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Article: Shiny, Lined and Brown: Building Conservation Context for Harry Jander's Document Restorations

Author: Sarah Norris and Kathryn Boodle

Source: Book and Paper Group Annual 39, 2020.

Pages: 69 - 86

Editors: Justin Johnson, Managing Editor & Kimberly Kwan, Assistant Editor

Editorial Office: bpgannual@gmail.com

ISSN: 0887-8978

The *Book and Paper Group Annual* is published once each year in print format by the Book and Paper Group (BPG), a specialty group of the American Institute for Conservation (AIC).

The *Annual* is distributed as a benefit of membership to those who were members of the BPG in the date year of the issue. Additional copies or back issues are available from AIC. All correspondence concerning subscriptions, memberships, back issues, and address changes should be addressed to:

American Institute for Conservation

727 15th Street NW, Suite 500

Washington, DC 20005

info@culturalheritage.org www.culturalheritage.org

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Shiny, Lined, and Brown: Building Conservation Context for Harry Jander's Document Restorations

INTRODUCTION

From 1947 to 1954, Harry Jander worked in document restoration at the Texas General Land Office, a state agency charged with land and resource management. His treatments on hundreds of maps and paper records were idiosyncratic and easily recognizable. In Jander's self-devised method, documents were coated with a varnish-like protective consolidant (fig. 1). The coating served as an adhesive for a lining made of open-weave nylon mesh. The lining's edges were trimmed with pinking shears, giving them a distinctive, zig-zag shape. Jander then signed many of his treatments with black ink on the verso (fig. 2).

Time was unkind to Jander's treatments. Fifty years later, treated materials had become dark brown, brittle, and translucent. The coating was shiny and waxy, sometimes showing remaining evidence of brushstrokes. A distinctive, medicinal odor wafted from the documents. Staff members at the Texas General Land Office coined a special term to describe these materials: *Janderized*.

Jander was proud and secretive about his methods and materials, saying, "they're safer in my own mind" (*Austin American* 1948). No treatment documentation accompanies his work. These realities have challenged modern-day understanding of his practice. Testing has shown that acetone is an effective solvent for Jander's coating, and many of his treatments have been reversed with successive acetone baths. Nevertheless, many questions remain about the full scope of Jander's materials, goals, and influences.

By modern understanding, Jander's treatment was invasive and challenging to reverse. Its impact on the appearance and structural viability of historical paper seems heavy-handed. Jander's autograph reveals a bravado long since passed from conservation aesthetics. But past mistakes were often made with the best intentions. How should today's conservator assess a past treatment like that of Jander? Was Jander a sole actor who improvised a preservation treatment and misrepresented himself as an authority? Or was he part

of larger preservation trends, acting within the best understanding of conservation science and practice in the 1940s and 1950s?

A complex story like Jander's benefits from a multifaceted research strategy. This study builds upon archival research and chemical analysis to establish conservation context for Jander's work. Through examination of Jander's background, his possible treatment materials, the contemporaneous treatments of his day, the chemistry underlying his work, and analytical testing, a fuller understanding of Jander's rationale and materials may be achieved.

WHO WAS HARRY JANDER?

Jander's life story is full of elusive and contradictory details. He spent his early years in eastern and coastal Texas; visited England around the time of World War I; lived in St. Louis, Missouri, in mid-life; and then returned to central Texas around the time of World War II. However, Jander's specific activities in each chapter of his life are somewhat unclear, and Jander's stories about himself sometimes challenge the bounds of believability.

Harry Garnett Jander (fig. 3) was born in the early 1890s and grew up in the small town of Palestine, Texas; (War Department 1943). Between 1911 and 1915, he lived in Galveston, Texas, where he worked as a cashier at a brewery. When a devastating hurricane struck Galveston in 1915, Jander relocated to his father's hometown of St. Louis, Missouri, where he took a job with the YMCA (Alonzo and Tuggey 2019).

In September 1918, near the conclusion of World War I, Jander traveled to England with the YMCA. Sources disagree as to whether Jander remained in England until January 1919 (Alonzo and Tuggey 2019) or for a period of "several years" (War Department 1943). During this time, Jander claimed to have studied at the University of London, although he did not say which member institution of this large educational system was his alma mater (Barnes 1952; Alonzo and Tuggey 2019). During this relatively short period in England, he reportedly received "a Doctor's degree" (Adair 1953) in an unspecified field. Jander spoke of taking an apprenticeship

Papers presented during the Book and Paper Group Session, AIC's 48th Virtual Annual Meeting, May 21-September 2, 2020

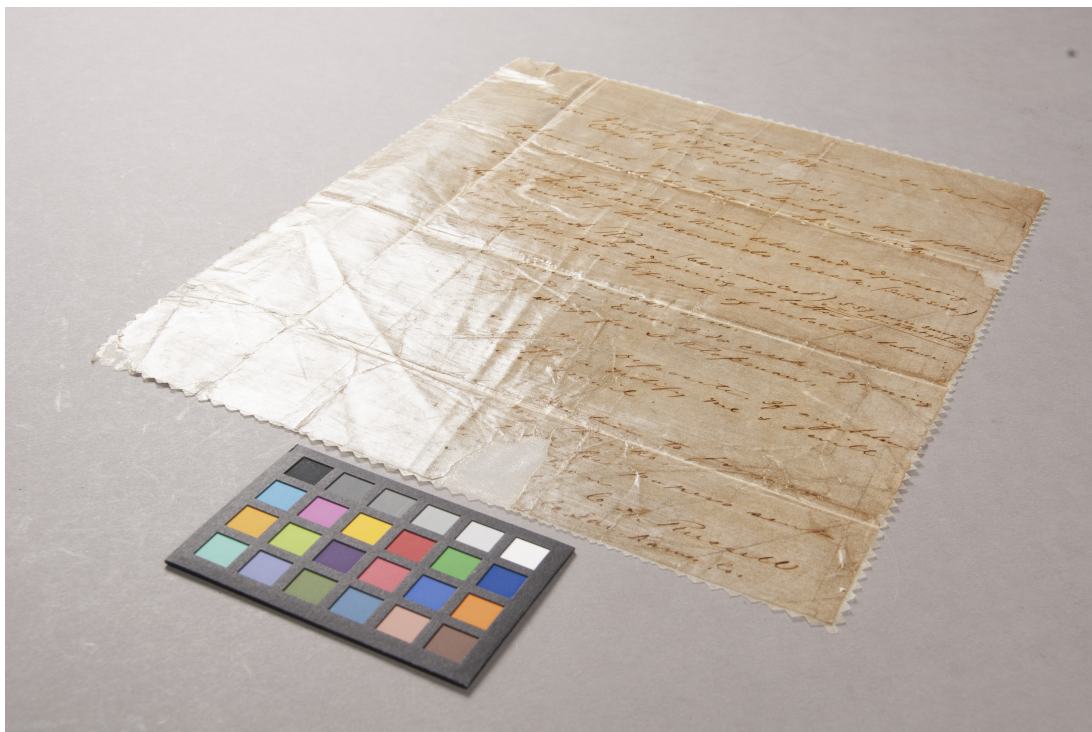


Fig. 1. Raking light reveals the shiny surface of the recto of a typical Jander treatment. Courtesy of S. Norris.

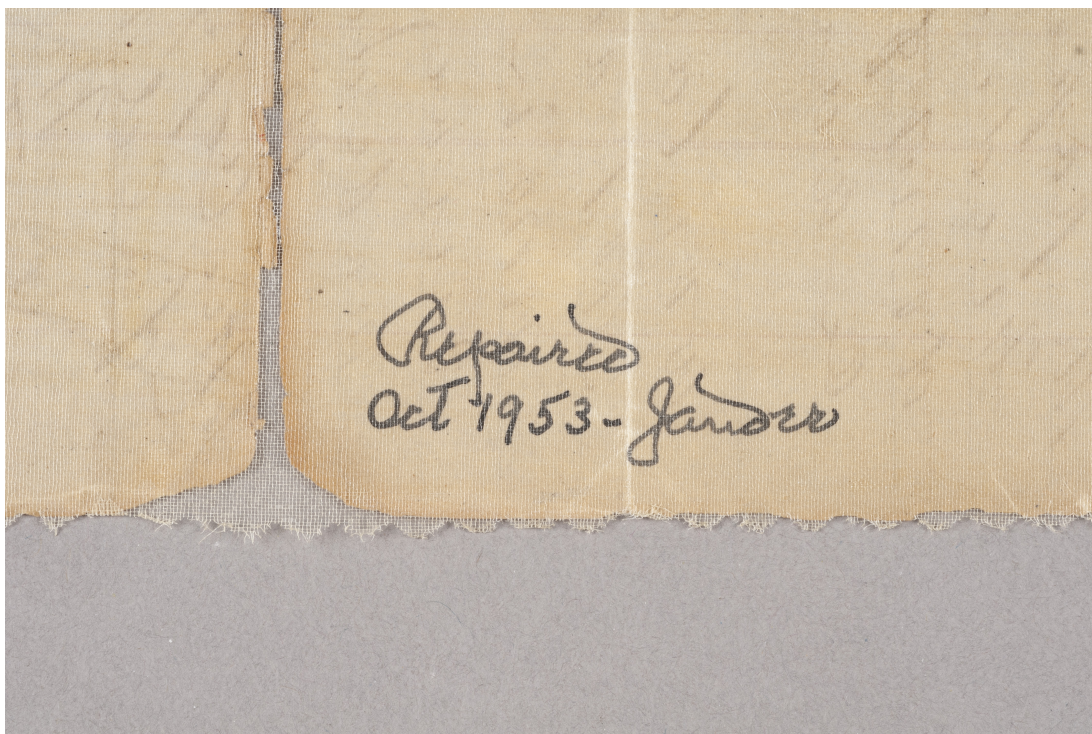


Fig. 2. The verso of a typical Jander treatment is lined with nylon mesh, trimmed with pinking shears, and signed. Courtesy of S. Norris.



