A SHORT HISTORY OF SIZING.

By GEORGE WHEWELL, F.I.C., F.C.S.

THE question of sizing and size mixing is just now coming prominently before the trade, and a short history of the subject may be of interest in helping to solve the problem. How to prevent, or reduce to a minimum, the liability of cotton cloth to suffer from mildew? Size is a paste made for the purpose of filling up the interstices in the yarn, and making the outside smooth, so that when it passes through the healds and reed the external fibers will not unite with the external fiber of the adjacent thread, and so be broken in its passage through the healds and reed. In preparing size, care should be taken to have materials as finely divided as possible, otherwise it will make the yarn uneven in passing through the healds and reed, and thus cause breakages.

The following are the chief requisites for a good size:

- 1st. To be in a very fine state of subdivision.
- 2nd. When placed upon the yarn it should make the fiber assume a horizontal position.
- 3rd. The size itself, when upon the yarn, ought to be as homogeneous as possible.
- 4th. The size ought not to decompose after being used, and so cause the cloth to mildew.

For a great number of years the only substance used in this country for sizing purposes was flour paste. In olden times it was customary for the weaver to size his own warp as it came off the beam, the only substance used being just sufficient flour paste to give the thread the required tenacity to overcome the strain caused in the weaving, for which purpose the Hindoo weaver had among his implements for weaving a water pitcher and rice pot. As the trade extended it was found more advantageous and economical to have the warps sized previous to being sent to the weaver; and it was also found that the sizing being given to a person who made a trade of sizing, the putter-out of warps to be woven had a control over the amount of size, and could increase or diminish it at pleasure. Finding from experience that more size could be put on the warp than was necessary, thus arose the practice of heavy sizing; that is, making cloth, previously consisting almost entirely of cotton, of a mixture of size and yarn. This system of weighting, which began in the latter end of last century, having become recognized by the trade, persons began to cast about for substances to use along with or instead of flour paste. With the new state of things came an increased risk, the heavy-sized goods having a larger quantity of putrefiable substance in them, the tendency to mildew when kept in a warm damp atmosphere increased also.

We find by referring to the records of the Patent Office, numerous applications for letters patent for substances to be used instead of flour paste, in which starch in the various forms takes a prominent position. We also recognize early attempts to counteract mildew. Papping seems to be the ancient name for sizing, for in a specification of a patent by John Barker, Joseph de Mayes, and John Cook, A.D., 1769, No. 937, it is said "that the wool is wound on bobbins, warped, papt, or sized." In 1776, James Wolstenholme, No. 1,123, took out a patent for goods called velveteens. The warp is made of linen in the brown, and the weft cotton. He described different kinds—some cotton instead of linen, bleached and sized. No mention is made of the composition of the size. In 1789, Edmund Cartwright, No. 1,696, says the sizing liquor or dressing is prepared of such glutinous material as is commonly made use of by weavers for that purpose, according to the article they are weaving, evidently referring to flour paste. The first sizing machine recorded is in a patent, No. 1,804, by Richard Gorton, 1791, of a loom intended to weave several pieces at a time. He says the warp is sized by means of brushes and a roller, which turns in a square trough filled with size. In 1794, James Travis, No. 2,003, took out a patent which related to the stiffening of twist or weft cotton, and had for its object using potatoes instead of wheat flour, up to then universally used.

"The potatoes are first washed, put into the grating machine without peeling, and without any mixture or other ingredient whatever. After grating they are washed in fine sieves, the starch falling to the bottom of the cask or tubs; it is then taken out, carefully dried, and cleansed. Quicklime is taken and exposed to the air, until it falls to powder. These two substances are then mixed together in the proportion of one hundredweight of lime to six hundredweight of the floury part of potatoes." This appears to be the first patent taken out to substitute starch (farina) for flour in size, and also to use a substance for weighting, so that it may be said that the practice of weighting cloth arose at this period. No mention is made why the floury part of potatoes was recommended instead of flour paste. Between the years 1794 and 1800, starch seems to have come into use, for we find Robert Stuart's inventions, A.D., 1800, No. 2,377, relates to starching and preparing cotton yarn in that state called the cop, by which means it is at once fitted for being made into warp or weft. The cop is boiled in starch or other mucilaginous liquor. In 1806, Patrick Whytock's invention, No. 2,913, relates to preserving fabrics made of cotton, flax, or hemp, and consists in the application of the oxides, or solution of quicksilver and copper salt to the articles intended to be preserved. The red oxide of mercury is levigated and mixed with starch, which the weaver uses in smoothing his threads; the red oxide being inserted along with the starch into the heart of the cloth tends to defend it from mildew, or acts as an antiseptic. In the same year Quinton McAdam, No. 2,924, mentions starch and flour as used in the process commonly called sizing or papping. The question naturally arises, when in 1794, we find the first mention of the introduction of starch in the sizing of warps, and the recommendation of salts of mercury and copper to prevent mildew in the year 1806, whether mildew had increased with the introduction of starch, or whether it was due to the increase in the amount of size used? It is, however, possible that Whytock was the first who undertook to remedy the evil; but whether his invention came into general use we know not, but it seems to be a fact that mildew was a common complaint about the beginning of the present century.

