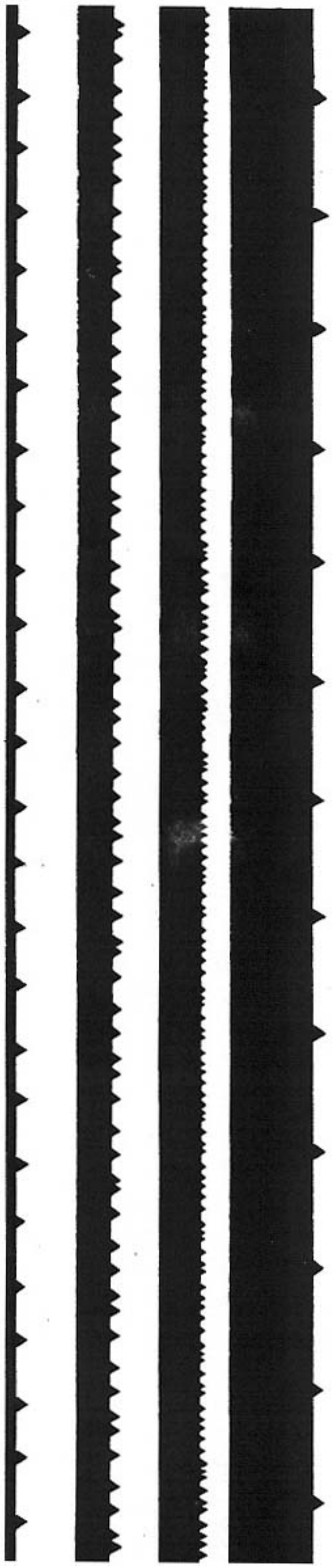
TECHNICALLY SPEAKING



Adhesive Binding Library Books

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For decades, library binders have experimented with linking paper fibers with adhesives. Some tried to “shake” the cellulose fibers into one solid mass with ultrasonics. Others tried chemical solutions to “weld” paper fibers with heat. Ultrasonic binding never made it out of the laboratory… Paper welding, however, is now being used extensively replacing side stitching for children’s books. This process requires the use of specially treated paper, which is subjected to an energy source (such as RF, laser, ultrasonics or microwave) that then welds or fuses the prepared sheets together. Although this process uses no adhesives, staples or any other orthodox means of holding pages together, a page affixed in this manner is not easily ripped from its binding. Unfortunately, this process requires specially treated and coated papers, presently marketed only by the P.H. Glatfelter Company, a major paper manufacturer. Maybe down the road, with further developments, we will succeed in being able to “soak” library material approximately 1/16 to 1/8 inch on the bindfold with a liquid similar to those used in present day welding technology. These specially prepared binding edges may then simply be welded or fused into a solidified mass that is flexible and strong.

Binders have tried to seal and secure paper fibers ever since they’ve been using adhesives. Back in 1911, the Sheridan Company introduced the “perfect” binder, utilizing India-rubber adhesives. Later, Arabol, a German-invented flexible vegetable glue, was used to “perfect bind” such items as 5,000,000 copies of the Sears & Roebuck mail-order catalog. Unfortunately, “perfect binding” was plagued by being anything but “perfect bound” until the 1960’s. Today, the term “perfect binding” is familiar to almost everyone. We technical people like to use this designation only for single sheet, hot melt-bound products or, in other words, commercial high-speed binding.

The development of PVA cold emulsion adhesives as we know them today began with the discovery of a synthetic resin adhesive in 1912 at the Chemical Works in Griesheim, Germany. The chemists developed this product by combining acetylene with acetic acid, with the resulting polymerizing properties then, allowing for further conversion to obtain a pure, polyvinal, acetal resins solution. The synthetic resin particles, suspended in a dispersing agent (water), are provided with a protective colloid, so that the particles of adhesive won’t start clumping together. When the water evaporates during drying, these protective colloids break apart and the individual particles of adhesive begin to coalesce. This is the beginning of the formation of an adhesive film. When drying is complete, this dispersion leaves a hard, rigid and translucent pellicle of pure, polyvinal, acetal resins. In order to enable further processing of this hard and rigid synthetic material on a larger scope of application, the admixture of plasticizing agents is required. Such plasticizers are comparable with lubricants which, when attached to the molecular structures of PVAs, give the product better elasticity and flexibility. However, such external plasticizing often results in problems with plasticizer migration, since these plasticizers merely adhere to the molecular structure of the PVA material.

This negative appearance of plasticizer migration initiated further developments of cold emulsion adhesives, which contain no external plasticizers. Chemists found a way of integrating plasticizers with the molecule of the synthetic PVA material, so that at the point of polymerization, permanently adhering chemical substances allow for the production of new. synthetic material of high flexibility and of new dispersion. These types of adhesives are defined as copolymers or as “internally plasticized” cold emulsion adhesives. There is one property, which these adhesives have in common: As a liquid substance, they may be diluted with water or even mixed with starch-type adhesives, whereas, when completely dried, they cannot be diluted in or with water. Conservators call this irreversible!