Fig. 3. Harry G. Jander displays a textile in his home. Nolan Borden, *Austin American-Statesman*, March 3, 1959. Austin History Center, Austin Public Library, AS-59-22006.

in interior decorating and of working in Buckingham Palace. He even recalled a personal conversation with Queen Mary, during which the queen purportedly gave him a diamond ring (Barnes 1952).

Two sources note that Jander studied at Columbia University and practiced interior decorating in New York (Barnes 1952; *Austin Statesman* 1962). However, Jander cannot be identified in New York City directories of the era (Alonzo and Tuggey 2019).

By 1922, Jander had returned to St. Louis and was employed as a decorator at Scruggs Department Store. He also took private decorating work, perhaps as early as 1920. Although one report placed him in St. Louis until about 1940, Jander has not been identified in St. Louis city directories after 1933 (War Department 1943; Alonzo and Tuggey 2019). Documentation of Jander's life then resumes in early 1940s Texas.

There are disparate narratives of Jander's World War II-era relocation to Texas. Newspapers report that Jander worked with aircraft fabrics at Randolph Field in San Antonio, Texas, and transferred to Bergstrom Field in Austin, Texas, in 1945 (*Austin American* 1948; Barnes 1952). However, a 1942 Austin city directory listed Jander as a professor at St. Edward's University in Austin; he was served an eviction notice from a residence

on university property in 1943 (Alonzo and Tuggey 2019). Archivists at the Texas General Land Office estimate that Jander worked there preserving documents from 1947 to 1954 (Alonzo, pers. comm., December 11, 2019). He may also have treated documents in private practice during this era (Adair 1953).

Jander died in Austin, Texas, in 1962. No next of kin were identified. His remains were sent to Indiana (*Austin Statesman* 1962), although biographical research has not identified family connections in that state.

JANDER THE COLLECTOR

In addition to working as an interior decorator, Jander was also a textile collector. At its peak, his collection may have included about 1,000 items, with an estimated 1952 value of \$50,000 (Barnes 1952; *Austin Statesman* 1962). By one account, Jander regularly relaxed at his home wearing an 800-year-old Ming dynasty robe from his collection, along with the diamond ring received from Queen Mary. (An 800-year-old robe would have originated in the Song dynasty, 960–1279.) Jander gave lectures about his collection at Austin-area civic clubs and society events. An exhibit of his textiles was at least briefly displayed at the Texas Memorial Museum (Barnes 1952).

Later in life, Jander reportedly donated parts of his collection to George Washington University (possibly a misstatement of Washington University) in St. Louis, Northwestern University, the Metropolitan Museum of Art, and the University of London (Barnes 1952; *Austin American* 1962). To date, these donations cannot be confirmed. Henry Francis DuPont declined an offered donation from Jander in 1951 (Alonzo and Tuggey 2019). A portion of Jander's collection was recently identified at St. David's Episcopal Church in Austin, where Jander was a member. It has been transferred to the conservation laboratory at the University of Texas School of Information (Alonzo, pers. comm., December 12, 2019).

A 1943 Army Service Forces report evaluating Jander's character and loyalty states the following opinion:

SUBJECT has a display of silverware and fabrics which are supposed to be very rare and valuable, but because SUBJECT is somewhat of a prevaricator, informants doubt the value of these articles and also doubt the claims of SUBJECT's wide travels and past experience that SUBJECT relates. (War Department 1943)

JANDER IN PRESERVATION

Jander's biography raises many questions. It also offers several possible clues about the origins, processes, and materials of his document restoration process.

Jander's earliest thoughts on preservation may have come around 1933. While working as an interior decorator in St. Louis, he seems to have envisioned using a type of preservative varnish:

[He] conceived the idea . . . of perfecting a formula that would preserve wall paper without discoloring it so that it would be impervious to water or any stains, be thoroughly washable, and retain its beauty as long as it stayed on the wall. (Adair 1953)

Another report states that Jander began experimenting with paper preservatives after a World War II-era experience at Randolph Field in San Antonio. This account introduces the practice of lining paper with textile and of working with the varnish-like substance known as airplane dope:

[A]n Air Corps officer came to him with a problem. The Army had been mounting navigators (sic) maps on fabric with glue or shellac. Both cracked and buckled badly. Jander took the map and mounted it with aircraft “dope.” It far outlasted the other maps. (*Austin American* 1948)

Jander himself described his treatment process at the Texas General Land Office as suitable for paper, parchment, photographs, and even furniture. His methodology of applying a nylon lining and a varnish-like “formula” was described as follows:

The finest grade of nylon guaze (sic) is applied on one side to give body and strength to the old paper and then the formula is applied on both sides. The article so treated is thereby sealed in airtight for all time and is proofed against dampness and discoloration. Ink or oil may even be poured on the treated article and washed off readily with soap and water without any damage to the surface of the formula or the paper so treated, and silverfish, roaches, mice and all paper destroying insects or rodents shun paper treated with the formula as they would poison. (Adair 1953)

Jander explained that his treatment results were “tough as leather,” and as an added benefit, they rendered “old paper maps transparent so that they can be blueprinted or photostated, saving endless hours of redrawing” (*Austin American* 1948). Transparency (or more likely translucency) is a trait shared with early oiled and waxed repair papers. This trait may indicate that Jander’s coating filled spaces between the paper fibers, changing the refractive index of the treated document.

Jander was secretive about his solution, claiming, “The formula cannot be analyzed. Three laboratories have tried.” The identity of these laboratories is unknown. Jander also reported that two tests were conducted on his treated papers. In one test at the National Bureau of Standards, a treated sample of newsprint was subjected to “accelerated aging equivalent to 100 years.” Results showed that the sample was “slightly discolored (sic), but has no frayed spots, normally found in old deteriorating paper.” Another test conducted at the Texas Highway Department subjected a treated paper sample to conditions typically used to evaluate road signs: “1,000 hours

at 150 degrees of heat, in light 15 times as powerful as the sun.” The resulting samples were “slightly browned, but with the print still legible” (*Austin American* 1948). Attempts to locate documentation or results from these test results have proven unsuccessful.

JANDER’S SECRET RECIPE

While researching the details of Jander’s background, Texas General Land Office archivists made an intriguing discovery. On a small slip of paper in Jander’s records, there appeared to be a handwritten recipe for Jander’s secret preservation formula (fig. 4). Ingredients listed were as follows (Jander n.d.):

3 gal distilled water
24 oz. glycerine
6 oz. carbolic acid (phenol)
90 oz. spirits of camphor
72 oz. alcohol

Like much of the evidence about Jander’s life, this discovery raised as many questions as it answered. No mixing instructions accompanied the ingredient list. It was unclear what chemical reaction might occur among these ingredients, as there were no obvious kinetic forces at play. Accordingly, the list seemed to represent only a partial recipe, with one or more missing ingredients. Despite these challenges, several types of compounds could be hypothesized.

Initial conjectures for the identity of Jander’s compound based on the handwritten recipe were a cellulose ether, ester gum, or a long-chained alkylphenol compound. These compounds can produce thermoplastic or pressure-sensitive adhesives. They were feasible options during the 1940s and 1950s, given advances in the manufacturing industry.

Additional possibilities were also considered. Was Jander’s compound a solvent solution used to solubilize nylon from his lining (Stavroutis, pers. comm., May 20, 2019)? Was cellulose nitrate the missing ingredient, diluted by the other, known ingredients (Lee, pers. comm., May 9, 2019)? The research team hypothesized that Jander’s mixture was at least slightly acidic, with increasing acidity over time. Additionally, given the known aging properties of the starting compounds, it was believed that the mixture had a high risk of cross-linking with both the paper and the lining.

