

UNITED STATES PATENT OFFICE

2,199,862

MANUFACTURE OF PAPERS HAVING LOW
AFFINITY FOR ADHESIVESFlorian Strovink, Medford, Mass., assignor to
Bennett Incorporated, Cambridge, Mass., a
corporation of MassachusettsNo Drawing. Application September 10, 1938,
Serial No. 229,315

10 Claims. (Cl. 91—68)

This invention relates to the manufacture of papers having low affinity for adhesives, especially for those of rubbery and/or resinous nature, and hence useful as an insulating or separating medium between successive plies or layers of adhesive material or adhesive-coated material. The paper product of the present invention may, for example, be advantageously applied to the adhesive face of an adhesive tape carrying a permanently adhesive rubber and/or resin coating composition, in which case such product prevents the convolutions or plies in a roll of such tape from undue coalescence or "blocking" and hence permits such tape to be readily unrolled and separated therefrom with the adhesive coating composition in the desired intact and adhesive condition. Again, the paper product of the present invention may be used as an insulating or separating medium between uncured or sticky rubber sheets and other sticky articles in a stack. It affords an excellent and inexpensive substitute for so-called Holland cloth, which is sometimes used for facing adhesive tape or sheet material to be stored or packaged in roll form and which is removed from the adhesive face when the tape or sheet material is put to its intended adhesive use.

In accordance with the present invention, a paper base is filmed or protected on its surface with soap or equivalent material deposited thereon from aqueous solution or suspension more particularly after the base has been primed or filmed with wax in the form of an aqueous wax emulsion containing water-wettable binder and then dried. The soap or equivalent exposed filming substance imparts to the paper product the desired low affinity for adhesive surfaces, especially for those of rubbery and/or resinous nature. The waxy priming film, which also has low affinity for such adhesive surfaces, constitutes a desirable background for the exposed surface film, since it ensures separation of the paper from an adhesive surface even when the exposed surface film is imperfect in the sense that it is abraded or otherwise impaired in its adhesive-insulating quality. The waxy priming film also prevents the soap, which is applied to the paper in the form of an aqueous solution or suspension, from being largely dissipated in the paper body, especially when a waterleaf or slightly sized paper base is used as starting material. In other words, the priming film promotes concentration or confinement of the soap solution on the paper surface, whereat the soap exercises its desired function. The water-wettable binder

forming part of the aqueous priming emulsion not only bonds together the surface fibers of the paper base and thus prevents such fibers from being plucked out or separated from the base and fouling the adhesive surface or coating of a tape or other body as it is being removed from the paper product hereof but also imparts to the waxy priming film sufficient water-wettable or water-absorbable quality so that it is possible to retain in and on such film enough aqueous soap solution or suspension to furnish an exposed surface film of the desired substantial weight and adhesive-insulating quality.

While not limited thereto, the present invention will now be described in terms of particular compositions and treatments that may be used in preparing a paper product of the desired adhesive-insulating quality, for instance, for facing the sticky, rubber-containing and/or resin-containing coating on rolled tape intended for masking, surgical, and other purposes. The paper base used as starting material may be ordinary waterleaf or body-sized paper of any suitable basis weight, for instance, about 25 to 35 pounds basis weight, and composed of any suitable papermaking stock, which may be beaten to such degree as is consistent with good formation or substantially homogeneous texture in the paper sheet made therefrom. A waterleaf kraft paper sheet of about 30 pounds basis weight is typical of the kind of base satisfactory for the purposes hereof. The priming composition may be applied to such sheet as it is being delivered progressively from the dry end of a papermaking machine or as it is being progressively withdrawn from a roll accumulation. Thus, the waterleaf sheet may be passed through a bath of the priming composition, and excess composition removed therefrom, as by passage through squeeze rolls, whereupon the primed sheet may be redried, as by passage over one or more steam-heated drier rolls.

A satisfactory priming composition may be prepared by admixing one part (by volume) of aqueous wax emulsion of about 30% wax content with about two parts of sodium silicate of about 40° Baumé and about one part of water. The aqueous wax emulsion, whose wax content may be paraffin or amorphous mineral or hydrocarbon wax, should preferably be stabilized by such agents as keep it from "breaking" or precipitating unduly when admixed with the comparatively large amount of concentrated silicate solution. Since wax emulsions prepared with only fatty acid soap as emulsifying agent tend to "break"

or precipitate under such conditions, they are distinctly less desirable than wax emulsions containing stabilizers practically inert toward sodium silicate, for instance, such wax emulsions as are stabilized with neutral salts of sulphonic acids, preferably sodium or other alkali metal salts of such acids, or water-soluble gums of the nature of gum arabic. Wax emulsions of this latter kind do not "break" or precipitate when mixed with comparatively concentrated sodium silicate solution in any and all such proportions as may be desired for the purposes hereof. Upon passing a waterleaf paper sheet of about 30 pounds through the silicate-wax composition described, the sheet may be squeezed to retain, say, about 10% to 20% of absorbed solids, based on the dry weight of the starting or original sheet.

