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IMPREGNATED PAPER

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This invention relates to paper and paper manufactures, and particularly relates to papers which are characterized by excellent durability in either a wet or dry condition, and may be used in the manufacture of goods commonly made from textile fabrics, such as, for example, table linens, sheets, pillow cases, handkerchiefs, towels and other hospital and home supplies.

Papers have been developed recently which are characterized by toughness, durability and water-repellent powers. These papers have about equal durability and toughness in a wet or a dry condition, due to treatment which coats the individual cellulose fibres with a water-repellent and adhesive material. The adhesive quality of the fibre coating binds the individual fibres together and the water-repellent action prevents disintegration or separation of the fibres. Papers of this type, while satisfactory for many purposes, are characterized by a dry, harsh texture which renders them unsuitable for many purposes, such as substitutes for textiles. Furthermore, these papers may be crumpled and creased and thereafter cannot be returned to a smooth, unwrinkled finish.

It has been suggested that other types of paper may be treated or impregnated with glycerine to render them softer and less harsh and to overcome the undesirable characteristic of being easily crumpled and creased, but while glycerine can temporarily soften the material, it is hygroscopic and withdraws moisture from the air, rendering the paper undesirably damp and weak. Furthermore, if the glycerine treated paper is placed in water, the glycerine is dissolved and upon drying the soft texture and flexibility of the paper is lost. The glycerine may be lost, also, by evaporation if the paper is stored in a dry, heated atmosphere and will be withdrawn at least partially from the paper if it comes in contact with other absorbent materials.

The principal object of this invention is to produce a paper which is soft, flexible and durable, either wet or dry, and which may be used in the manufacture of articles commonly made of textile fabrics.

Another object of the invention is to produce paper and paper manufactures which remain soft and strong in a wet or dry condition.

Another object of the invention is to produce paper and paper manufactures which are characterized by softness, porosity, absorption, and are strong when wet, have drapability, and can be cut and sewn like cloth.

An additional object of the invention is to

produce articles of manufacture from paper which have the texture and flexibility of similar textile articles and which may be moistened and handled similarly to the textile articles.

Other objects will become apparent as typical embodiments of the invention are described hereinafter.

The objects of the invention have been attained through the use of a novel sizing material which forms the subject matter of my copending application, Serial No. 183,801, filed Jan. 7, 1938, and which is applied to "wet strength" paper, such as that disclosed in the patent to Schur, No. 2,035,024, patented March 24, 1936, by a novel method which forms the subject matter of my copending application, Serial No. 183,756, filed Jan. 7, 1938, now Patent 2,183,711.

The sizing material consists essentially of softening agents, such as glycerine or other stable water soluble liquids having higher boiling points than water, for example, other polyhydroxy alcohols, and the ester and esters of polyhydroxy alcohols, such as ethylene glycol, diethylene glycol, and mono-ethyl ether of ethylene or diethylene glycol, dissolved in water, and a water insoluble mineral filler. The filler material preferably is a white pulverulent powder in order that the paper will not be discolored thereby. It will be understood, of course, that colored fillers may be used when colored papers are to be produced.

The function of the filler is to fix or anchor the softening agent in the paper so that moisture will not dissolve or dry and heated atmosphere will not evaporate the softening agent and leave the paper in the stiff and harsh condition which normally characterizes papers having considerable mechanical strength. The filler materials hereinafter described apparently act as adsorbents to retain the softening agent in the paper and distribute it throughout the paper. The filler distributes itself throughout the fibres of the paper and adheres thereto with sufficient tenacity to resist removal by wetting or washing.

Typical fillers which, have, in actual practice been found entirely satisfactory, are water insoluble mineral fillers, such as, for example, calcium, magnesium, and aluminum oxides and salts. The silicates, carbonates, sulfates and fluorides of calcium and magnesium and aluminum silicates, such as, for example, kaolin, fuller's earth and pumice are particularly satisfactory for use as fillers. Some of these fillers have been used heretofore in making high grade coated papers, but their ability to act as an ad-

sorbent for a paper softening agent has not heretofore been appreciated.

The impregnating and sizing composition is preferably applied by passing the paper through a bath in a continuous sheet and thereafter drying it as on a drum drier to drive off excess moisture. The sizing or impregnating composition may be applied, also by dipping sheets of paper therein and festooning the wet sheets in a suitable drying chamber.

It should be understood that the filler materials are in a finely divided form and during application of the sizing composition to the paper the bath should be agitated to prevent the filler from settling out.

Typical sizing compositions may contain the following constituents:

Example I

Glycerine	fluid ounces	28
(70%) denatured alcohol	do	28
Water	do	72
Magnesium silicate	ounces	14

These quantities are purely illustrative and may be varied in accordance with the quantity of sizing composition desired. While the above example includes magnesium silicate as the filler, other water insoluble mineral fillers, such as magnesium fluoride, magnesium oxide, pumice, calcium carbonate, calcium siliculate, calcium sulfate, or mixtures of the same may be substituted therefor. Another suitable composition may consist of:

Example II

Glycerine	fluid ounces	28
Water	do	80
Magnesium silicate	ounces	16

In this composition, also, the magnesium silicate may be mixed with or replaced by suitable water insoluble mineral fillers of the general type set forth above.