To learn more, an informal test of Jander’s recipe was conducted at the Summerlee Conservation Laboratory at the Texas State Library and Archives Commission in August 2019. Two reduced batches of the recipe were mixed: one using spirits of camphor (84% alcohol, 10% camphor) and one using pure camphor oil. Jander did not specify alcohol type; this test used isopropanol 70% (with water). The test also omitted phenol due to health concerns. This omission

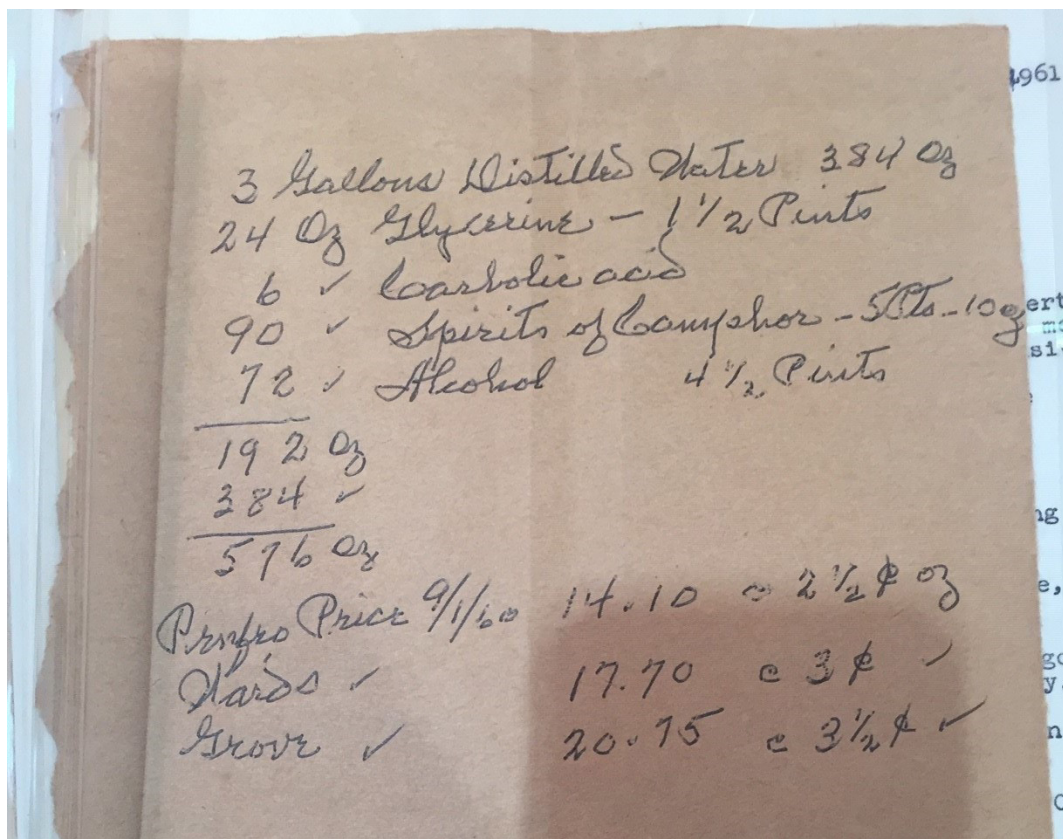


Fig. 4. Jander's handwritten note. Austin History Center, Austin Public Library, AR.2005.024. Courtesy of D. Alonzo.

prevented the test from forming a long-chained alkylphenol, which was considered a least likely compound possibility. It is thought that the phenol may have functioned as a preservative for the mixture rather than as a critical part of the formula's preservation function. However, if Jander's recipe did produce a long-chained alkylphenol, it would be identified in subsequent analytical testing.

The two mixtures were each brushed onto six sample sheets of paper: one sample of modern Mohawk 25% cotton paper; and five samples each of varied 19th- and 20th-century blank, loose, historical endpapers present in the laboratory. The coated samples were allowed to air-dry.

Observations were as follows:

- The pH of both test mixtures was 4–4.5, measured with a pH strip.
- The treated samples had a medicinal odor similar to typical Jander treatments.
- The treated samples lacked the waxy, shiny surface typical of Jander treatments.
- The mixture made with pure camphor oil yielded large, clear globules despite vigorous stirring. This resulted in

beading and streaking when the mixture was applied to the paper samples. When dry, treated samples showed dark spots.

- The mixture made with spirits of camphor yielded a fine, cloudy particulate layer, despite vigorous stirring. Beading and streaking were not evident in the application. Dark spots did not appear on treated samples when dry.

Several working conclusions from this test guided ongoing inquiry:

- Acidity was likely an issue in Jander's treatment. According to best understanding, the pH 4–4.5 mixture was brushed directly onto historical documents and allowed to dry. No washing or deacidification step was documented.
- The distinctive, medicinal odor shared between the treated test samples and historical Jander treatments informally supported the idea that camphor was part of Jander's recipe.
- The difference in surface texture between the treated test samples and historical Jander treatments reinforced the research team's conjecture that the discovered recipe was at least partially inaccurate or incomplete.

- Spirits of camphor produced a more homogenous mixture and more even application than pure camphor oil. This even application bore closer similarity to the historical Jander treatments and lent informal support to the idea that spirits of camphor were part of Jander's recipe.

After this informal test was completed, a 1948 newspaper article was discovered that described an entirely different set of ingredients. These included airplane dope, ether, concentrate of castor oil, sugar, salt, sodium bicarbonate, and paraffin (*Austin American* 1948). This new information increased the number of possible materials under investigation from 5 to 12. It also increased consideration of a cellulose nitrate or similar modified compound as Jander's final goal.

MATERIALS IN CONTEXT

Despite the seemingly unconventional nature of Jander's treatment, many ingredients associated with his formula had historical precedent and contemporaneous use in library and archives preservation. Documented preservation uses of Jander's ingredients fall into several broad categories: humectants (to improve flexibility); pest repellents; coatings, consolidants, or sizing agents; and preservatives in pastes and glues. These categories imply a focus on common concerns in aging paper: brittleness, pest activity, and fragile media and substrates. These concerns have challenged conservators through many years and many styles of practice.

The following is a brief investigation into preservation precedent for each of the known ingredients Jander may have used. The first five ingredients are listed in Jander's handwritten note; the following seven come from the 1948 *Austin American* article.

Camphor

Camphor is an aromatic crystalline compound with a sweet smell (CAMEO, "Camphor" 2016). It is made by distilling the wood of the *Cinnamomum camphora* (camphor tree) into a waxy resin or oil (Smith 2016, 392). Camphor has been made synthetically since the 1930s as uses expanded beyond traditional medicine and pest control and into the chemical, manufacturing, and photographic fields. It sublimates slowly, it is flammable, and it evolves explosive vapors with heat (CAMEO, "Camphor" 2016). Camphor is also found in pharmaceuticals, disinfectants, and explosives (Getty Art & Architecture Thesaurus Online, "Camphor (Resin)" 2004).

Camphor was used in the 19th century as an insect and rodent repellent in library collections. Powdered camphor was sprinkled on library shelves for pest control (Smith 2016, 117–18, 120). In one instance, camphor was used in the 20th century in India as a disinfectant for a books exposed to tuberculosis. Like Jander's treatments, this treatment resulted in severely browned, embrittled paper. The camphor used

in India was reversed with acetone (Ubbink 2019), just like reversals of Jander's treatments.

Camphor also has a rich history as a plasticizer. It was mixed with cellulose nitrate to form the first plastic, celluloid, popular in American and European manufacturing from about 1875 to 1940 (CAMEO, "Camphor" 2016). A variant of this mixture created a preservation coating called *Zapon*, which was used as a varnish, size, and consolidant on documents in the early 20th century. In 1901, camphor was added to cellulose acetate to create the trade-named product Cellit (Smith 2016, 97–104, 392, 403).

Phenol/Carbolic Acid

Phenol, or carbolic acid, is a poisonous, caustic aromatic alcohol (Smith 2016, 392). It is a colorless or white crystalline solid with a sweet odor, created through the pyrolysis of coal tar (Getty Art & Architecture Thesaurus Online, "Carbolic Acid" 2004).

In the 19th and 20th centuries, phenol was used to prevent bacterial degradation in fish glue and to forestall mold growth in starch and flour pastes. It has high antiseptic and preservative properties even in low concentrations. It was also recommended as an insect repellent and insecticide in library collections in the 19th century (Smith 2016, 117–18, 178, 234).

Glycerine

Glycerine is a transparent, colorless, viscous liquid originally created as a by-product of soap-making (CAMEO, "Glycerol" 2016). It is a hygroscopic liquid used as a humectant, emulsifier, and plasticizer in printing inks, watercolor and gouache paints, glues, cements, and regenerated cellulose products such as rayon and cellophane (Smith 2016, 396).

Glycerine was added as a humectant to improve flexibility in fish glue, gummed papers, and mucilages in the 19th and 20th centuries. It served a similar purpose in some starch and flour pastes, including the paste used in the Emery lining process (see section 9). It acted as a thickener and drying retardant in letterpress inks. It has been included in some recipes for gelatin size and was reportedly mixed with shellac as an experimental paper preservation coating at the New York Public Library (Smith 2016, 79, 85, 86, 129, 178, 181, 266, 348).

Alcohol

Alcohol is a class of organic compounds in which one or more hydroxyl groups (-OH) are bound to a carbon atom or hydrocarbon chain (CAMEO, "Alcohol" 2016; Getty Art & Architecture Thesaurus Online, "Alcohol (General)" 2004). Jander does not specify what type of alcohol he used. Given popular availability and usage in Jander's day, likely candidates are methanol, ethanol (denatured alcohol or methylated spirits), and isopropanol (Savage 1954, 4). All have small enough chain structures that there would not

be much physical difference between the final solutions mixed with them, although some chemical properties may be slightly different.

