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PAPER SIZE AND PROCESS OF MAKING SAME

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This invention relates to an improved paper size and process of making the same, and relates especially to a size which is of particular value for the manufacture of transparent or translucent and waterproof paper.

Various sizes have been used heretofore for this purpose, consisting mainly of various soaps, rosin and waxes. Particular difficulty seems to have been encountered in producing such a size as will make a paper of proper transparency or of proper waterproofness, and which will at the same time "take print" well, that is, absorb printing inks uniformly over the entire surface. Another fault of the present type of size is that of producing a too brittle paper.

My invention comprises the preparation of such new and improved sizes as will largely overcome the difficulties heretofore encountered and in order to do this I prepare a size by emulsifying a wax such as, for example, paraffin wax, japan wax, carnauba, ceresine, Montan, beeswax, etc., with an oil and water. I prefer to use a petroleum hydrocarbon oil of extremely light color boiling substantially over 200° C., and having a specific gravity of approximately 0.850 at 17° C., although various other hydrocarbon and slow drying vegetable oils may in some cases be used. It is also possible to utilize partially, or completely hydrogenated vegetable or marine oils, in which case, some or all of the wax may be eliminated. The use of a pure white, practically medicinal grade of petroleum hydrocarbon oil, such as is generally known in the trade as "Marcol" and "Nujol" in combination with a wax, especially paraffin wax, is of particular value in the manufacture of paper or paper products intended to come into contact with food products, such as milk bottle discs, ice cream containers, oyster pails, etc. The comparative physiological inertness of paraffin and such pure water-white petroleum oils renders them of particular value and use thereof confers the needed pliability or flexibility, whereby the paper is more readily drawn through dies, or subjected to other mechanical operations.

The use of these oils is the primary feature of my invention, for by utilizing these oils I render the paper impregnated with these sizes much more flexible than would otherwise be the case, and at the same time the surface texture is improved to such an extent that the printing ink is absorbed more uniformly than would otherwise be the case. Considerable variation in these properties may be produced by variations in the proportions of oil and wax, and in some cases, it is advisable to introduce a small amount of some soluble soap in the emulsion, although not essentially necessary, particularly if a colloid mill be used to prepare the emulsion. Such a composition as sodium or ammonium stearate, palmitate, resinates, and the like, are suitable for the purpose.

In preparing these emulsions, it is usually advisable to previously dissolve the soaps, when used, in water. The wax is preferably dissolved in hot oil and then admixed with the water, or aqueous soap solutions. The use of a colloid mill to accomplish the proper dispersion and emulsification of the wax and oil is advisable, although I may utilize special stirring devices, or other suitable means to produce this emulsification. In some cases, the addition of small amounts of alkaline salts, such as sodium phosphate, soda ash, or of an alkali such as caustic soda, or potash may be employed to promote the emulsification, the use of such argillaceous materials as bentonite also being somewhat advantageous for this purpose. Bentonite when used with a wax dispersion appears to exert a softening influence and helps to increase the pliability.

It is objectionable to use such substances as rubber, gutta-percha, sulphurized oils, etc., in these emulsions and particularly for the production of papers which are intended for use in contact with food products, for all objectionable odors and flavor inducing substances must be avoided and it is also of great importance to utilize very pale colored, non-darkening, chemically inert materials.

In the preparation of wax emulsions for paper sizing, according to my invention, it is of importance to use very little, if any, soaps or foam forming ingredients as are present

in the usual emulsion. Soaps particularly in fairly high percentages are apt to cause serious foaming in the beater and being water soluble and chemically reactive are objectionable ingredients. The particular value lies in their stabilizing influence on emulsions and therefore the minimum amounts should be used which will confer desired stability. By employing a colloid mill for the preparation of the wax emulsions or dispersions I am in most cases enabled to produce satisfactory stability with only ½ of 1 per cent of a water soluble soap, and in some cases, no soap at all need be used.