Although sodium silicate is a preferred water-soluble binder in the priming composition hereof because it is comparatively inexpensive and imparts to the priming film the desired water-wettability while appropriately binding together the surface fibers of the paper, it may be replaced in part or in entirety by other binders. Thus, it is possible to replace part or all of the sodium silicate solution in the priming composition described by an equal volume of cooked aqueous starch solution of 3% starch content, for instance, a cooked tapioca starch solution or the like, to which may have been added preparatory to cooking a small amount of caustic soda or other alkali to promote swelling or gelatinization of the starch granules. It is also possible to use albuminous binder solutions, such as casein or glue solutions, in lieu of, or together with, the silicate and/or starch solutions. The aqueous wax emulsion may be stabilized essentially by fatty acid soap when it is admixed with a binder solution, such as alkaline starch or caseinate solution, having little or no tendency to "break" or upset a soap-stabilized wax emulsion.

The predried, primed paper sheet is filmed or coated with soap, as by passing such sheet through a bath of soap solution or suspension or by applying the soap solution or suspension to such sheet on calender rolls, and drying the solution-wet or suspension-wet sheet to deposit soap in and on the underlying priming film, which confines the soap very largely to the paper surface. It might be noted that the water-wettable binder content of the priming film is sufficient to impart to the dried priming film the desired substantially uniform pickup of soap from the soap solution or soap suspension. Were the priming film composed only of wax, the wax would tend to repel an aqueous soap solution or suspension and hence limit unduly the amount of solution picked up by the priming film; and such pickup as did occur would be apt to be "spotty" or non-uniformly distributed over the priming film. A typical soap solution useful on a calender stack for the purposes hereof may be a potassium oleate solution of about 25% to 30% soap content. Such a solution may be applied to the rolls of a calender stack so that both faces of the primed paper sheet are filmed with the soap solution and the finished or dried paper product contains about 1% to 3% or more soap, based on the weight of the starting or original paper sheet. Another typical soap solution useful in the form of a bath through which the primed paper sheet is passed at an appropriate rate of speed may be a potassium oleate solution of about 10% to 20% soap content. After the

primed paper sheet is passed through a bath of the soap solution, it may be squeezed to the desired soap content and then redried, as on the usual steam-heated drier drums. The various factors affecting the degree of retention of the soap by the paper sheet, including the concentration of the soap solution, its temperature, the time of immersion or contact between the paper sheet and the bath of soap solution, and the degree of pressure exerted by the squeeze rolls, may be coordinated to lead to a finished or dried paper product containing about 1% to 3% or more soap, based on the weight of the starting or original paper sheet. If desired, part or all of the water-soluble soap of the aqueous soap composition may be replaced by such water-insoluble soaps as zinc or aluminum stearates, palmitates, or other heavy metal fatty-acid soaps, in which latter case the water-insoluble soap occurs as a fine suspension or dispersion in the aqueous medium. When a water-insoluble or heavy metal fatty-acid soap is used, it is preferably applied to the paper in the form of a dispersion or suspension in water-soluble fatty-acid soap solution, for instance, as a dispersion in an aqueous solution of potassium, sodium, or other water-soluble soap of oleic acid, stearic acid, palmitic acid, or the like.

Both the soluble and water-insoluble fatty acid soaps as absorbed and deposited in and on the priming film from aqueous solution or suspension, furnish upon drying a protective paper film of the desired low affinity for adhesive surfaces or coatings, for instance, permanently adhesive coating compositions containing rubber and/or resin. There are various compounds of soaplike or detergent character which may be applied in aqueous solution or suspension to a primed paper base with results similar to those realized with the fatty acid soaps. Among such compounds may be mentioned the sulphonated or sulphated aliphatic fatty or higher alcohols, such as the acid sulphuric acid esters of lauryl alcohol, cetyl alcohol, and stearyl alcohol and the sodium or other salts of such sulphonated or sulphated fatty or higher alcohols; also the sulphonated naphthenic acids and the sulphonated naphthenates or the salts of the sulphonated naphthenic acids. The sulphonated or sulphated fatty alcohols are sometimes regarded as the acid sulphuric acid esters of hydroxy-fatty acids; and it is perhaps not amiss to consider such acid esters and the sodium or other salts thereof as soaps and likewise to consider the sulphonated naphthenic acids and the sulphonated naphthenates as soaps. Irrespective of whether any or all such compounds can be technically classified as soaps, they function for the purposes hereof much in the same way as fatty acid soaps and are hence equivalents of the fatty acid soaps. Accordingly, it is to be understood that, unless otherwise qualified, the term "soap" is used in the appended claims in a comprehensive sense to include not only the various saponified fatty acids but also sulphonated oil soaps, such as sulphonated castor oil soap, and the various compounds obtained by sulphonating oils, fatty acids, naphthenic acid, the higher or fatty aliphatic alcohols, either in the form of such compounds or after their neutralization with suitable sodium, potassium, or other alkali metal, alkaline earth metal or heavy metal compound.