Since the 19th century, alcohol has been used as a paper-washing agent; as a solvent for removing staining agents like wax, oil, and grease; and as a softener for removing varnish from paper prints (Smith 2016, 61, 164, 267).

Water

Water has historical and current uses as a solvent and a diluent in wide-ranging applications, including paper pulp, photographic solutions, aqueous paint media, textile dyes, cement mixtures, detergents, and adhesives (CAMEO, "Water" 2016). It has been used as a cleaning agent for paper since the 19th century.

Airplane Dope

Airplane dope was a varnish or lacquer used to coat textile surfaces in airplanes in the World War I era (CAMEO, "Airplane Cloth" 2016). Varying formulations were made with cellulose nitrate, cellulose acetate, and cellulose acetate butyrate. Airplane dope tightened and stiffened fabrics to make them suitable for flight, but it required regular reapplication to address rapid cracking and delamination (Regel, Langfelt, Burden, and Ryan 2016). These issues continue to create preservation challenges for modern conservators working with historical airplanes.

The possible use of airplane dope was particularly intriguing given Jander's work with textiles and his service on an Air Force base. Cellulose nitrate and cellulose acetate have wide-ranging precedent in cultural materials and their preservation. Varied uses have included photographic stock, lamination materials, and varnishes, among many others. Mention was made in Jander's day of spray coating fragile textiles with a solution of cellulose acetate in acetone (Savage 1954, 112).

Ether

Ethers are a class of compounds with an oxygen atom linked between two carbon groups (Getty Art & Architecture Thesaurus Online, "Cellulose Ether" 2004). Jander does not specify the type of ether he may have used. Cellulose ethers form clear, hygroscopic films and are used as adhesives, poultices, consolidants, and coatings. Other types of ethers, such as diethyl ether and petroleum ether, are used as solvents for resins, oils, fats, and waxes (CAMEO, "Diethyl Ether" 2016).

Castor Oil

Castor oil is a transparent, viscous oil derived from the seeds of the castor bean. It is very slow to dry, and thick layers never dry fully. Castor oil has been used as a lamp oil, insect repellent, lubricant, paint plasticizer, an ingredient in soap, and emollient to keep leather supple (CAMEO, "Castor Oil"

2016). It has also been used in the production of synthetic resins, plastics, fibers, and varnishes (Getty Art & Architecture Thesaurus Online, "Castor Oil" 2004).

Sugar

Sugar is a carbohydrate composed of saccharose groups and formed by photosynthesis in plants (CAMEO, "Sugar" 2016). Varied uses have been documented as a humectant to enhance flexibility. In the 19th and 20th centuries, sugar was added to adhesives in animal glues, self-adhesive repair papers, and gum arabic (Smith 2016, 79, 178, 234). Sugar was also used interchangeably with glycerine in gum adhesives and letterpress inks (Smith 2016, 81, 266).

Salt

Salts are compounds formed by a pair of positive and negative ions. Many types of salt exist; Jander does not specify the type he may have used. Table salt, or sodium chloride, is certainly the best-known salt in popular applications, but it is little documented in preservation or associated practices. In the 1950s, it was identified as a cleaning aide for porcelain and a poulticing agent to contain grease stains on textile (Savage 1954, 103). It has been identified as a dry-cleaning ingredient in Absorene pink kneadable erasers (*AIC Wiki*, "BPG Surface Cleaning" 2019). It may be used in modern-day practice as a possible additive to water for steaming (*AIC Wiki*, "BPG Hinge, Tape, and Adhesive Removal" 2019).

Sodium Bicarbonate

Sodium bicarbonate, or baking soda, is a water-soluble, crystalline or granular powder. It has little historical precedent in preservation. Like salt, it may be used in modern-day practice as a possible additive to water for steaming (*AIC Wiki*, "BPG Hinge, Tape, and Adhesive Removal" 2019). It can also be used as a dry-cleaning agent for textiles (*AIC Wiki*, "Dry Cleaning" 2015).

Paraffin

Paraffin is a white, translucent, flammable mixture of saturated straight-chain hydrocarbons. It can exist as a wax or an oil. It was first made from petroleum in 1867 and later from coal after World War II (CAMEO, "Paraffin Wax" 2016). Applications relevant to preservation and associated practices include making waxed and oiled papers, leather dressings, inks, polishes, and wood sealants (Getty Art & Architecture Thesaurus Online, "Paraffin (Wax)" 2004; *AIC Wiki*, "BPG Sizing and Resizing" 2019).

In Jander's day, paraffin was described as an insecticide, a drying agent for wood, and a coating for varied museum objects, including textiles (Savage 1954, 83). Today, uses of paraffin in paintings and photographs as a coating and consolidant have mostly been discontinued due to crazing and discoloration (*AIC Wiki*, "PMG Section 1.3 Effects

of Exhibition on Photographic Materials” 2009; *AIC Wiki*, “Wax as a Surface Coating” 2014). In modern-day practice, paraffin can be used in heptane as a temporary fixative for water-soluble media in aqueous treatment (*AIC Wiki*, “BPG Consolidation, Fixing, and Facing” 2019). It is also an ingredient in BEVA 371 (*AIC Wiki*, “BPG Adhesives” 2019).

Paraffin was a major component of the Emery process for document preservation. It was reportedly tested as a component in newspaper preservation at the New York Public Library around 1914 (Smith 2016, 348).

ANALYSIS OF CHEMISTRY

The examination of Jander’s background, influences, materials, and techniques suggested several types of compounds that could have been created by his secret formula. According to Jander’s handwritten recipe, a cellulose ether, ester gum, or alkylphenol compound initially seemed most likely. However, these possible compounds implied that Jander’s recipe was incomplete, as they all required a polymer or other compounds to complete the reaction. The subsequently discovered 1948 *Austin American* article suggested that the missing ingredient might be cellulose nitrate or cellulose acetate from airplane dope. This introduced a fourth possible type of compound: a diluted cellulose nitrate solution or

similar modified compound. Each possible compound type is explored next.

Cellulose Ether

Cellulose ethers are compounds that are primarily composed of cellulose, with ether groups substituted at the original -OH sites on the cellulose chain (Getty Art & Architecture Thesaurus Online, “Cellulose Ether” 2004). One of the most common types of cellulose ether is methylcellulose (fig. 5). Cellulose ethers are water soluble and can form a clear film that can be used as an adhesive, coating, poultice, or consolidant. Cellulose ethers became commercially available during the 1920s and 1930s, a time in which Jander might have developed his ideas for preservation treatments.

For Jander to make a cellulose ether, he would have had to perform etherification by treating the cellulose (not listed as one of his ingredients) with concentrated sodium hydroxide, heat, and an unknown ether. The phenol, glycerine, and camphor would most likely have acted as a preservative, thickener, and insecticide, respectively.

A cellulose ether was regarded as the least likely compound for several reasons. First, the level of degradation and damage that the treated objects exhibited did not match with observed deterioration trends in cellulose ethers. Second, several ingredients required to make a cellulose ether were



Fig. 5. Left: Powdered methylcellulose. Right: 5% methylcellulose solution.

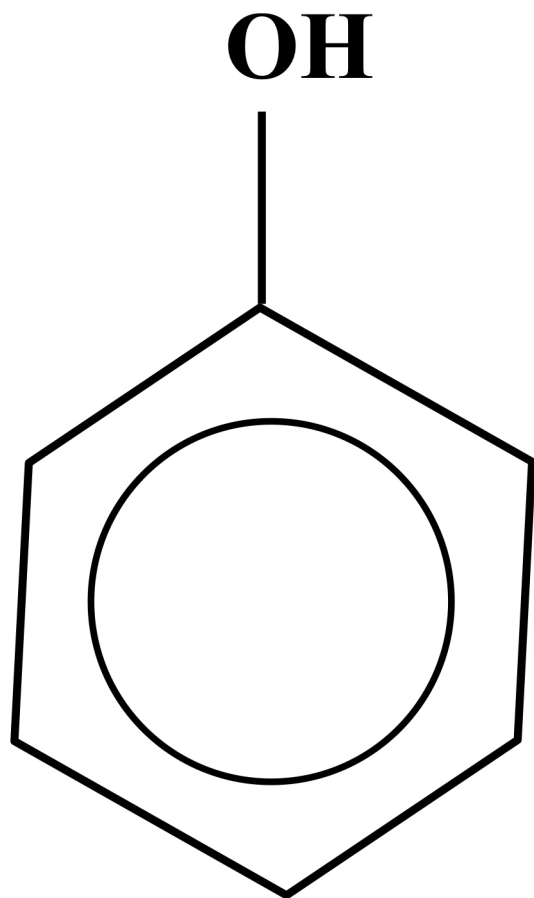


Fig. 6. Structure of phenol (carbolic acid).

missing from Jander's handwritten recipe or lacked enough specificity to produce a viable result. Although procuring these ingredients was not impossible, especially for a resourceful individual, creating them from scratch seemed outside of Jander's knowledge base. Finally, given the development of cellulose ethers in the 1920s and 1930s, it would have been more likely that Jander procured a premade cellulose ether powder and used phenol, camphor, and glycerine as additives. This would have made the presence of the ether entirely moot.