In the practice of my invention it is of great importance to utilize paper pulps containing a substantial amount of hydrocellulose, since the hydrocellulose causes a greater and more rapid absorption of the wax dispersions or waxes and produces a product of better texture and increased water resistance. In order to insure the presence of sufficient hydrocellulose I find it necessary to either subject the pulp to an unusually long treatment in the beater engine, that is, over forty-eight hours, or else to pretreat the paper pulp chemically to form a substantial amount of hydrocellulose. It is understood that paper which has been well-worked in the beater contains a certain amount of hydrocellulose in dispersed form and this colloidal agent coming in contact with the dispersion of the substantially homogenized wax, or other waterproofing agent, through certain absorptive phenomena, causes its occlusive union with a part of the fibre. The action is quite a different one from that which occurs when a sheet of paper is passed through a bath of, for example, molten paraffin. Under these conditions there is no colloidal occlusion.

The formation of an increased amount of hydrocellulose may be accomplished in many ways, but particularly by an acid hydrolysis with sulphuric or other acids such as for example, hydrochloric, phosphoric, oxalic; acid salts such as, zinc chloride, sodium or potassium bisulphate; salts such as, potassium iodide, or calcium thiocyanate, and other substances may be used in lieu of the sulphuric acid. When sulphuric acid is to be used, I preferably employ an acid having a specific gravity of approximately 1.52 to 1.54 and allow the pulp to soak in an excess of this acid for three to four hours, or more, then neutralize and wash. The beating operation, namely; the incorporation of my improved wax-oil dispersions may then be started and will require much less time than if no acid hydrolysis was used.

Since various papers will require different amounts of hydrocellulose for best results, I do not wish to limit myself to any particular stage of hydration of the cellulose in carrying out my invention. As indicated, the preferred form contemplates a substantial degree of hydration, sufficient to engender a notable affinity towards the dispersions of waxes involved herein. Furthermore, mixtures of the hydrated cellulose and unhydrated cellulose may be employed in preparing the paper stock, for example, dry pulp which has been thoroughly dried, or dry paper stock from any other source which is relatively difficult of hydration in the beater engine, may be admixed with fresh wet pulp which has not been dried and which hydrates readily and a mixture of these two types of paper stock duly subjected to treatment in the beater.

The process may be better understood from the following example, to which, however, the invention is not limited.

Two tenths parts by weight of ammonium stearate is dissolved in approximately 10 parts by weight of water. Four parts by weight of paraffin wax are dissolved in 6 parts by weight of petroleum hydrocarbon oil having a specific gravity of 0.850 at 170° C., boiling substantially over 200° C., and practically water-white in color, and known generally as "Marcol", said oil being sufficiently heated to readily dissolve the paraffin. The two liquids may then be fed simultaneously to a colloid mill in order to produce an emulsion. Various other soaps may be employed, or may in some cases be entirely omitted, especially when emulsification is produced by a colloid mill. The soaps, however, in general act as stabilizing agents, and their use is recommended. It is sometimes advisable to use a fatty acid as such and add an alkali in order to form a soap in the mixture, while in other cases the soap is formed separately and then added to the mixture.

In place of paraffin wax, I may utilize various other waxes, such as ceresin, carnauba, japan, beeswax, etc. Rosin or rosin soaps may be added if desired.

Variations in the method of mixing the various ingredients may readily be made, as for example, the soap may be added to the wax and oil solutions and then introduced to the water, and while I have indicated a special procedure in the foregoing example, it is not absolutely necessary to follow just this procedure, and many variations in the method of mixing may be introduced. Where saponifiable oils are used in place of the petroleum oils, they may, in some cases, be partially saponified by the slight addition of alkaline materials, in which case, no soaps need to be added under any conditions.

Having prepared the emulsion I finally introduce said emulsion into a beater with the wood pulp. I find it highly desirable to add the emulsion before the pulp has been thoroughly disintegrated and hydrated and is ready to be removed from the beater. The emulsion is rapidly absorbed by the fibres (the speed of absorption depending to some extent on the proportion of hydrocellulose

present). On drying the paper, the emulsified material is left occluded in and upon the fibres. On passing the sheets through calender rolls, the latter preferably hot, the occluded material is forced under high pressure even more thoroughly throughout the sheet, and such uniform distribution renders sheets of thin paper unusually transparent. For the preparation of opaque and cheap waterproof papers, such as pressboard, and the like, I may introduce into the beater a certain proportion of ground wood flour and similar materials. Various other procedures of introducing the size into the pulp to form paper may readily be used and the foregoing is merely given as an example of one such method.

