



Article: MENDING OF FIBER BASED SILVER-GELATIN PHOTOGRAPHS

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Topics in Photographic Preservation, Volume 3.

Pages: 62-65

Compiler: Robin E. Siegel

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MENDING OF FIBER BASED SILVER-GELATIN PHOTOGRAPHS

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Conservators have traditionally used wheat starch paste, gelatin, and methyl cellulose for the mending of photographs. These water-based adhesives are known to be reversible and not to fade or darken the silver image. Although they generally give good results, there are some problems inherent in the use of a water-based adhesive.

Silver gelatin photographs have a three-layer structure consisting of the paper support, the baryta layer, and the silver-gelatin emulsion. Each of the three layers react differently to the moisture in the adhesives used in mending.

The paper support, which is usually of good quality, presents few difficulties. Moisture will cause slight expansion of the paper fibers along the edges of the tear, and this helps the adhesive hold the mend together. The only time the paper becomes a problem is when it is degraded and discolored by exposure to other acidic materials or by poor storage conditions. If the paper is discolored, moisture from the adhesive can cause tide lines along the edges of a mend.

The baryta layer, which is made up of finely divided barium sulphate suspended in gelatin, expands very little with moisture. It is very prone to staining, however. If moisture from the adhesive carries discoloration from a deteriorated paper support into the baryta layer, it will chemically combine with the barium sulphate and make a stain that cannot be removed. If the baryta layer's gelatin binder has been deteriorated by excessive dryness or by mold, the baryta layer will dissolve with moisture.

The emulsion layer is the most important because it carries the image, and it poses the most difficulties. It is very reactive to water, and the slightest amount of moisture will cause it to swell, stretch, and wrinkle. Normally, the gelatin emulsion is very flexible and tough, and it can withstand gentle manipulation in its softened state; however, it will tear if it becomes too wet. If the gelatin is crazed due to extremely dry storage conditions, or if it has been damaged by mold, even touching it with a moist brush or cotton swab can cause it to dissolve or rub off.

I prefer to use a combination of wheat starch paste and warm liquid gelatin for mending. Their specific application is determined by the type of damage. Paste is used when strength is needed, as in mending the paper support, and gelatin gives adhesion where strength is not required, as in setting down loose emulsion.

Wheat starch paste will not be discussed in this paper because most conservators are familiar with its properties. Gelatin may not be as familiar. Any good quality, highly purified gelatin is suitable for mending photographs. Gelatin is usually sold in granular form, and is sometimes available in sheet form. It is classified as type A or type B. Most Type A gelatin is made from pork skins. It is obtained by acid processing and has a pH between 7 and 9. Type B gelatin is made mostly from bones.

It is obtained by alkaline processing and has a pH between 4.6 and 5.2. Because such a tiny amount of gelatin is used in mending, the method of extraction is not really an important factor.

The "Bloom" number that is assigned to different gelatins refers to the measurement of gel strength by means of a Bloom gelometer. A 12 1/2% concentration of the gel is subjected to pressure from a 0.5" hollow plunger which is filled with lead shot. When the plunger has traveled 4 mm. into the gel, the flow of shot is cut off and the shot in the plunger is weighed. The number of grams of lead shot required to move the plunger 4 mm. into the gel gives us the "Bloom jelly strength." The higher the Bloom number, the stronger the gel. For mending photographs, one would choose a gelatin with a high Bloom number because it could be used in a thin solution and still have good adhesive strength.*

Knox granular gelatin 4117 is Type A and has a Bloom of 272. Fisher Laboratory Grade granular gelatin is also Type A and has a Bloom of 275. I use 1.5 grams of granular gelatin mixed with 40 mls. of hot water (a 4% solution). The gelatin dissolves in a few minutes and prolonged cooking is not required. When dissolved, the Knox gelatin is crystal clear and the Fisher gelatin is slightly cloudy. I have found their working properties to be identical.