Alkylphenol Compound

Another possibility for Jander's handwritten recipe was the creation of a long-chained or cyclical alkylphenol compound, made by combining unmentioned alkenes and phenol (carbolic acid) (fig. 6).

Although unlikely, this reaction might have been able to break camphor's bicyclic ring to form a chain with a secondary cyclic tail, given the right catalyst. As a far more likely outcome, however, the camphor only would have acted as an insecticide and preservative. Perhaps Jander's end goal was something closer to a phenolic resin, but this would have

required additional compounds, such as formaldehyde, to move the reaction forward. If Jander had made a phenolic resin, he might have been working toward a substance similar to the first commercial plastics, like Bakelite (fig. 7). In this case, the camphor most likely would have been a diluent and plasticizer.

This hypothesis faced several challenges. Although the deterioration of Jander's treatments plausibly matched that of some early plastics, no obvious method could be identified to move an alkylphenol reaction forward in a reasonable manner. There are simply too many chemical variables in the creation of alkylphenols to identify a likely path. In addition, although Jander could have procured an enol ether (an alkene with alkoxy substituent on one side) as his unknown ether, this type of compound was not as readily available at the time as were his other ingredients. Additionally, procuring, creating, and/or using an enol ether would have implied a more extensive chemical background than Jander's history suggests. Neither camphor nor glycerine is classified as an alkene, so in this hypothesis, they would act as preservatives or plasticizers rather than participating in the reaction. Finally, although alkylphenols are precursors to several substances, like phenolic resins, they do not act alone as any sort of adhesive or coating material. This would indicate missing ingredients or other unknown reactions to produce the final adhesion material.

Ester Gum

Ester gums provided an appealingly simple option, as they have relatively fewer variables. Ester gums are also known as glycerol esters of wood rosin, a name that describes how they are made. Wood rosin is heated in such a way that it reacts with the glycerine to form the ester gum through the process of esterification (fig. 8).

Traditionally, the wood rosin in an ester gum is pine based. However, poorer-quality ester gums can be made from other wood resin or resinous spirits, possibly like camphor (Wolbers, pers. comm., May 20, 2019). In this case, the spirits of camphor would have gone through oxidation prior to mixing to form camphoric acid (fig. 9). Given camphor's structure, this would have required nitric acid, yet another unlisted reagent.

Here, phenol would have been used as a preservative rather than an active compound in the reaction. However, without a background in materials chemistry, Jander more likely chose camphor as an insecticide and preservative, and acquired pine rosin to form the gum. Given the volatile nature of esters, an ester gum might have broken down through reaction with its environment, possibly leading to the degradation observed by archives staff. Although ester gums are not commonly seen in paper conservation, their presence and deterioration effects can be observed in enamels, paints, nitrocellulose lacquers, and tung oil mixtures (CAMEO, "Ester Gum" 2016).

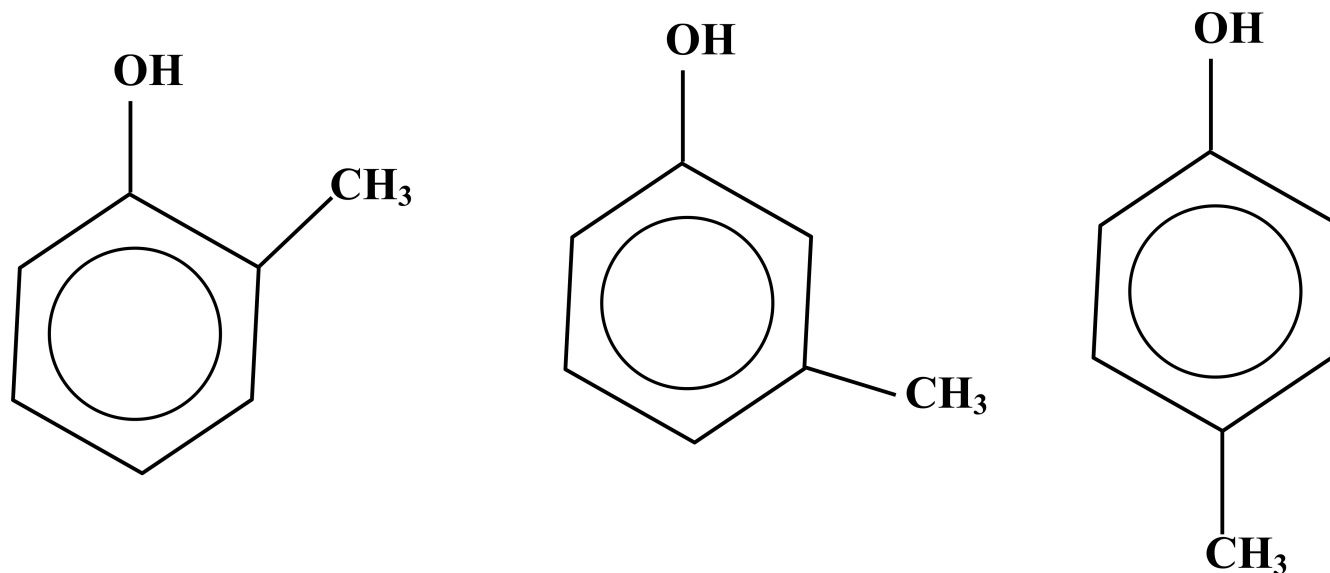


Fig. 7. Isomers of the compound cresol (o-, m-, and p,- respectively) cyclic phenol variants found in Bakelite.

Cellulose Nitrate or Similar Modified Compound

When the 1948 *Austin American* article was discovered, it introduced airplane dope as a possible ingredient. Perhaps Jander was trying to create a modified, “preservation” version of airplane dope. In this scenario, ingredients like spirits of camphor, glycerin, alcohol, water, and phenol would have been chosen for their individual purposes rather than as components of a chemical reaction.

A key ingredient in airplane dope is cellulose nitrate or cellulose acetate (fig. 10). Cellulose nitrate frequently used camphor as a plasticizer and/or diluent. Additional camphor could be mixed in without reducing its strong smell, allowing it to act as an insect deterrent. Glycerin could add increased

flexibility, and phenol could act as a preservative. Water could dilute the whole solution to a desired consistency, possibly to improve application or paper saturation. Alcohol could lower the contact angle of the water and improve absorption on thicker or heavily sized papers. Alternatively, alcohol could act as a solvent along with the water. The heat provided from the exothermic reaction of alcohol and water could ease the mixing of the materials.

The hypothesizing of possible compound types created an informed framework for analytical testing. As the research team approached testing, viable options were narrowed and limited to either an ester gum or a modified cellulose nitrate/acetate compound.

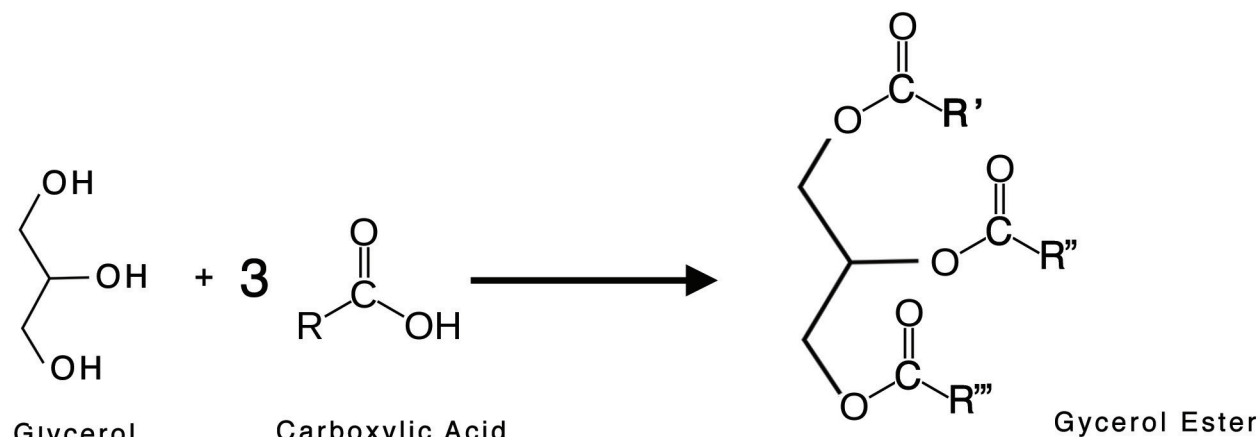


Fig. 8. Generic esterification reaction for the formation of an ester gum.