The illustrative compositions or treatments hereinbefore described are susceptible of considerable change or modification without depart-

ing from the scope of the instant invention as defined by the appended claims. Thus, the priming composition may be varied as regards its concentration and the relative proportions of water-soluble binder and emulsified wax present therein; and the amount of priming solids deposited on the paper surfaces may also vary, depending upon such factors as the basis weight of the paper sheet being treated, its porosity or absorbency, etc. In some instances, the priming composition may contain fillers of the nature of clay and calcium carbonate, but it is usually desirable to avoid the presence of a substantial amount of filler in the priming film by reason of the fact that a filler detracts from the strength of such film and may weaken such film to an extent such that it may be partly or locally stripped from the paper sheet upon separation of the sheet from an adhesive surface, thereby fouling the adhesive surface undesirably. Again, the concentration of the soap solution or suspension for depositing the exposed soap film is subject to considerable variation, depending, for example, upon whether the paper is passed through a bath of the soap solution or suspension or whether the soap solution or suspension is applied to the paper on calender rolls, upon the soap-retentivity of the priming film, upon the basis weight of the paper base, etc. Generally speaking, it is preferable that the soap be deposited from solution or suspension in and on the priming film in an amount upwards of about 1%, based on the weight of the paper base, but the amount of soap may be even less than 1% when the paper base is comparatively heavy and falls into the category of paperboard, for instance, is of a weight upwards of about 100 pounds. It is preferable to avoid a starting paper sheet or base of drastically or highly calendered character, since a highly calendered paper sheet evidently presents what may be termed a case-hardened superficial fibrous layer or skin of lower tear-resistance than the internal body or layers of the sheet; and, upon removal of a finished paper product hereof comprising a highly calendered paper base from an adhesive surface, fragments of the relatively weak surface layer or skin may be locally stripped from the internal paper body with attendant undesirable fouling of the adhesive surface.

The particular mode of applying to the paper sheet the priming and/or surfacing compositions is also subject to variation. For instance, either or both such compositions may be applied to the paper sheet in the form of a spray from suitable spray nozzles or in the form of a film from a suitable applicator roll rotating partially submerged in a bath of composition. Again, the priming composition may be applied to the paper sheet at any suitable stage of traverse of the sheet on the papermaking machine, for instance, to the still-moist paper web before it enters the drier section of the papermaking machine, to the partially dried paper sheet at an intermediate region of the drier section, or to the fully predried paper sheet upon its delivery from the drier section. When the paper sheet is primed before it is fully dried, the surfacing or soap composition may be applied to the predried, primed sheet as it is progressively issuing from the drier section of the papermaking machine. Thus, the procedure may involve the application of the priming composition to the still-moist paper sheet by means of a so-called size tub stationed at an intermediate stage in the drier

section and the application of the soap or surfacing composition on a pair of rolls of the calender stack located immediately after the drier section, the predried, primed sheet receiving the composition from such rolls as it is passing through such rolls and being redried as it passes through hot rolls forming part of the stack.

It is possible to produce a finished paper product satisfying the requirements hereof by applying to the paper base a single composition containing the ingredients of both the priming and surfacing compositions hereinbefore described, particularly when the soap of the surfacing composition is compatible with the ingredients of the priming composition, as when the aqueous priming composition contains essentially emulsified wax and such binder substances as cooked starch, glue, casein, or equivalent albuminous material. In such latter case, the application of a single composition to the paper base followed by a drying of the paper base protected on its surface with the requisite amount of wax, binder, and soap results in a dried paper product having the desired low affinity for adhesives. However, the use of a single composition is generally less satisfactory than the application of separate priming and surfacing compositions as hereinbefore described, for it is preferable that the soap ingredient, which is especially stick-resistant or of low adhesive affinity, be kept undiluted rather than be diluted or adulterated by the binder and/or wax. In other words, by the two-step procedure hereinbefore described, it is possible to deposit the soap as a separate entity or film on the surface of the paper sheet, even though some of the soap does penetrate into the priming film when the soap-surfaced sheet is dried under heat. On the other hand, the use of a single composition containing the soap as well as the priming ingredients presents the advantage of greater simplicity and economy in commercial practice.

