

UNITED STATES PATENT OFFICE.

AUGUSTUS T. SCHMIDT, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN TREATING PAPER AND VEGETABLE FIBROUS SUBSTANCES.

Specification forming part of Letters Patent No. **113,454**, dated April 4, 1871.

To all whom it may concern:

Be it known that I, AUGUSTUS T. SCHMIDT, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improved Process of Treating Paper and other Vegetable Fibrous Substances; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the treatment of paper, paper-pulp, and other vegetable fibrous substances, whereby they are greatly increased in toughness and strength, rendered impervious to water, capable of resisting the action of most acids and alkalies, and made either firm and hard or soft and pliable, as may be desired.

To enable others skilled in the art to use my improvement, I will proceed to describe the process which I employ.

My improved process may be applied to paper, sized or unsized, and made of any vegetable fiber, or to other vegetable textile fabrics, or to paper-pulp, which, after treatment, may be made into sheets of paper in the ordinary way or molded into any desired shape.

The first step in the process is to immerse the paper-pulp or other substance to be treated, until it is saturated, in a bath of concentrated mother water or liquor resulting from the manufacture of chloride of zinc or of the chlorides of tin, calcium, magnesium, or aluminium. As this mother-water is a waste product, and not commonly an article of merchandise, and therefore not easily obtained in sufficient quantities, it will be more convenient, as well as more economical, to produce it for this express purpose from the manufacture of the chlorides above named, which are easily made and command ready sale. For this purpose (if chloride of zinc is employed) I dissolve metallic zinc in dilute muriatic acid, and then concentrate the solution by heat to about 70° or 75° Baumé. On cooling the solution will deposit crystals of chloride of zinc, which being removed the resulting mother-liquor is obtained. To this mother-liquor I then add a solution of chlorine in water until the presence of chlorine is detected by the smell on the agitation of the liquor. This solution may be obtained by dissolving chloride of lime in water to the strength of from 1° to 2° Baumé. I then add to the liquor a sufficient quantity of carbon-

ate of zinc (or any other carbonate) to render the solution neutral.

If it is desired to render the paper or other substance to be treated very opaque, I add to the bath of mother-liquor as much oxide of tin or oxide of zinc (or other suitable oxide) as it will retain in solution. For this purpose an excess of oxide is preferable, so as to insure the desired end. Care should be taken not to employ ingredients having iron or sulphur in combination when it is important that the color of the article to be treated should not be injured.

The paper or other fabric to be treated should be heated before being immersed, so as to expel all moisture and facilitate the process. This may be done by passing it through a heated chamber or even a heated surface, the plan which I find most effective being to pass it over a hollow metallic roller heated internally by steam or otherwise, with a surrounding jacket having slits for the paper or fabric to pass through between the roller and the jacket. The heating chamber, roller, or other apparatus should be so placed that the paper, &c., may pass immediately from it into the bath of mother-liquor, so as to lose as little heat as possible.

The vessel containing the chemical bath should be made of lead, sandstone, or other substance not readily affected by chlorine, and should be sufficiently large to permit the paper or other fabric, if in a continuous sheet, to pass backward and forward within it while immersed in the bath. This may be effected by the use of a series of leaden rollers, over which the paper, &c., may pass up and down or horizontally, so as to remain a sufficient time in the bath to become completely saturated, or a series of baths may be employed, if preferred, for this purpose.

As the paper or other fabric passes out of the chemical bath, the surplus adhering liquor is removed by means of scrapers or by passing between rollers and is allowed to run back into the bath. The paper or other fabric is then passed into a trough of water and washed until free from all surplus liquor. This water may be made slightly alkaline by the admixture of carbonate of soda or other alkali, so as to neutralize any adhering liquor. The paper or other fabric thus treated is then dried slowly at moderate heat and afterward

smoothed and calendered, if desired, in the manner usual in the manufacture of paper. By this process the paper or other fabric is rendered strong and tough, approaching in these respects to the quality of parchment or skin, while some degree of flexibility is retained. Paper thus treated may be made of any desired thickness by placing together the sheets as they pass from the chemical bath, as by rolling continuously around a cylinder or otherwise and uniting them by pressure, after which the article thus formed is washed in water to remove the surplus liquor. The requisite pressure may be obtained by using a pair of rolls, one of which should be heated.

Paper-pulp or other vegetable fiber may be saturated in the chemical bath and then molded by pressure into any desired form and then hardened, as hereinafter described.