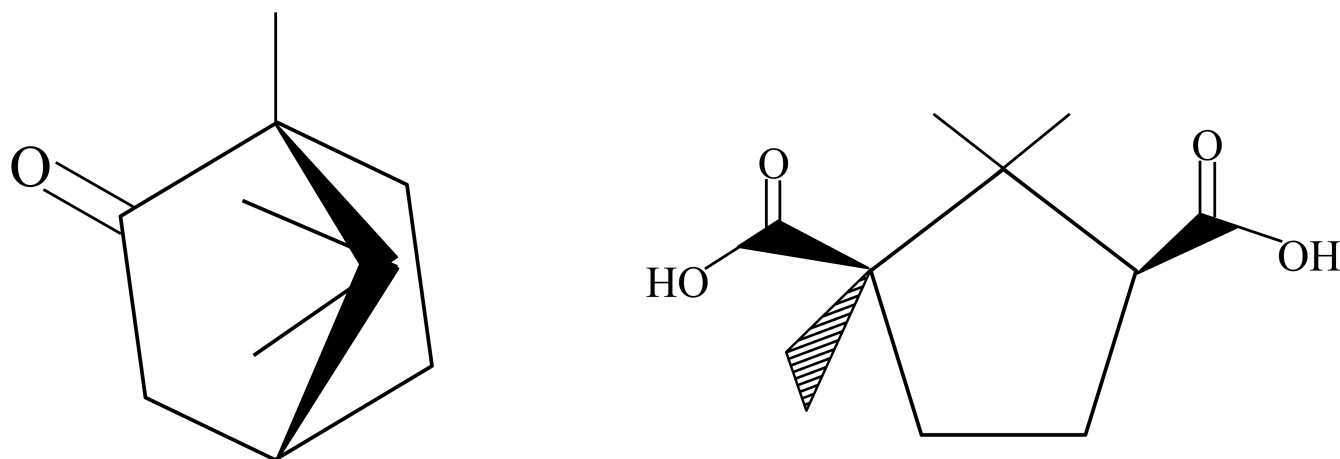


Fig. 9. Structures of camphor: R configuration (left) and camphoric acid (right).

ANALYTICAL TESTING

Analytical tests of two samples of Jander's coating were carried out using gas chromatography-mass spectrometry (GC-MS) and FTIR at the Scientific Research Laboratory at the Museum of Fine Arts, Boston. The samples were (1) a shaving of the coating and (2) nylon mesh with coating embedded in it. Both were used to analyze and confirm (or reject) the possible ingredients compiled from Jander's handwritten note and from the 1948 *Austin American* article. The GC-MS testing could also detect trace elements, which would assist in identifying other possible ingredients that Jander did not mention. Neither test would be able to show any materials that had previously evaporated, which meant that there would probably be no indicators for ether or phenol.

For the FTIR, small portions of both samples were treated with chloroform to extract any soluble materials and create a solid sample. The results for both samples were identical, indicating that the nylon did not affect the solution during

application. The GC-MS testing was performed by treating the samples with Meth-Prep 2.¹

The FTIR results (fig. 11) indicate that the solution extracted from the samples was most likely a mixture of cellulose nitrate and some kind of vegetable oil. The figure also shows a comparison of the known peaks of cellulose nitrate and linseed oils for reference. The GC-MS results (fig. 12) had numerous peaks,² which were expected given the variety of ingredients that Jander reported. Surprisingly, most of the peaks were attached to a pine resin. Other surprising peaks were the ones indicating that phthalates were also present in the coating.

Overall, results from the FTIR and GC-MS analyses indicate that some of Jander's reported materials were present. They also indicate that Jander neglected to mention using a natural resin or other resinous adjacent compound (beyond camphor). Assuming that all detected compounds created a single coating, the definitive ingredients used by Jander were cellulose nitrate, N-butyl phthalate, diethyl phthalate (DEP),

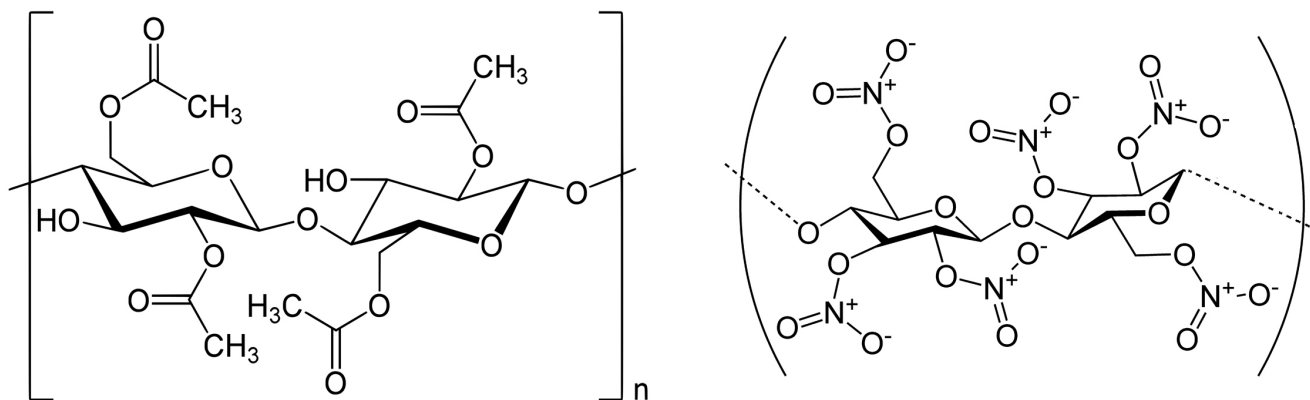


Fig. 10. Left: Cellulose acetate. Right: Cellulose nitrate.

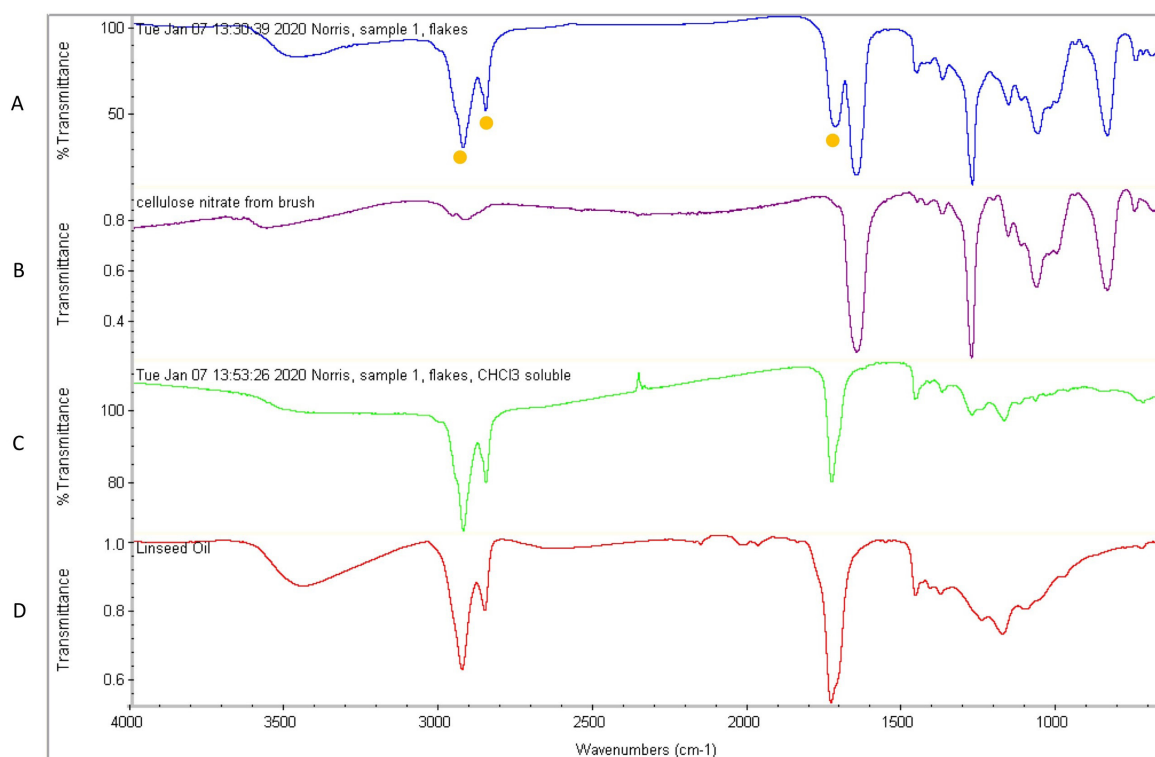


Fig. 11. Transmitted FTIR spectra from samples and references. (A) Solid Sample 1. (B) Reference sample of cellulose nitrate. Note that this spectrum contains most of the absorption features exhibited by Sample 1 below 1700 wavenumbers. (C) Chloroform extract from Solid Sample 1. The major absorption bands are those marked with filled gold circles in Spectrum A. (D) Reference spectrum of fresh linseed oil. Note that the spectrum closely matches the chloroform extract of Sample 1 (Spectrum C). Most vegetable oils have very similar FTIR spectra and cannot be easily distinguished from one another.

