper to be shifted about on that face for accurate location before it is pressed firmly into substantial contact with the panel coating.

As the paper is thus pressed into stable position, the cellulose ether is believed to be forced in considerable measure into the pores of the paper, embedding the surface fibers and impregnating at least the inner surface layer of the paper. That condition is schematically shown in the figure in the region where layers **12** and **16** overlap. However, that impregnation of the paper may vary considerably in depth, depending in large measure upon the type of finish of the paper used.

After application, the wet paper and cellulose ether are allowed to dry. During that process the paper tends to shrink, and thus draws itself taut on the panel face. However, the bond between the drying cellulose ether and coating **12** on the panel face becomes and remains strong enough to prevent the drying paper from pulling away from the panel. Once fully dry, the paper remains completely stable upon the panel during all normal use, effectively withstanding such wear and tear as wall-paper, for example, is ordinarily subject to.

It has been found, for example, that when plywood panels are suitably prepared by coating with shellac, and are provided with a covering layer of paper applied as described herein, they may be assembled to form a complete stage set, being handled in the same manner that was customary when flour paste was used as adhesive, without in any way disturbing the bond between paper and panel. Similarly, posters applied in the herein described manner, including suitable preparation of the support surface, have been found to remain firmly in position in spite of repeated wetting and drying.

Yet, in both of those instances, whenever it was desired to remove the covering layer, it could readily be peeled from the support, starting at one edge or corner and progressively separating the cellulose ether from the coated panel. During that peeling process, which requires no wetting of the paper or other preparatory operation, the paper ordinarily comes off substantially untorn, and carries with it substantially all of the cellulose ether. The coating on the panel thus remains undamaged and substantially unchanged, and is immediately ready for application of a fresh covering layer.

An important advantage of the invention results from the ability of cellulose ether, even in such relatively thin layers as are here involved, to strength paper to which it is applied. The described impregnation of the paper (in contrast to the superficial contact with the panel face) is particularly significant in this connection. Measurements indicate that the cellulose ether layer, in addition to and apart from its action as an adhesive, increases the tearing strength of typical paper by a factor of as much as two, an effect that is not found with ordinary flour paste. That strengthening action by the adhesive layer greatly facilitates the operation of peeling, and may well constitute a critical factor without which it would be impossible to obtain adequate stability of adhesion in combination with ready peelability of the paper.

The preferred form of cellulose ether for carrying out the invention is methyl cellulose of a type that yields a viscosity of about 4000 centipoises in a solution that contains less than about 6% of cellulose. It has been discovered that forms of methyl cellulose which require a more concentrated solution than about 6% in order to produce the desirable pasty consistency are less satisfactory, and even useless in carrying out the invention. With such less viscous types of methyl cellulose the resulting bond with the shellac or similar surface is generally too strong to strip conveniently. That is believed to be caused by the larger mass of solid material that is deposited upon drying of such materials. The amount of wet paste of a given consistency that is applied per unit surface tends to be constant, so that the mass of dry cellulose ether per unit area varies inversely with its degree of viscosity, as defined above. Optimum results are obtained when the methyl cellulose is of such a type that the paste as used contains not more than about 6% of cellulose, and preferably approximately 2%; and the solution has a viscosity of from 1000 to 6000 centipoises.

Another cellulose ether that satisfies the criterion just described, and that is satisfactory for carrying out the invention, is sodium carboxymethyl cellulose. About 1.5% of that substance yields an aqueous solution of suitable consistency. On the other hand, hydroxyethyl cellulose of the type now commercially available, even in 10% solution, is rather too thin for convenient mounting of paper, and contains so high a concentration of solids that the operation of stripping is difficult and sometimes impossible. That situation is avoided by employing only cellulose ethers that have the property described above, namely, the ability to produce a solution of practically usable viscosity, say from 1000 to 6000 centipoises, at a solution concentration of not more than 6%, and preferably at a concentration close to 2%.

