

UNITED STATES PATENT OFFICE

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PROCESS FOR THE PRODUCTION OF COMBINATIONS OF RUBBER AND PAPER AND
PRODUCT OBTAINED THEREBY

No Drawing.

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This invention relates to processes for the production of combinations of paper, rubber and other ingredients adapted to impart special properties to the paper. The invention is also concerned with methods for depositing such paper modifying materials from a dispersion upon a paper making pulp of any sort. The invention also includes within its scope the production of paper having special properties of water resistance, grease resistance, or high electrical insulating value, or of several of these and other properties conferred upon paper by the methods and materials herein recited.

In the manufacture of paper for special purposes, where the paper is required to be water resistant, grease-proof, or must possess high insulating value, it has been the practice to incorporate various ingredients with the paper prior to its manufacture into sheets or subsequently thereto as a coating. These special papers are not new in the art. But when rubber is incorporated with the paper, as for example by the addition of rubber latex to the paper pulp, the value of the ingredients usually added to increase water resistance, etc., becomes greatly enhanced and the properties of the papers thus prepared are frequently entirely different than where the rubber is not used.

The primary object of the present invention is to provide a method for incorporating various ingredients with rubber and paper stock. Another object is to provide a method for adding such ingredients to paper from their dispersions, suspensions, or emulsions. A further object is to increase the retentive power of paper with respect to the so-called loading materials. A further object is to modify the properties of rubber containing paper. Another object is to prepare a waterproof and/or grease-proof paper having varying degrees of flexibility. A still further object is to prepare an electrical insulating paper. Other objects will be apparent from the specification and claims.

Without intending to place undue limitations upon the scope of the invention beyond what may be required by the state of the prior art, the invention may be briefly de-

scribed as consisting in forming a dispersion of a desired paper modifying ingredient, combining the dispersion with a paper-making pulp in the presence of a dispersion of rubber, and depositing the desired ingredient together with the rubber upon the pulp and subsequently forming the pulp into sheets.

The addition of rubber to paper, particularly the addition of rubber derived from latex, increases the retentive power of paper for finely divided solids, such as clays, talc, and the like, known to the industry as loading materials. The increased retention may be as much as 50% higher when rubber is present on the paper fibre than where rubber is not incorporated. Various other materials may be added similarly to a paper making pulp, thereby modifying the properties of the paper with respect to moisture, grease, adhesion, etc. According to the present invention, various modifying ingredients may be added to the pulp, in the form of dispersions, to confer special properties upon the paper. Such ingredients are tars, pitches (such as the hard wood pitches), resins (such as cumar), phenol-aldehyde condensation products, resinsates, waxes, gums, ester gums, drying oils, non-drying oils. They are added in the form of dispersions, suspensions, or emulsions, and it is preferable to prepare the dispersions in such a way that they will be coagulated by means of the paper-makers' alum or whatever coagulant is to be used for the particular paper being made.

As one example of the invention, an emulsion or suspension of aluminum resinate, is prepared by grinding the material in a ball mill or colloid mill or other suitable apparatus with a solution containing 5-10% of ammonia. The addition of an emulsifying or peptizing agent such as casein, glue, one of the modified starches, soaps, such as the oleates, stearates or palmitates of sodium, potassium or ammonium acts to hasten the dispersion of the resinate and at the same time tends to stabilize the resulting dispersion.

In applying this material to the manufacture of a waterproof paper, paper pulp is prepared for the formation of a sheet on any standard type of paper machine by beating

the pulp in an ordinary beater or Hollander engine. After the beating process is for instance about three-fourths finished, an alkali such as ammonia or caustic soda is added in the proportion of about $\frac{1}{2}\%$ on the dry weight of the pulp in the beater. At this stage of the beating process a protective colloid such as one of the modified starches known as feculoid, or glue, or casein may be added. After the beating is completed the beater roll is raised off the bed plate and rubber latex is added. The alkali and protective colloid are added to the suspension of paper pulp in order to avoid any possible coagulation of the latex when added to the pulp. Different batches of latex may vary insensitivity due to partial destruction of the proteinous protective colloid surrounding the latex particles. As a result, when the latex is diluted, if its protective colloid has been partially removed or destroyed, it is in an unstable condition. Another condition which may tend to cause coagulation of the latex is that in some cases the pulp may be acid, and still another condition liable to cause this trouble is that the water may contain suspended finely divided lime compounds. By the addition of the alkali and the protective colloid to the pulp, any acidity of the pulp suspension is neutralized and the individual particles of pulp and any suspended calcium compounds are coated with a protective colloid. Hence, when the latex is added, all risk of coagulation is obviated. The beater roll is then made to serve as a means for agitating the pulp and thoroughly mixing the latex therewith. After the latex has become mixed with the pulp, the dispersion of aluminum resinate is then added to the contents of the beater in a quantity sufficient to give, say 5-10% of dry aluminum resinate on the weight of the dry fibre in the beater. It is obvious that the order of adding the latex and aluminum resinate dispersion may be reversed, or they may be added together. The rubber may then be agglomerated by the addition of an insufficient amount of coagulant to cause complete coagulation, meanwhile continuing the agitation. When about $\frac{2}{3}$ of the quantity of coagulant necessary to accomplish complete coagulation has been added, the latex will have become agglomerated, but not coagulated upon the pulp. The addition is then stopped for a short time while the agitation is continued. This serves to distribute the agglomerated rubber and the aluminum resinate uniformly upon the paper fibre, and the rubber will be found adhering to the fibre. The remainder of the coagulation solution is then added to complete the coagulation and to impart an acid-reaction to the contents of the beater. The paper fibre obtained by this treatment is then formed into

a finished sheet by any standard paper making process. The finished sheet will be found to contain approximately 70% of the aluminum resinate added to the beater, and the sheet is substantially waterproof. The degree of resistance to water may be varied within wide limits by the use of varying quantities of the aluminum resinate.