There is not the slightest doubt but that the increase of putrefiable substance put into the yarn was one of the causes of increase of mildew; but that the introduction of starch had its influence there is good ground for belief, for we know that starch very rapidly mildews when exposed to a warm and moist atmosphere. Between the year 1806 and 1841, no patents were taken out for improvements in the composition of size. In the latter year, J. H. Watson's invention, No. 9,194, consisted in the application of a composition formed by mixing resin and alkali with sulphate of magnesium, and also the application of a composition formed by mixing a combination of tallow or other grease and

alkali (which of course would form a soap) with sulphate of magnesium. The next improvement consisted in causing cloth, after a mixture has been applied to it, containing sulphate of magnesia, alum, or other salt whose base is a metallic oxide, to be acted upon by an atmosphere of or containing ammonia gas, to deposit the metallic base on the cloth. The next improvement, a combination of ammonia with lard, tallow, oil, or other grease, was spermaceti or stearine. This is the first mention of the use of sulphate of magnesia, and also the first application of soap for sizing purposes, and the beginning of the general use of water absorbing substances to give weight to cloth, and prevent mildew.*

In 1842, James Anderton's interesting patent, No. 9,255, was to substitute the "farina" in the common process of preparing, stiffening, and dressing yarns or warps for wheat flour. He says: "I am perfectly aware that the employment of the same article, 'farina,' has already been attempted to be used for such purpose; the novelty being to use it at once instead of allowing it to ferment, by which means its glutinous or stiffening quality is lost." Thus it might safely be said, although starch (farina) was suggested in 1794, starching came into use at the beginning of the present century. Yet in 1842, wheat flour seems to have had the leading position in the making of size, and starch either to have gone out of use, or only slightly employed.

In 1842, John Ridsdale's improvement, No. 9,482, consisted in preparing fibrous materials for weaving and in sizing warps (no specification). In 1844, J. B. Cotter's invention, No. 10,330, consisted in a composition to be applied to fabrics to render them "impervious" to or repellant of water, and consisted of boiled oil one gallon, white lead one lb., charcoal 26 ozs. in powder, litharge $2\frac{1}{2}$ ozs., and common salt $2\frac{1}{2}$ ozs. In the year 1847, William Todd's invention, No. 11,595, was to place the cop, bobbin, or yarn beam in a cylinder, and exhaust the air. The boiling size was then introduced by a pipe from a trough.

The first patent for the composition of size during the present generation was one taken by J. B. Chalmers in 1851, No. 13,829. He recommends the following: For every four hundredweight of warp, 32 lbs. starch, 32 lbs. wheat flour, 23 lbs. potato starch, 3 ozs. bleached bees'-wax, $2\frac{1}{2}$ lbs. sulphate of zinc, and $\frac{1}{2}$ lb. sulphate of copper, to 700 pints of water. The only novelty in the materials of this composition is the bleached bees'-wax and sulphate of zinc, the copper salt appearing in Whytock's specification.