A suitable plasticizing agent is preferably added to the solution of cellulose ether to control the setting time, as well as degree of hardness of the final dried layer and of the covering layer itself. The plasticizer may be a polyhydric alcohol, such as glycerine, sorbitol, mannitol, erythritol, and diethylene glycol, for example. For average use with wall-paper, between 2 and 3%, of the water solution, by volume, of glycerine is found to be satisfactory. This reduces the degree, and particularly the rate, of the evaporation of water, permitting paper to be hung successfully even a considerable time after application of the paste solution. A larger proportion of plasticizer also tends to reduce the strength of the adhesive bond between the dried cellulose ether and the coated panel face, providing a useful means of controlling that bond.

A suitable preservative, such, for example, as sodium benzoate or sodium salts of chlorinated and/or phenylated phenols, may be added to the solution, 0.5 to 3% of such compounds being usually sufficient to permit indefinite storage of the solution without bacterial or other growth. If the water used as solvent is not pure, any alkalinity of the final solution is preferably neutralized, as by addition of a suitable weak acid.

The following are illustrative examples of paste compositions that are typical of those described above, and that are useful as temporary drying adhesives for covering layers such as paper.

Example 1

20 gms. methyl cellulose (4000 cps.)
1000 cc. water
20 gms. glycerine

Example 2

15 gms. sodium carboxymethyl cellulose
1000 cc. water
20 gms. glycerine
5 gms. sodium benzoate

Example 3

50 gms. methyl cellulose (1000 cps.)
1000 cc. water
20 gms. glycerine

It may be advisable to include in the formulations of Examples 1 and 3, employing methyl cellulose, a preservative such as is indicated in Example 2, employing sodium carboxymethyl cellulose. However, that is usually necessary with methyl cellulose solution only if the conditions of production or use are particularly likely to subject it to infection.

We claim:

1. A renewably faced wall element comprising a supporting wall panel, a surface coating permanently adhered to a face of the wall panel and providing a water-impermeable and relatively hard and smooth but optically irregular surface thereon, a facing sheet of paper having a limited tear resistance and in immediate juxtaposition upon the face of the surface coating, and a layer comprising dried water soluble cellulose ether for which a water solution having a viscosity of 4000 centipoises has a concentration between about 1 and about 6 per cent by weight, the last said layer at least partially impregnating the paper to form therewith a permanent bond, and forming with the face of the surface coating a superficially adhering bond that is capable of withstanding shearing forces resulting from changes in moisture content of the paper, and that is releasable in response to a tension force within the limited tear resistance of the paper.

2. The method of temporarily mounting a sheet of paper on the face of a wall panel, said method comprising the steps of preparing the panel face by coating it with a substantially permanent, water-impermeable surface layer having a relatively hard and smooth but optically irregular face surface, substantially saturating the paper with a paste-like aqueous solution comprising cellulose ether in a concentration between about 1 and about 6 per cent by weight, the viscosity of the said solution being between about 1000 and about 6000 centipoises, applying the saturated paper to the face of the coated wall panel, and drying the solution to form a layer of dried cellulose ether at least partially impregnating and permanently bonded to the paper and forming with the face of the panel coating a superficially adhering bond that is capable of withstanding shearing forces resulting from changes in moisture content of the paper, and then removing the paper and the layer of dried cellulose ether as a unit by progressively peeling back the said unit in dry condition from the coated panel face.

3. The method of mounting different sheets of paper temporarily and successively on the face of a wall panel, said method comprising the steps of preparing the panel face by coating it with a substantially permanent, water-impermeable surface layer having a relatively hard and smooth but optically irregular face surface, substantially saturating the paper with a paste-like aqueous solution comprising cellulose ether in a concentration between about 1 and about 6 per cent by weight, the said solution having a viscosity between about 1000 and about 6000 centipoises, applying the saturated paper to the face of the coated wall panel, drying the solutiton to form a layer of dried cellulose ether at least partially impregnating and permanently bonded to the paper and forming a superficially adhering and readily releasable bond with the face of the panel coating, then removing the paper and the layer of dried cellulose ether as a unit by progressively peeling back the said unit in dry condition from the coated panel face, whereby the coated panel face is exposed with the face surface in its said permanent condition, then applying directly upon the thus exposed face of the coated wall panel another piece of paper substantially saturated with the said solution, drying the solution to form another layer of dried cellulose ether in superficially adhering contact with the face of the panel coating, and then peeling the last said paper and layer of dried cellulose ether in dry condition and as a unit from the coated panel face.

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