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SIZING PAPER

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My invention relates to the sizing of paper and has to do more particularly with an improvement in so-called "engine sizing", wherein rosin and a setting agent are commonly used.

5 The paper art has for many years been familiar with this type of sizing, which is used particularly in the manufacture of printing papers and the like. As usually practiced, this process consists in adding to the pulp in the hollander or beater
10 a solution of mixed sodium resinate and free rosin resulting from a partial neutralization of rosin by alkali (prepared by boiling rosin with soda ash) and, after the beating operation, adding a
15 substantial quantity of a solution of aluminum sulphate or paper-maker's alum. According to the generally accepted theory, the ensuing reaction results in the precipitation of free rosin which, with some alumina, becomes attached to the fibers and forms a varnish-like coating on
20 the sheet after it is passed between the hot calender rolls.

It has been supposed within recent years that the effectiveness of sizing of this type depends to a large extent upon the smallness of the particles of resin deposited upon the fiber; that is to
25 say that, generally speaking, the smaller the particles the more effective the sizing. In accordance with this theory, it has been proposed that the resin be dispersed by means of a colloid mill without the use of alkali, and it has also been
30 proposed (Wieger United States Patent No. 1,882,680, October 18, 1932) to prepare the sizing solution by heating the resin in the neighborhood of its melting point in the presence of an alkaline solution containing a protective colloid,
35 such as casein. All of these prior-art proposals have been and are subject to serious objections. It will be seen that in these methods an attempt is made physically to subdivide the resin to obtain
40 particles of colloidal size.

In accordance with my invention there is produced a size of colloidal resin by the method of molecular condensation or aggregation, with numerous advantages which will become apparent.

45 I have found that protein matter suspended in the presence of alkali resinates, functions efficiently as an alkali binder, i. e., to abstract the alkali and thus free the resin in the form of an emulsion or suspension, from which it can be
50 deposited on the fiber in particles of colloidal dimension. As examples of proteins which I have found satisfactory, I mention the "casein" extracted from soy bean flour as well as that obtained from other leguminous materials, such as

peanuts, etc., as well as the leguminous flour itself; I may also use other proteins which function as hydrophilic emulsoid colloids, such as milk casein, glue, etc. For convenience I refer to the action here described by the electrolytic
5 term of "hydrolysis", although I do not restrict myself to any theory of operation.

Example

The following is a preferred example of my
10 invention, it being understood that the same is merely illustrative and not in any sense limiting.

The beater is furnished with stock in the usual way except that no alum or white water containing the same is introduced. After the beating
15 operation is substantially completed, my improved sizing material is added. The quantity of size may, of course, vary within wide limits, depending upon the nature of the pulp and the quality of the paper intended to be produced.
20 Roughly, the amount of dry size in the sizing solution may usually represent from 1 to 2 per cent of the dry weight of the stock.

My improved sizing material just referred to may be prepared as follows: To an aqueous
25 solution of sodium resinate of a strength of, say 2½ per cent and preferably containing a slight excess of free rosin but containing no alum, is added a proteinous material as described above, for example, soy bean casein. The proportion of
30 protein added may vary considerably, and I have found that my process may be practiced satisfactorily with from 10 to 50 per cent or more or less of dry protein based on the weight of dry sodium resinate, although I prefer to operate
35 within the range just specified. The mixture is allowed to stand until the protein has become dispersed and the resin soap has been hydrolyzed partially or wholly, depending upon the conditions. This will be indicated by increasing
40 turbidity of the liquid. The reaction may be improved by moderate stirring and also hastened and extended by heating to temperatures generally not exceeding approximately 80° C., but in some cases up to the boiling point.

45 The reaction may also be improved and extended by the addition of very small quantities of dilute acidic materials, and preferably by the addition of buffer mixtures, such as boric acid-alkali mixtures, mono- and di-basic phosphate
50 mixtures, such as have the property of lowering the alkalinity of the sodium resinate solution without overstepping into a zone of acid precipitation. The final pH value should not be
55 below about 7 pH.

As stated above, I prefer to use at least 10 per cent or more of protein material based on the weight of sodium resinate, but my invention is not limited to this minimum. In fact, I have
5 found that my process will operate with much smaller quantities of protein, say, from 1 to 5 per cent.

In the use of my improved size described above, the liquid is introduced into the beater or hol-
10 lander, as stated above, preferably after most of the beating operation has been completed. It will be desirable at this point to add sufficient acid-reacting material to render the stock neutral (pH 7.0) or slightly acid, preferably of a pH
15 between 6.0 to 6.8. Usually this will require the addition of only a trace of acid, and care should be taken to avoid too high an acidity. If the stock is alkaline, excessive foaming is likely to occur and also the sizing effect is greatly reduced,
20 while, if the acidity is too high, the size tends to precipitate in large flocks, and thus the deposit of colloidal particles as contemplated by my invention is not obtained. For producing this change in acidity, I prefer, for purposes of con-
25 venience and economy, to use paper-maker's alum, although I may also use practically any acid, such as acetic, hydrochloric, etc., or any acid salt, as well as alum, such as aluminum chloride.

30 Sizing in accordance with my invention presents many advantages. Thus, I am able to produce a size effect against water penetration of from 200 to 300 per cent better than that obtained from ordinary rosin size. The process is
35 easy to carry out inasmuch as no special equipment is required either for the preparation of the size or for its application to the stock. Furthermore, the composition of the size can be accurately adjusted to meet the furnish conditions,
40 which is a very great advantage, since various pulps require different amounts of free rosin in order to be properly sized.

A further advantage accrues from the fact that my improved size gives the best results at the
45 neutral or very slightly acid conditions of the furnish, thereby insuring a lower acidity in the sheet than is customary with the usual rosin sizing. This results in greater permanence of the sheet as well as in less damage to equipment than

occurs under the strongly acid conditions of ordinary sizing.

Various other advantages resulting from my invention will be apparent to those skilled in the art.

5 Numerous variations and modifications coming within the spirit of my invention as set forth above will no doubt suggest themselves to those skilled in the art. Hence, I do not wish to be limited to the specific embodiments or details
10 herein given but intend that the scope of my invention is to be limited only by the appended claims, which are to be interpreted as broadly as will be permitted by the state of the art.

15 While I refer specifically herein to rosin sizing, obviously my invention may be used with any practicable resin or like material.

I claim as my invention:

1. A method of preparing a paper pulp sizing solution containing acid precipitable colloidal
20 particles of rosin which comprises adding to a dilute aqueous solution of alkali resinate about 10 to 50 per cent soya bean casein based on the weight of the alkali resinate, allowing the mixture to stand until the casein has become dis-
25 persed and the alkali resinate has become at least partially hydrolyzed as indicated by the increasing turbidity of the solution.

2. A method of preparing a paper pulp sizing solution containing acid precipitable colloidal
30 particles of rosin which comprises adding to a dilute aqueous solution of sodium resinate containing a slight proportion of free rosin about 10 to 50 per cent soya bean casein based on the weight of the sodium resinate, stirring the mix-
35 ture until the casein has been dispersed and the sodium resinate has become partially hydrolyzed as indicated by the increasing turbidity of the solution, and finally adjusting the solution to a pH value of about 7 by the addition of a small
40 quantity of weakly acidic buffer material.

3. A paper pulp sizing solution having a pH value of about 7 and containing acid precipitable colloidal particles of rosin, comprising the reaction product of a dilute aqueous alkali resinate
45 solution with about 10 to 50 per cent casein protein based on the weight of the alkali resinate.

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