This may be said to be the first of a large number of patents for the composition of size. In the year 1853, Wm. Bashall, Jr.'s invention, No. 641, is for the application of oil, by means of a roller, to the yarn after it has passed through the size box. The composition of the size is not mentioned. John Greenwood and Robert Smith took out three patents in the year 1854. The first, No. 373, relates to the employment of the mucilaginous matter of linseed, the seed of the common flax. The second, No. 867, relates to the novel application of the flour or meal obtained from Indian corn or maize, either alone or mixed with the mucilaginous matter of linseed. The third, No. 1,238, relates to the use of rye flour and acetic acid; chloride of calcium, and, for the first time, chloride of magnesium is noticed. 240 lbs. rye flour, half the usual quantity of water, six or seven quarts of acetic acid at 9 degs. Twaddell; the other half is made up with chloride of calcium or chloride of magnesium liquor, at 40 degs. Twaddell, and well boiled. In the same year, John Ashworth's invention, No. 2,012, relates to the application of the following composition: 35 lbs. of glue substitute, 60 lbs. of Castile or any other soap, 20 lbs. of salt or saltpetre, 5 lbs. of isinglass, and 20 lbs. of ordinary wheat starch. In 1855, John Greenwood's invention, No. 101, consists, first, in the use of barley flour; second, barley flour combined with chloride of calcium or chloride of magnesium. The barley flour may be used either fermented or not; in the latter case three or four quarts of acetic acid, 9 degs. Twaddell, is to be added. In 1856, Jean Louis Ambroise Huillard's improvement, No. 214, consists in the employment of metallic cyanides—preferably the cyanides of zinc and tin, instead of gum, starch, etc.—the cyanide being fixed on the yarn by passing it over a vessel in which superheated steam circulates, whereby the metallic dressing becomes oxidized. In the same year, Peter and George Brown, No. 693, claim the use of a seed or grain called "dari," and frequently called "millet," which was prepared in a similar manner to rice. In the same year, John Leigh, No. 838, proposed the use of alkaline silicates, as potash, soda, etc., either alone or mixed with sulphate of baryta; tallow, soap, etc., may also be used.

Here we discover the second patent for the use of weighting substances, the first being hydrated lime, proposed by Travis, in 1794. In the same year, 1856, Augusté Cellier's invention, No. 2,817, relates to the application of a preparation of lichens and pearl moss. And this reminds us of the recent attempted introduction of a substance manufactured in France, and called by the name of *Haitra*, or *Hai-thao*, which, according to J. J. Heilmann, *Dingl. Polyt. J.*, ccxviii., 522, is obtained from an algæ, occurring abundantly in Cochin China and in the Mauritius, in the form of coarse, flat fibers, which, when hard and tough, are about 30 in. long. It is without smell or taste, and consists of a transparent colorless mass, covered with a net of non-transparent veins. It is insoluble in cold water, and dissolves completely in hot water, but only after boiling for ten minutes, forming a transparent, thin, dirty white jelly, soluble on boiling. The jelly is neither acid nor alkaline, and does not show any signs of fermentation or putrefaction, even when kept for about eight days. Heilmann concludes from his experiments that it can only be used for fine textures, soft and firm to the touch, and that it cannot be used as a substitute for dextrine or potato starch, where a strong and stiff material is required. The tendency since 1842 seems to have been to substitute substances containing less gluten and more starch for wheat flour.—*Textile Manufacturer.*

GELATINE PLATES IN INDIA.

By Col. F. DAWSON.

DURING the past twelve months I have experimented upon gelatine plates and pellicle, and thinking my notes may be of use to others, I take the liberty of jotting them down.

It is quite possible to develop plates with the liquids used at the temperature of 85° Fah.

It is quite easy to make your own dry pellicle without setting the jelly or using ice.

TO MAKE PELLICLE.

Nelson's gelatine. 250 grains.
Brom. potassium 200 "
Distilled water. 5 ounces.

* It appears to our contributor has made a slip of the pen here. There is no reason *per se* why deliquescent substances should be antiseptics.

Use pounded and dried bromide, weigh carefully, and dissolve in 4 ounces of the water; now weigh the gelatine, and place in a yellow hock bottle; filter the bromide into the bottle, and wash out the filter with the remaining ounce of water.

Allow the gelatine to soak for two hours, when it should be quite swollen and soft. Now have a large saucepanful of nearly boiling water, dip the bottle into the hot water quickly for a second, continue the dipping until there is no fear of the bottle breaking and it becomes as hot as the water, shake up, and ascertain that the gelatine is quite dissolved.

Melt 280 grains fused nitrate of silver in 2 ounces of distilled water, filter, and wash out the filter with 1 ounce of distilled water. Place this clear solution in a small bottle in the hot water until warm.

Now add the silver solution to the gelatine in small quantities, not exceeding 10 minims at a time, with violent shaking after each addition; when the whole of the silver is added, shake up for five minutes, and place the bottle in the hot water; give occasional shaking at intervals of a quarter of an hour for two hours, then leave the bottle in the hot water for at least four hours longer (occasional shaking is an advantage); at the end of these six hours the water will have cooled to 85° or 90° Fah., about the temperature of the atmosphere.

Now remove the bottle, and into it pour, by an ounce at a time:

Methylated absolute alcohol. 6 ounces.
Methylated spirit. 6 "
(The spirits must be free from gum.)