To make from paper, paper-pulp, or other vegetable fibrous substance an alkali having the solidity and hardness of horn or vulcanite I employ the same chemical bath as before described, but concentrated to a strength of about 50° Baumé or upward, according to the article to be treated. The bath is heated to about 150° Fahrenheit, and the paper or other article, after being first heated and then saturated in the bath, as above described, is passed (on leaving the bath) over or between heated rolls and then plunged in water pure or only slightly alkaline, in which it is allowed to remain for from six to twenty-four hours, according to degree of hardness required, after which it is subjected to pressure to solidify it and make it smooth or give it any desired shape. It is then slowly dried at a temperature of from 70° to 80° Fahrenheit. It may be made of any required thickness by bringing together several plies or layers as it passes out of the chemical bath. A still greater degree of hardness may be attained by dissolving in the chemical bath vegetable fiber, dextrine, gum, or starch, and also by sifting onto or between the layers of the paper or fabric as it passes from the bath any mineral substance or gums.

A rough texture or surface may be given by sifting emery, powdered glass, sand, or other mineral substance between the layers or on the outer surface, as may be desired, and paper or other vegetable fiber thus prepared may be used for many purposes in the arts. If, on the other hand, it is desired to produce a substance having great flexibility and softness, resembling soft vulcanized rubber, without the elasticity of that article, the paper or other fabric is immersed to saturation in the chemical bath in the manner first above described, and then as it leaves the bath it is passed over a heated roller of lead (or other suitable material) into a washing-vessel containing a weak solution of any suitable alkali in water, and thence into a bath of a solution of water and glycerine in the proportions of two parts, by measure, of water to one of glycerine, or a solution of sugar

and water in similar proportion. This glycerine or sugar bath may be used cold; but it is better to have it heated a little below 212° Fahrenheit. In this bath it should remain about six hours or more, according to the degree of softness required.

Paper thus prepared, and made of suitable thickness by uniting several plies as they pass from the chemical bath, makes excellent belting, the strength of which may be increased by introducing between the layers of paper cloth made of cotton or vegetable fiber, either dry or previously saturated in the chemical bath, as may be preferred; but it adheres better if inserted dry.

In uniting several thicknesses of paper or other vegetable fabric as they pass out of the chemical bath a pair of rolls may be used, so arranged as to give the requisite pressure and yet allowing a gradual separation as the thickness of the article passing between them increases, the upper roll being heated to from 120° to 200° Fahrenheit and the lower one, around which the paper, &c., is to pass, being partially immersed in the bath of alkaline solution, or of glycerine and water or sugar and water, as the case may be.

The paper, paper-pulp, or other fibrous vegetable substance treated as above described, when of suitable thickness, is extremely soft and pliable and resembles soft leather in texture, and may be used for many purposes for which leather is employed. When of increased thickness, it may be employed for belting, packing, and various other purposes to which soft vulcanized rubber, owing to its great elasticity and its liability to be acted upon by heat and various chemical substances, is inapplicable. When manufactured in a hard state, by omitting the glycerine or sugar treatment, it may be made as horn and used for various purposes, being susceptible of being molded or otherwise formed into any desired shape. The article thus produced, whether soft or hard, when exposed to sufficient heat burns without flame, and is not readily combustible. It may be used to advantage in making hose or pipe for conducting water, gas, and other fluids, and also for the bodies of carriages, railroad-cars, or boats, and for various other purposes in the arts and manufactures.

The details of machinery and apparatus employed may be varied to suit the convenience of the manufacturer and the character of the article to be made.

I do not claim the use of a solution of chloride of zinc or chloride of tin for the purpose of treating paper and other vegetable fibrous substances; but, as distinguished therefrom,

I claim as my invention—

1. The treatment of paper, (sized or unsized,) paper-pulp, and other vegetable fabrics and substances with a bath of the mother-water of the chlorides of zinc, tin, calcium, magnesium, or aluminium, or either of them, with or without the admixture of carbonates and ox-

ides or other substances, and the subsequent washing with water or alkaline solution, substantially as and for the purposes described.

2. The treatment of paper, paper-pulp, or other vegetable fabrics and substances (which have been previously saturated with or immersed in a concentrated solution of chloride of zinc, or other chlorides hereinbefore specified, or of the mother-liquor of such chlorides or their equivalents) with a solution of glycerine and water or sugar and water, substantially as and for the purposes described.

3. The combination of a layer or layers of paper treated in the manner hereinbefore described, with a layer or layers of vegetable cloth similarly treated, for the production of

a new manufacture suitable for belting, packing, and other purposes, substantially as described.

4. The combination of paper, paper-pulp, or other vegetable fibrous substance treated, substantially as hereinbefore described, with emery, powdered glass, sand, or other pulverized or granular metal or mineral, as a new article of manufacture.

In testimony whereof I, the said AUGUSTUS T. SCHMIDT, have hereunto set my hand.

AUGUSTUS T. SCHMIDT.

Witnesses:

W. N. HOWARD,
W. BAKEWELL.