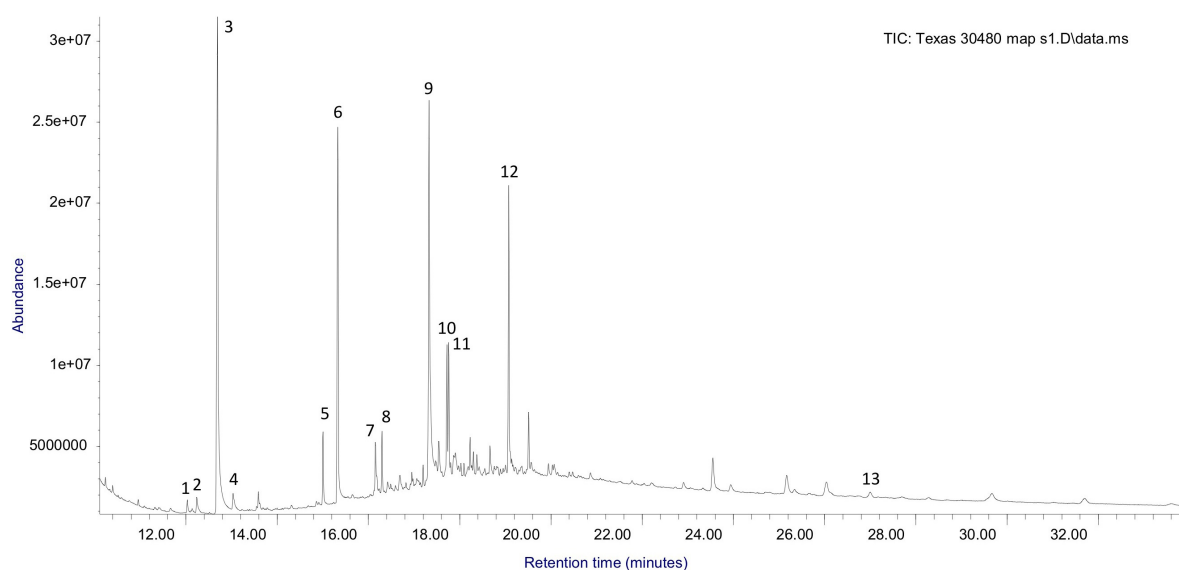


Fig. 12. Detail of chromatogram from GC-MS analysis of Sample 1. The sample was prepared with 1:1 (volume) Meth-Prep 2/toluene. Labeled peaks: (1) lauric acid, (2) 1-ethyl 2-methyl phthalate, (3) DEP, (4) sebacic acid, (5) palmitic acid, (6) dibutyl phthalate, (7) C18 unsaturated fatty acids, (8) stearic acid, (9) ricinoleic acid, (10) 6-dehydrodehydroabietic acid, (11) dehydroabietic acid, (12) 7-oxodehydroabietic acid, and (13) masticdienonic acid.

castor oil (ricinoleic acid), and pine resin (Newman and Derrick 2020).

Cellulose Nitrate

Confirmation of the presence of cellulose nitrate indicates that Jander's formula produced a cellulose nitrate compound. This effectively rules out the other possible compounds: a cellulose ether, alkylphenol compound, or ester gum. This also points toward Jander's experience with airplane dope at Randolph Air Force Base in San Antonio, as described by the 1948 *Austin American* article. Perhaps Jander's varnish was an attempt to make airplane dope from scratch. Perhaps it was an attempt to modify airplane dope to achieve better consistency or other working parameters. Possibly it was even an attempt to work toward a customized version of another preservation coating or varnish, such as Zapon.

Ricinoleic Acid

Ricinoleic acid is a fatty acid found in castor oil as part of the triglyceride chain. It is present in very high concentrations of the plant's seeds and is not diluted or minimized extensively during production. Testing also showed the presence of sebacic acid (peak 4, fig. 12) which is also found in castor oil. Castor oil has a long history of use in the arts, specifically textile dyeing, as an antifungal, soap, and lubricant, and in the production of plastics, varnishes, and paints (Encyclopedia Britannica Online, "Castor Oil" 2020). Castor oil was identified as a possible Jander ingredient in the 1948 *Austin American* article.

Conifer Resins

Multiple conifer resins were identified in the sample of Jander's coating (peaks 1, 5, 8, and 10–12, fig. 12). Conifer resins come from the Pinaceae family, of which the pine tree is the best-known member. Pine resins have been used as a coating to improve durability and water resistance in tracing cloths for architectural drawings. Some conifer resins can have similar properties and uses as camphor, including use as an insecticide.

Camphor oil, a possible Jander ingredient, is derived from *C. camphora*, which is a member of the Lauraceae family. This family is a cousin to the Pinaceae family. Conifer resins could have been included in a "spirits of camphor" mixture, or they could have been used independently. Another possible source of the conifer resins is turpentine or "spirits of turpentine." A widely available solvent, turpentine is obtained by taking resin from live trees and distilling it (Rossol 2001, 39, 40, 89).

Plasticizers

Plasticizers identified in the sample of Jander's coating were N-butyl phthalate and DEP. Most phthalates, chemically described as esters of phthalate anhydride, are plasticizers.

The polarized nature of these compounds makes them bind to polar polymer chains when heated, increasing the polymer's flexibility, transparency, and durability. The phthalate's effectiveness as a plasticizer varies depending on the type of phthalate and the type of polymer bonded together. However, because phthalates bond ionically rather than chemically with polymers, they are easily removed with heat or organic solvents. Over time, phthalate plasticizers tend to move out of polymer plastics, causing embrittlement.

Although plasticizers could have been added to Jander's formula as previously unidentified ingredients, they more likely appear as trace materials that were embedded in Jander's cellulose nitrate. In the 1920s, phthalates began replacing the earlier plasticizer camphor because they were less volatile and lacked camphor's medicinal odor (Valverde 2005). By the 1930s, camphor's use as commercial plasticizer was almost completely eliminated with the development of di-2-ethylhexyl phthalate and the rise of polyvinyl chloride (PVC) plastics (Encyclopedia Britannica Online, "PVC" 2019).

ASSOCIATED PRACTICES

Jander does not seem to have had formal preservation training or exposure to libraries and archives. Inconclusive and contradictory biographical details make it difficult to evaluate his preservation knowledge. Nevertheless, his treatment and his materials echo long-standing preservation practices of lining, consolidation, and lamination.

Before drawing final conclusions about his work, the research team sought out the historical treatment precedents that relate to Jander's materials and methods (fig. 13).

Silking

Silking, or lining with silk, was widely introduced in 1898 at the International Conference for the Conservation and Repair of Old Manuscripts in St. Gallen, Switzerland (Smith 2016, 60). The process offered better long-term stability than repairs conducted with oiled and waxed papers, which discolored and wrinkled over time. After the St. Gallen conference, the practice spread to the Library of Congress and throughout American institutions. Lightweight crepe silk has an open weave that creates translucency and allows text to be read through the lining. Historically, silking existed alongside tissue lining; some European institutions never adopted silking, instead continuing to perform linings and repairs with Japanese tissue (Smith 2016, 93). As the role of pH in paper degradation became more thoroughly understood in the 20th century (Ellis 2014, 256, 262; Smith 2016, 172), silking was gradually replaced with lamination procedures, tissue lining, and archival plastic sleeves.

In appearance and function, Jander's nylon lining is very similar to crepe silk. It has an open weave through which text may be read, and it reinforces fragile paper during

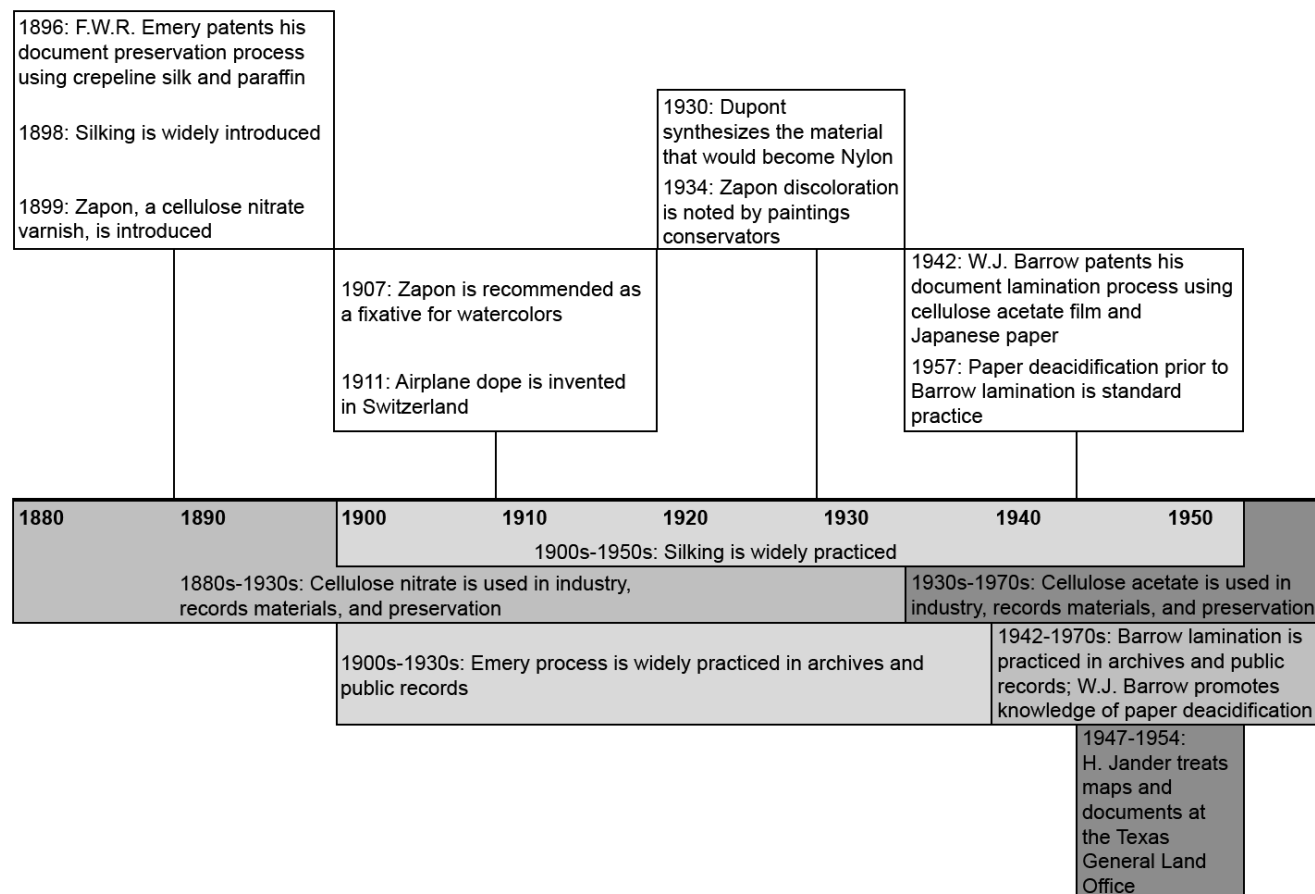


Fig. 13. A timeline of treatment practices and materials relevant to Harry Jander's work.