The above result may be also obtained by the formation of aluminum resinate from the reaction between the ordinary rosin size used in paper making and paper makers' alum. However it has been found that considerable difficulty may be experienced in the clogging of the wires and felts on the machine when high percentages (over 4%) of this material are used. This sticking can be entirely eliminated by the use of aluminum resinate prepared as described above.

Another illustration of the invention is in the production of papers having high insulating properties by the addition of an insulating material to the paper. Resinous products such as cumar resins, phenol aldehyde condensation products, pitches such as hard wood pitches, may be added to paper according to the example given above. These materials can be dispersed in a carrier liquid, preferably water, and they may be used in exactly the same manner as the aluminum resinate dispersion described above. Loading materials such as clays, talc, etc., may be added as dry powders or as dispersions, and the finished paper will be found capable of retaining considerably greater quantities of these materials than is possible for ordinary paper to retain.

Other types of waterproof papers may be prepared by the addition of the fatty acid salts of the alkaline earth metals or of the metals of the aluminum group. Papers of the general type known as wax papers may be prepared according to this invention by adding emulsions or dispersions of waxes such as those of the paraffin group, saponifiable waxes, such as Japan wax, carnauba, etc. The properties imparted by these waxes and other materials are eminently more desirable in the presence of a dispersion of rubber than without the rubber, and frequently the properties are different in the finished sheet. Varying degrees of flexibility may be obtained in the papers by using more than one ingredient or by using a specially adapted ingredient such as a low softening point tar or an oil. Pliable papers having the property of hardening after a period of time may be prepared by including a drying oil in the added dispersion.

The present invention offers methods for producing papers which are entirely impervious to moisture and gases. These products are of particular interest in connection with various electrical insulation requirements. Papers containing cumar resins, hard wood

5 pitches, or the waxes mentioned above have, after hot calendering, a glossy, impervious surface. This may probably be due to the fact that the materials sweat or bloom to the surface of a sheet when passing through the hot calender, and thus form films on the surface of the paper. It is preferable, but not absolutely necessary, in some cases such as electrical insulating paper to calender the paper in a vacuum, in which instance the resultant sheet will contain substantially no air or gas or moisture within its structure, and after hot calendering the film which is formed on the surface prevents any reabsorption of air, gases or moisture by the paper.

10 The expression "paper modifying material" in the specification and claims is used in a generic sense as descriptive of the materials employed in the paper industry to impart specific properties to the paper, such as water resistance, grease resistance, high electrical insulating value, opacity, stiffness, flexibility, and other special properties which ordinary paper does not possess at all, or else to a limited degree, and the expression therefore excludes the ordinary loading and sizing ingredients.

15 Having thus described our invention, what we claim and desire to protect by Letters Patent is:

1. A process of manufacturing a water-proof paper which comprises beating paper making fibre, adding a protective colloid and an alkali thereto, mixing a dispersion of paper waterproofing material and a rubber dispersion with the beaten fibre, depositing the material and the rubber upon the fibre, and forming the treated fibre into a sheet.

2. A process of manufacturing a water-proof paper which comprises beating paper making fibre, adding a protective colloid and an alkali thereto, mixing a dispersion of waterproofing material embodying a resin and a rubber dispersion with the beaten fibre in the presence of the protective colloid, uniformly depositing the material and the rubber upon the fibre with the aid of a coagulating agent, and forming the treated fibre into a sheet.

3. A process of manufacturing a water-proof paper which comprises mixing a pre-formed dispersion of a water insoluble resin soap and rubber latex with beaten paper fibre containing a protective colloid, depositing the resin soap and the rubber upon the paper making fibre, and forming the fibre into sheets.

4. A process of manufacturing a water-proof paper which comprises mixing a pre-formed dispersion of a water insoluble metallic resinate with beaten paper fibre containing a protective colloid and rubber latex, depositing the metallic resinate and the rubber upon the paper making fibre, and forming the fibre into sheets.

5. A process of manufacturing a water-proof paper which comprises mixing a pre-formed dispersion of aluminum resinate with beaten paper fibre containing a protective colloid and rubber latex, depositing the aluminum resinate and the rubber upon the paper making fibre, and forming the fibre into sheets.

6. A process of manufacturing a paper article which comprises, forming in the presence of a protective colloid a colloidal suspension of a water insoluble paper modifying ingredient exclusive of the usual filling and sizing ingredients, mixing the suspension and a rubber dispersion with a suspension of paper pulp in the presence of a protective colloid and an alkali, uniformly and firmly depositing the suspended materials on the pulp by the addition of a coagulant, and forming the pulp into an article.

7. A process of manufacturing a paper article which comprises beating a paper making fibre, adding a protective colloid and an alkali thereto, mixing in rubber latex, forming a colloidal suspension of a water insoluble paper modifying ingredient exclusive of the usual filling and sizing ingredients and adding said suspension to the latex and the pulp mixture, adding a coagulant and uniformly depositing the rubber and paper modifying ingredient on the pulp, and forming the pulp into an article.

Signed at New York, New York, this 3rd day of October, 1925.

REED P. ROSE.

Signed at New York, New York, this 15th day of September, 1925.

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