This 4% solution is water-thin when warm and will stay workable for several hours if kept in a pan of warm water. The water can be reheated periodically. Do not try to keep the gelatin warm directly on a hot plate, because it will rapidly become too thick. Thick gelatin is very difficult to work with; it will gel on your brush before you can apply it to the photograph. The beaker of gelatin may be stored, tightly covered, in the refrigerator. If mold appears, it must be discarded.

A simple overlapping tear which does not disturb the emulsion layer can be mended with wheat starch paste and reinforced on the back with Japanese tissue, almost like any other paper artifact. Paste should be used very sparingly because if it oozes out onto the surface of the photograph it will dry with a mat appearance. It is hard to clean the paste off with a moist swab without taking off fragments of emulsion. If the edges of the emulsion are not well adhered they can be set down with warm liquid gelatin.

A split which was caused by creasing and flexing of the paper support is more difficult to mend. The baryta and emulsion layers, or sometimes just the emulsion layer, have often been bent back, and there are no overlapping edges of paper to adhere together. It can be difficult to insert enough wheat starch paste into the split to adhere the edges without getting it on the emulsion. I have found that warm liquid gelatin is more successful, even though it is not as strong as wheat starch paste.

*Animal Glue and Related Protein Adhesives. A.M. Kragh and J. Wooten

3.

Working under the microscope, the image is lined up perfectly and the two pieces of the photograph are held in place with weights. The warm gelatin is fed into the split with a very fine brush. Ideally, the paper fibers will swell slightly and adhere themselves together, and the baryta and emulsion layers will relax and fall back into place. Burnishing lightly through a piece of smooth polyester web will secure them. It may be necessary to dry the mend under weight for a few minutes. If a little bit of gelatin oozes out onto the surface of the photograph, it will simply be absorbed into the emulsion and need not be cleaned off.

The split is now rather tenuously held together, and the photograph can be turned over between two supports and reinforced on the back with Japanese tissue and wheat starch paste. It is best to work on no more than 2" at a time before reinforcing the gelatin mend with tissue. The gelatin alone is not strong enough to hold the mend together for long. If the split has a tendency to stick up in a sharp ridge, called "tenting," a second reinforcement of a wider strip of heavier tissue will sometimes help to hold the mend flat.

At its best, this technique produces an almost invisible mend, and if none of the emulsion is missing there is no need to inpaint. It is most successful when the split occurs in a dark shadow area or one with a lot of detail. If the split runs through a plain, light area such as the sky, it will probably be visible. Application of the liquid gelatin always causes the emulsion to swell slightly, resulting in an overlap along the mended edge. This appears as a thin, darker line. Large flaps of loose emulsion pose a particular problem because they tend to stretch and wrinkle, and attempts to manipulate them into place can even tear them.

Sometimes fragments of the emulsion and baryta layers, usually with some paper fibers still attached, have been pulled away from the paper support. This often happens to photographs which have been mounted in albums. Photographs on facing pages become stuck together, and when the album is opened, pieces of the emulsion/baryta layer are torn off.

Large fragments, especially when they have a layer of paper attached to the back, can be set down with wheat starch paste. It is best to apply the paste to the paper support of the photograph and let it dry a bit before setting down the fragment. Do not paste right to the edge because it will ooze out. After the fragment has been put in place, burnished through a smooth piece of polyester web, and dried under weight for a few minutes, the edges of the emulsion can be set down with warm liquid gelatin. Small fragments are easily readhered with warm liquid gelatin. It is best to do this work under the microscope to ensure perfect alignment of the image.

Areas that have been readhered will always have a slightly different texture when viewed at an angle, due to the inevitable swelling of the gelatin emulsion from the moist adhesive. This is especially noticeable on glossy photographs.

In conclusion, the traditional mending techniques which employ aqueous adhesives are fairly effective, but they do have the disadvantages of swelling the emulsion, a change in surface when large fragments of emulsion/baryta layer are readhered, and possible staining of the baryta layer if the paper support is discolored. These changes may be tolerable in archival photographs such as the ones that I have treated, but we may not find them acceptable in a print of great aesthetic value. There is a need for experimentation with a solvent-based, low-temperature heat-activated adhesive that is as easy to use as wheat starch paste and gelatin but has none of the drawbacks.