The present application is a division of my prior application, Serial No. 78,329, filed December 30, 1925, now Patent No. 1,607,552.

What I claim is:—

1. In the process of making water-resistant paper, the step which comprises adding to paper pulp, in a beater, an aqueous dispersion of paraffin wax and an oil, said wax and oil being of substantially non-odorous and non-flavor inducing character; said dispersion having the property of substantial freedom from foaming when incorporated in the beater engine.

2. In the process of making paper, the step which comprises adding to the pulp containing a substantial amount of hydrocellulose, in the beater engine, an aqueous dispersion of paraffin wax and a water-white substantially medicinal grade of a petroleum hydrocarbon oil; said dispersion having the property of substantial freedom from foaming when incorporated in the beater engine.

3. In the process of making paper, the step which comprises adding to the pulp in the beater engine, substantially at the beginning of the operation, a dispersion of wax and an oil; said disperson having the property of substantial freedom from foaming when incorporated in the beater engine.

4. In the process of making paper, the step which comprises adding to pulp which has been subjected to an acid hydrolysis, in the beater engine, an aqueous dispersion of a wax and an oil; said dispersion having the property of substantial freedom from foaming when incorporated in the beater engine.

5. In the process of making water-resistant paper, the step which comprises incorporating with the paper pulp, a dispersion comprising paraffin wax; said dispersion containing a minimum amount of appetizing agent, whereby foaming of the pulp when agitated is substantially avoided.

6. A paper size consisting of an aqueous dispersion containing wax and an oil in proportions to yield a size, said size having the property of substantial freedom from foaming when incorporated in the beater engine.

7. A paper size consisting of an aqueous dispersion containing paraffin wax and a hydrocarbon oil in proportions to yield a size, said size having the property of substantial freedom from foaming when incorporated in the beater engine.

8. A paper size consisting of an aqueous dispersion containing paraffin wax, an oil, and a small amount of a water soluble soap, in proportions to a yield a size having the properly of substantial freedom from foaming when incorporated in the beater engine.

9. In the process of making paper, the step which comprises adding to pulp in the beater engine, a dispersion of wax and oil, said dispersion containing particles comparable in degree to those resulting from colloid mill treatment, said dispersion having the property of substantial freedom from foaming when incorporated in the beater engine.

10. In the process of making paper, the step which comprises adding to the pulp containing a substantial amount of hydrocellulose in the beater engine, an aqueous dispersion of paraffin wax and hydrocarbon oil, said dispersion containing particles comparable in degree to those resulting from colloid mill treatment, said dispersion having the property of substantial freedom from foaming when incorporated in the beater engine.

11. In the process of making paper, the step of incorporating with paper pulp, an aqueous dispersion of wax and oil.

12. In the process of making paper, the step which comprises incorporating with paper pulp, a non-foaming, soap containing aqueous dispersion of wax and oil.

13. In the process of making paper, the step which comprises incorporating with pulp containing a substantial amount of hydrocellulose, an aqueous dispersion of wax and oil.

14. In the process of making paper, the step which comprises incorporating with pulp containing hydrocellulose, a non-foaming soap containing aqueous dispersion of wax and oil.

15. A paper product produced from a paper pulp incorporated with an aqueous dispersion of wax and oil.

16. A paper product produced from a paper pulp incorporated with a non-foaming soap containing aqueous dispersion of wax and oil.

17. A paper product produced from a paper pulp containing hydrocellulose incorporated with an aqueous dispersion of wax and oil.

18. A paper product produced from a paper pulp containing hydrocellulose, incorporated with a non-foaming soap containing aqueous dispersion of wax and oil.

19. A paper product produced from a paper pulp incorporated with a dispersion of wax

and oil, which dispersion contains particles comparable in degree to those resulting from colloid mill treatment.

20. A paper product produced from a paper pulp containing a substantial amount of hydrocellulose and incorporated with an aqueous dispersion of paraffin wax and hydrocarbon oil, which dispersion contains particles comparable in degree to those resulting from colloid mill treatment, and which dispersion possesses the property of substantial freedom from foaming when incorporated in the beater engine.

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