The paper product hereof, which is adapted for use as a readily separable protecting medium on adhesive surfaces of various kinds and more especially on rubbery and/or resinous adhesive coatings, can be characterized generally as carrying an exposed soap film on its face and an underlying priming film of wax and water-wettable binder substance bonding together its surface fibers. It is evidently the lubricating quality of soap and its fragility or low cohesive strength that renders it stick-resistant or of low adhesive affinity. The wax evidently has similar properties and also evidently serves to modify the binder content of the priming film so that, although the binder substance exercises the desired bonding effect on the surface fibers of the paper base, it is diluted sufficiently by the wax to part readily from an adhesive surface even when the overlying soap film is abraded, cracked, or otherwise impaired. Irrespective of whether such explanation for the behavior or utility of the paper product hereof is correct, it is a fact that it is readily separable from adhesive surfaces, after having served as a protective or facing medium thereon, with no appreciable fouling of such adhesive surfaces or detraction from the tenacity of adhesion of such surfaces to other surfaces with which they are intended to be adhesively united.

It might be noted that the initial treatment of the paper base or sheet with the aqueous composition comprising water-soluble binder and emulsified wax is attended by infusion of the

binder and the wax into the paper at least at its surface fibers and that subsequent drying of the paper, which is effected at an elevated temperature above the melting point of the emulsified paraffin wax or equivalent waxy material, promotes more or less fusion of the wax and its penetration into the paper body. The extent to which the paper body is penetrated by the binder and wax may vary, depending, for example, upon the porosity or absorbency of the paper base and the viscosity of the aqueous priming composition. In any event, the priming composition fills the surface pores or voids of the paper and deposits on the paper surfaces a smooth priming film penetrating more or less into the paper body. Such a film affords a substantial barrier against penetration into the paper body of soap from aqueous solution or suspension even though such film is not so water-repellent as to prevent soap from being absorbed and/or adsorbed thereon in substantial amount from aqueous solution or suspension.

I claim:

1. A paper adapted for use as a readily separable protective medium on adhesive surfaces, said paper carrying as a distinct entity an exposed soap film and being infused at least at its surface fibers underlying said soap film with wax and water-wettable binder, which afford a substantial barrier against the penetration of said paper by said soap film.

2. A paper adapted for use as a readily separable protective medium on adhesive surfaces, said paper carrying as a distinct entity an exposed soap film and being infused at least at its surface fibers underlying said soap film with waxy material, which affords a substantial barrier against the penetration of said paper by said soap film.

3. A paper adapted for use as a readily separable protective medium on adhesive surfaces, said paper carrying an exposed film comprising water-soluble fatty acid soap and water-insoluble fatty acid soap and also an underlying priming film of wax and water-wettable binder substance bonding together its surface fibers.

4. A paper adapted for use as a readily separable protective medium on adhesive surfaces, said paper carrying an exposed film comprising water-soluble fatty acid soap and also an underlying priming film of wax and water-wettable binder substance bonding together its surface fibers.

5. A paper adapted for use as a readily separable protective medium on adhesive surfaces, said paper carrying an exposed film comprising water-insoluble fatty acid soap and also an underlying priming film of wax and water-wettable binder substance bonding together its surface fibers.

6. A paper adapted for use as a readily separable protective medium on adhesive surfaces, said paper carrying an exposed film of fatty acid soap and also an underlying priming film of wax and sodium silicate.

7. A paper adapted for use as a readily separable protective medium on adhesive surfaces, said paper carrying an exposed film of fatty acid soap and also an underlying priming film of wax and starch.

8. A paper adapted for use as a readily separable protective medium on adhesive surfaces, said paper carrying an exposed film of fatty acid soap and also an underlying film of wax and water-wettable albuminous binder.

9. A method of producing paper adapted for use as a readily separable protective medium on adhesive surfaces, which comprises priming a paper sheet with an aqueous composition comprising emulsified wax and water-soluble binder, drying the primed sheet, surfacing the dried sheet with aqueous soap composition, and redrying the surfaced sheet.

10. A method of producing paper adapted for use as a readily separable protective medium on adhesive surfaces, which comprises priming a paper sheet with an aqueous composition containing silicate, emulsified wax, and an emulsifying agent for the wax practically inert to the sodium silicate; drying the primed sheet; surfacing the dried sheet with aqueous soap composition; and redrying the surfaced sheet.

FLORIAN STROVINK.