UNITED STATES PATENT OFFICE.

WILLIAM A. HALL, OF BELLOWS FALLS, VERMONT.

SIZING.

SPECIFICATION forming part of Letters Patent No. 653,237, dated July 10, 1900.

Application filed May 13, 1899. Serial No. 716,759. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM A. HALL, a citizen of the United States, residing at Bellows Falls, in the county of Windham and State of Vermont, have invented or discovered certain new and useful Improvements in Sizing, of which the following is a specification.

This invention or discovery has for its object to provide a sizing for paper, straw goods, &c., which can be cheaply produced, which when applied to the goods will strike in so as to penetrate or permeate the same, which will not have a tendency to turn straw goods or paper containing ground wood yellow, and which will also have no tendency to discoloration of the goods when it is applied hot or when the goods are subjected to heat. To this end the new sizing consists of a chemical combination of casein, ammonia, and formaldehyde.

Many attempts have heretofore been made to produce a satisfactory sizing for paper, straw goods, &c., from casein; but such efforts have thus far been unsatisfactory. A patent was granted to George Vining January 13, 1880, No. 223,459, for a casein sizing for paper, &c., and which patent was subsequently purchased by me. The casein sizing made in accordance with the Vining patent could not be successfully used for the purpose intended, principally because it would not penetrate or permeate the goods, but would remain on the surface, and also because it would turn straw goods and paper containing ground wood yellow. In the course of my experiments with casein sizing I discovered that if ammonia were used as a solvent the casein sizing would be caused to penetrate the goods; but this sizing still had the objection of discoloring articles affected by alkali, and, moreover, paper or other goods sized with it were liable to become very sticky, even after having once been dried, if the sized goods were exposed to moisture, as in a damp atmosphere. The tendency to stickiness with glue or gelatin sizing is readily overcome by the addition of a little alum; but no alum can be used in connection with casein sizing without causing precipitation, and alum cannot, therefore, be used to correct the tendency to stickiness with an ammoniacal casein sizing. To produce a casein sizing which would not have a tendency to stickiness, I made attempts to use formaldehyde instead of alum; but I found that the addition of formaldehyde to a solution of casein made with soda, potash, or borax caused a precipitation, even when an amount of formaldehyde was used which was not fully sufficient to overcome the alkalinity. I finally discovered that formaldehyde acts entirely different on ammoniacal solutions of casein from what it does on solutions of casein made with soda, potash, borax, or similar solvents. Formaldehyde has a slight acid reaction, and enough of it can be added to an ammoniacal solution of casein to neutralize the alkali, and even give the solution some acidity, without any danger of precipitating or curdling, thus enabling the use of casein in sizing for paper or straw goods or other articles which would be affected by an alkali, as for such classes of goods the sizing solution must be neutral or acid. An ammoniacal solution of casein is of itself extremely unstable, turning dark very rapidly when heated, and as it is necessary to use these solutions very hot for some purposes, such ammoniacal solution is unfit for most purposes for which a sizing is desired; but I have found that the addition of formaldehyde completely overcomes this tendency of the solution to turn dark when heated, and, moreover, increases its penetrating or permeating effect.

My new casein sizing consists of about ninety parts of casein dissolved in about six parts of, preferably, a thirty-per-cent. solution of ammonia, with the addition to the ammoniacal casein solution of about four parts of, preferably, a forty-per-cent. solution of formaldehyde—that is to say, enough ammonia, usually about six per cent. or seven per cent., is used to dissolve the casein, and enough formaldehyde, usually about four per cent. or five per cent., is added to render the solution neutral or slightly acid, as may be desired. The stated proportions of these ingredients may be either by volume or weight, which would be about the same in either case, as the specific gravity of each is about the same.

I do not herein claim, broadly, as new the use of formaldehyde with casein, as such a combination is described by my Patent No.

609,200, of August 8, 1898, but the combination described in my said patent is used as a waterproofing agent and requires a mineral retardent; but

What I do herein claim, and desire to secure by Letters Patent, is—

A sizing for paper, straw goods, &c., consisting of a chemical combination of casein, ammonia and formaldehyde, in substantially the proportions specified.

In testimony whereof I affix my signature in the presence of two witnesses.

WILLIAM A. HALL.

Witnesses:

C. M. SWEENEY,

T. H. RUSSELL.