Today, modern cold emulsion PVA adhesives are used by all bookbinders for almost all binding operations. Due to the fact that these cold emulsion adhesives contain water, water absorbent materials to be glued will end up with a layer of pure synthetic pellicle. Once dry, they are resistant to water, humidity and heat, while maintaining perfect elasticity. There are no aging problems and PVAs are resistant to bacterial and fungicidal attack over considerable periods of storage time. The application of PVA cold emulsion adhesives produces a strong bond of the paper fibers, with excellent durability and solidity. In fact, it is likely that the paper material itself will deteriorate before the PVA adhesive film loses its strength! It might also be interesting to know that, according to the chemists at the well-known PLANATOL Werke in Germany, final bonding strength of cold emulsion adhesives is independent of the pH-value determined for adhesives, regardless of whether the pH-value is 4 to 5 (average) or 8 to 9. (Most cold emulsion adhesives are slightly acidic, due to the free acetic they contain.)

With all the good news on adhesives, why do some adhesive bound library volumes fail? The reasons are many... Usually, the binder has no control over the material given for binding, particularly in respect to the paper-grain direction. Nearly half of all the books and other printed materials published today have the paper-grain perpendicular to the binding edge. The all-important paper fiber, the basic ingredient in a sheet of paper, is affected by changing atmospheric conditions, direct moisture or compression. Paper fibers may stretch or shrink four to five times more in their width than in their length. Therefore, paper-grain directions perpendicular to the binding edge will make the paper stiffer and more difficult to turn and lay down, with distortion and buckling of the paper usually resulting. Although readers interpret this as a serious quality defect, binders have no choice but to struggle along and often try the impossible. Also, binders are often faced with heavy volumes with coated papers and multiple layers of oily inks, which extend all the way into the bindfold. Since the margins preclude oversewing or cleat lacing, adhesive binding then is the only alternative left.

A plain, guillotine-cut edge is simply not good enough for a lasting adhesive bound product. Cutting knives create an ironed or burnished surface on the edges of the sheet, which are hard and non-receptive. The proper preparation of the binding edge, therefore, must be considered the most important task in linking paper fibers with the adhesive. Binders have developed various kinds of roughing techniques for increasing the binding surface, so as to achieve optimum penetration into or around exposed paper fibers. This, combined with double fanning (that is, “tipping” one page to another) has resulted in adhesive bound products of high quality. Unfortunately, all the mechanical devices used today have one major shortcoming that affects adhesive binding quality. The prepared book edges are all the same. Whatever the roughing tools’ patterns are, they do not allow for adjustable patterns for the ultimate spine preparation! After all, a binder must cope with an unlimited of papers: soft and hard, uncoated and clay-coated, thin and heavy weights and those with various finishes. Clay-coated papers, for example, have very short fibers and certainly need a different spine preparation pattern than light and fluffy paper stocks. The paper-grain direction, the dimension of the book, its bulk, its weight, etc., must also be taken into consideration. However, a binder equipped with a single blade-roughing tool is simply unable to make necessary adjustments to cope successfully with these variations. Therefore, with all edges prepared alike and the binder relying exclusively on the high quality adhesives, it’s no wonder that some of the bindings succeed and others fail.

A recently developed special spine-grooving machine, introduced in Germany, already is changing the quality and acceptance of adhesive bound library materials. The new slitting and grooving machine was developed especially for use in conjunction with modern binding adhesive technology. It guarantees the optimum linkage between paper and adhesive and the grooves or slits are adjustable in width and depth, as shown on the illustrations on page 10. The manufacturer of this unique binding machine not only sent us a variety of roughing patterns, but also enclosed, adhesive bound book (8 x 11 inches, two inches thick, coated paper-stock with a the weight of eight pounds). The volume has tight margins and yet, even though adhesive bound, showed superior (almost to unbelievable) strength, a good round and, excellent openability.

After receiving this impressive sample book at our book-testing laboratory, it appears that we’ve arrived at a new threshold in the development of adhesive binding for library materials. It is our hope that we may be able to obtain such a unique spine-grooving machine in the near future for further testing and experiments. (For example, we could study the proper linkage of an adhesive bound bookblock with the cover.) Adhesive bound books, properly prepared with this new spine-grooving machine and coated with an internally plasticized cold emulsion PVA adhesive, are most likely to be introduced into a future LBI Standard. Based on the sample received, it is the closest thing to actual paper welding.
For further information and samples, contact Mekatronics, Inc./Bendror International, Inc., 85 Channel Drive, Port Washington, NY 11050.

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