Shake up violently after each addition of the spirits, and continue adding at intervals of a few minutes, until the gelatine begins to precipitate upon the sides of the bottle; when this is observed, add an extra ounce or two, according to available space in the bottle, shake up violently, and leave standing in the dark room for two or more hours. One hour may be found to be sufficient; the appearance of the fluid in the bottle should be your guide.

If, upon pouring a small quantity into a minim measure, it appears thick and very milky, either sufficient time has not elapsed, or your spirits are too weak, or you have not used enough. As a rule, two ounces of the mixed spirits are enough to abstract 1 ounce of water known to be used in the formula.

If the liquid in the minim measure is merely opalescent, you may with confidence pour out the whole of the fluid. If, after the fluid has stood for two hours, the gelatine has not separated, you have made some mistake.

When the pellicle has precipitated, pour off the fluid and drain the bottle; now pour into the bottle 2 ounces distilled water, place in hot water and remelt the gelatine, pour out as much as possible into a clean glass dish, and remove the surplus adhering to the bottle by additions of 1 ounce distilled water at a time; 2 separate ounces I find quite sufficient. With a glass rod mix the gelatine in the dish, and then with one hand stir up, and with the other slowly pour in 2 ounces of spirit (same strength as before) for every 1 ounce of water you have used in redissolving the pellicle.

Almost immediately the gelatine will stick to the glass rod, and also to the bottom of the dish; continue stirring until the whole of the pellicle is collected in a lump on the glass and a part smeared over the dish, but with the spirit only slightly opalescent; when this is the case throw off the spirit and drain the dish, then pour into the dish an ounce or two absolute alcohol, and knead with your fingers the pulpy mass of gelatine; scrape up all you can from the dish with an ivory knife; after a few minutes you will find the gelatine getting tougher and tougher; pull it into bits and keep it well wetted with spirit; it will not adhere to the fingers. When the pellicle becomes about as tough as a piece of India-rubber of a similar size, drain the dish; give the pellicle a squeeze in a clean pocket handkerchief or towel, and proceed to tear it into very small bits; now place the dish containing the bits on a tin dish of hot water or other means of applying heat by water. As time passes inspect your pellicle; you will find the outside gets hard, while the inside remains soft; when this is the case, tear the bits into smaller bits, and continue the drying and tearing until the pellicle is as dry as it is possible to make it. Then place it in a stoppered bottle and keep in the dark.

The fused nitrate of silver is simply crystallized silver brought to melting in a small capsule.

I have used pure spirits with similar results. Crystallized silver may be used without fusing.

FOR USE.

Dry pellicle. 2 drachms.
Distilled water. 3 ounces.
Spirits of wine. 1 drachm.

Allow the above to soak for a couple of hours in a 6-ounce stoppered bottle, then warm in a mug of hot water; shake up well until the ingredients are thoroughly incorporated, and filter.

The above quantity will coat 18 plates 8 by 5.

TO PREPARE THE PLATES.

Obtain a 2-ounce glass filter; round the nose tie muslin four thicknesses, and clip.

Next obtain a 4-ounce comestless collodion pourer. Remove the pourer, and into it plug a thin piece of sponge, sufficiently thin to permit the gelatine to flow through it and stop bubbles.

Damp the sponge before use. Filter the gelatine into the collodion bottle, and replace the pourer. Place the filter in the stock bottle, and stand it in a tin pot of hot water. In another tin pot of hot water stand the collodion pourer containing the gelatine. Have ready some pieces of plate glass carefully levelled on a table and capable of holding 18 plates 8 by 5; also have ready some means of warming the plates—a spirit lamp or a tin water bath. Warm each plate sufficiently, about as warm as you would when varnishing a negative, rather under than over. Now pour the gelatine on to the plate exactly as you would collodion, let it run all over the plate, and then pour off into the filter, while you count three in quick time.

Remove any surplus from the corner of back of the plate by passing the finger over the spot, and at once place the plate down on the levelled plate glass. The plates will take about one hour to prepare, and will be perfectly dry in four hours; some, of course, will be dry before others. The candle may with impunity be nine feet from the place you are preparing the plates. Plates prepared by the above formula are at least as sensitive as wet collodion, and I know no signs of fogging from the candlelight. The color of the film is a deep ruby. The films should be fairly thick, but not too thick. If, in using the amount here named, you can prepare 18 plates 8 by 5, you may anticipate they are correct. If the