In each of the above examples the quantities of alcohol, water, glycerine, and filler may be varied within somewhat wide limits without losing the valuable paper softening and flexibility producing characteristics.

Ordinary papers may be treated with the sizing or impregnating composition to render paper soft and flexible. This type of paper is inexpensive, has good adsorbent properties and may be used for many purposes when "wet strength" is not important.

The use of "wet strength" paper, with the sizing composition produces a linen-like paper which cuts and sews like cloth, is as flexible or drapable as cloth, and is an excellent substitute for cloth in the production of many articles which normally are intended to be used several times, wetted several times, and thereafter disposed of. The presence of the softening agent renders the paper so flexible and soft that it may be crumpled or crushed and thereafter smoothed out without visible creases or bending marks remaining. This characteristic, as well as pleasant soft texture are retained throughout the life of the paper.

Examples of the many uses to which this paper, economically and satisfactorily, can be put, are as follows:

Bed sheets and pillow cases, dentists' bibs, doctors' coats and covers, table linen, diapers, costumes and draperies for theatres, towels (dish

and bath), handkerchiefs, dresses, sport hats, shower curtains and window drapes.

These articles may be either white or colored and in the case of hospital supplies, may be sterilized and packaged in a sterile condition inasmuch as the ingredients used are not incompatible with surgical or other medicinal uses.

Pillow cases made from these papers are particularly suitable for use by individuals suffering from allergies such as hay fever. The paper is impervious to dust and the pillow dust is therefore prevented from escaping from the pillows.

It will be seen that papers embodying this invention have many novel uses and characteristics not found in papers of the types heretofore known.

It should be understood that the examples of the sizing compositions set forth above are illustrative only and therefore should not be considered as limiting the scope of the following claims.

I claim:

1. An article of manufacture comprising a sheet of paper impregnated with a paper softening agent and a water-insoluble filler capable of adsorbing and retaining the softening agent in the paper, said softening agent and filler being present in the ratio of about 14 to 16 ounces of filler to about 28 fluid ounces of softening agent.

2. An article of manufacture, comprising paper having substantially the same mechanical strength whether wet or dry impregnated with a paper softening agent and containing a water-insoluble mineral filler by which the paper softening agent is adsorbed and retained in the paper, said softening agent and filler being present in the ratio of about 14 to 16 ounces of filler to about 28 fluid ounces of softening agent.

3. A paper article characterized by strength, durability, flexibility and softness and capable of being moistened and dried without losing these characteristics, comprising a sheet of paper having substantially the same mechanical strength whether wet or dry impregnated with a stable water-soluble polyhydroxy alcohol having a boiling point higher than water, and a water-insoluble mineral filler which fixes the alcohol in the paper, said alcohol and filler being present in the ratio of about 14 to 16 ounces of filler to about 28 fluid ounces of said alcohol.

4. A paper article characterized by strength, durability, flexibility and softness and capable of being moistened and dried without losing these characteristics, comprising a sheet of paper impregnated with a stable water-soluble ester of a polyhydroxy alcohol having a boiling point higher than water adsorbed on a water-insoluble mineral filler, said ester and filler being present in the ratio of about 14 to 16 ounces of filler to about 28 fluid ounces of said ester.

5. A paper article characterized by strength, durability, flexibility and softness and capable of being moistened and dried without losing these characteristics, comprising a sheet of paper impregnated with a stable water-soluble ether of a polyhydroxy alcohol having a boiling point higher than water adsorbed on a water insoluble mineral filler, said ether and said filler being present in the ratio of about 14 to 16 ounces of filler to about 28 fluid ounces of ether.

6. A paper article characterized by strength, durability, flexibility and softness and capable of being moistened and dried without losing these characteristics, comprising a sheet of paper impregnated with glycerine and a water-insoluble

mineral filler which fixes the glycerine in the paper, said mineral filler being present in the ratio of about 14 to 16 ounces of filler to about 28 fluid ounces of glycerine.

7. A paper article characterized by strength, durability, flexibility and softness and capable of being moistened and dried without losing these characteristics, comprising a sheet of paper having substantially the same mechanical strength whether wet or dry containing a water- 10

insoluble mineral filler on which is adsorbed a paper softening agent of the class consisting of water soluble, stable polyhydroxy alcohols and derivatives of the same having higher boiling points than water, prepared by impregnating said paper with a solution containing filler, softening agent and water in the proportions of about 28 fluid ounces of softening agent, 72 to 80 fluid ounces of water and 14 to 16 ounces of filler.

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