handling. Nylon is a synthetic, long-chain polyamide resin created for textile applications in the 1930s at DuPont. Nylon has low water absorption and twice the strength of cotton (CAMEO, "Nylon 6,6" 2016; CAMEO, "Nylon Resin" 2016). Soluble nylon was used in the mid-20th century as an adhesive, coating, and sizing agent in paper preservation (CAMEO, "Soluble Nylon" 2019). At the time of Jander's treatment, crepeline-style nylon was a relatively new material that might have seemed like an appealing and cost-saving alternative to silking, especially given Jander's background in textiles.

Zapon

Zapon was one of several synthetic varnishes used for paper preservation in the early 20th century. It was an early plastic popularized for preservation at the 1898 conference in St. Gallen, Switzerland, where silking was also widely introduced. A mixture of cellulose nitrate and camphor, Zapon was applied by immersion, brush, or spray to provide a barrier against moisture and mold and to reinforce weak paper. Concerns about Zapon emerged around 1910, given the

yellowing that occurred as cellulose nitrate deteriorated. However, preservation work with Zapon continued through the 1930s (Smith 2016, 99–104).

Zapon shares with airplane dope, a possible Jander ingredient, the common underlying materials of cellulose nitrate and cellulose acetate. These plastics had wide-ranging application in the early decades of the 20th century. Zapon was more widely used in Europe and the UK than in the United States. Perhaps Jander encountered it during his time in London.

The Emery Process

The Emery process was a paper preservation technique patented by F. W. R. Emery in 1896. From approximately 1900 to the 1930s, the process was prevalent in city, county, and government agency records ranging from New England south through the Carolinas (Smith 2016, 91). It also appeared in state, public, and academic libraries. The process involved lining a document with silk or tissue, then coating the lined document with paraffin to protect against damage from water and pests (Smith 2016, 85).

There were early concerns that Emery's treated documents would discolor, much like oiled and waxed paper repairs. However, Emery's company served many American institutions that lacked skilled preservation staff until its eventual closure in 1958. The treatment's decline resulted in part from the rise of the Barrow lamination process (Smith 2016, 90, 91).

Jander does not appear to have spent significant time in the Northeast or Mid-Atlantic regions of America, but his treatment strategy of combining a translucent, crepeline-style lining with a varnish-like coating shares much in common with the Emery process. The waxy feel and sheen of Jander's applied formula also bears a strong resemblance to the paraffin coating used by Emery.

Barrow Lamination

Like the Emery process, Barrow lamination was a patented preservation process used prevalently in government, public records, and state libraries. Beginning in the late 1930s, W. J. Barrow commercialized the practice of using heat and pressure to seal documents between layers of cellulose acetate plastic and tissue. The process strengthened weak paper for easier handling and was promoted as an easily scalable, inexpensive alternative to silking (Woodward 2017). In response to concerns about yellowing paper, Barrow added a deacidification step to his process in 1939 (Smith 2016, 351). By the 1970s, many institutions turned away from Barrow lamination in favor of encapsulation with Mylar and Melinex. This provided a less invasive and more easily reversible treatment method (Smith 2016, 362).

Barrow's lamination process was introduced at the Texas General Land Office in 1958, after the conclusion of Jander's work there (Alonzo, pers. comm., January 28, 2020). One of Barrow's lasting legacies was popularizing knowledge about the role of pH in paper degradation among librarians and collections managers. Given the discoloration and embrittlement observed in the documents Jander treated, it seems likely that this understanding of pH was critically absent from Jander's work.

CONCLUSIONS AND DISCUSSION

Although the riddles of Harry Jander's life and work may never be fully solved, some insights are now within reach.

Jander's handwritten recipe, discovered in his archival papers, includes no compounds that could be definitively identified by GC-MS or FTIR. Perhaps Jander had other uses in mind for this recipe. Perhaps the handwritten note was a partial shopping list. Perhaps the ingredients were used for their historic purposes as additives to his solution and have long since evaporated away. The distinctive medicinal odor observed in Jander's historical treatments likely resulted from castor oil and conifer resins rather than spirits of camphor, as initially suspected.

Cellulose nitrate was the central ingredient in Jander's mixture. It was strongly represented in the FTIR spectra below the 1700 wavelength. This material is consistent with the sheen and body observed in remaining Jander coatings, as well as their yellowing, discoloration, and solubility in acetone. Within Jander's biography, cellulose nitrate resonates as a component of airplane dope, a substance with which he likely gained experience during his time on Air Force bases in San Antonio and Austin, Texas. It is plausible that Jander's cellulose nitrate contained within it the phthalates detected in the coating sample. These phthalates would have acted as plasticizers.

Likely goals of Jander's treatment included improving handling (via the nylon lining and cellulose nitrate varnish); improving flexibility and reducing brittleness (via the plasticizers and castor oil); minimizing future moisture damage (via the cellulose nitrate varnish and conifer resins); and possibly controlling pest activity (also via the conifer resins).

Although treatment materials and methodologies have changed greatly, Jander's treatment goals have been shared by conservators and allied practitioners across many years and many styles of practice. Historically, Jander's treatment shared much in common with the Emery process of document restoration and with Zapon varnish. Like Emery, Jander applied a mesh lining and a protective coating to his documents. But instead of coating with paraffin, like Emery, Jander used a cellulose nitrate-based varnish like the 19th- and early-20th-century paper preservation treatment Zapon. Perhaps to modernize or economize on Emery's treatment, Jander lined his work with the relatively new material nylon instead of silk.

Jander's treatment also relates to Barrow lamination, the cellulose acetate-based preservation treatment that succeeded the Emery process. Like the Emery process, Barrow lamination was presented as a simplified, economical, scalable solution for public records like those at the Texas General Land Office. Given the timing of Jander's work at the decline of the Emery process and the rise of Barrow lamination, his treatment could even be conceptualized as a transitional technology between the two processes.

A number of Jander's possible ingredients were not identified by the type of GC-MS analysis (methylation) used. These include camphor, phenol, glycerine, alcohol, water, ether, sugar, salt, sodium bicarbonate, and paraffin. In some cases, the materials could not be identified or tested by GC-MS of a solid sample. Compounds in this category include water and alcohol. Detection of salts is not advised, as it can damage testing equipment. Other ingredients can be detected by GC-MS but were not pursued for this project. These ingredients include glycerine, sugar, sodium bicarbonate, and ether. These were not further investigated given the information obtained by the FTIR spectra, concise testing methodology, and limitations in accurate extraction and identification. Future testing could be formulated for these

ingredients. The remaining ingredients, including camphor, phenol, and paraffin, have been effectively ruled out. There is some chance that camphor and phenol could be methylated by a different solution, but the Meth-Prep 2 solution was chosen for this test given its proven ability to identify most cultural and historic materials.

Although Jander's processes and materials were not unreasonable within their era, modern treatment perspectives highlight serious problems in his work. Inherent in Jander's treatments are issues of acidity in paper degradation, cellulose nitrate instability, and the structural integrity of paper.

Acidity is a major focus in modern-day book and paper conservation. Low pH values create acidic conditions that underlie the browning and embrittlement often observed in paper's natural aging process. By coating paper in an acidic formula that became increasingly acidic over time, Jander intensified and hastened degradation issues. Acidity issues in paper became more popularly understood through Barrow's work in the 1950s. Perhaps due to the timing of his treatments, Jander seems to have been unaware of these concepts.

Cellulose nitrate posed a second preservation risk in Jander's treatment. This unstable plastic passes through degradation stages that include yellowing, stickiness, curling, embrittlement, powdering, and ultimately dangerous flammability. Cellulose nitrate-based roll film, such as motion picture film, poses severe flammability risks; it often requires specialized storage in a fire vault. Risks result in part from the high concentrations of self-catalyzing nitrogen oxide gasses within the densely rolled structure. Flammability risks are greatly reduced in flat materials with a lower density of cellulose nitrate (Williams 1994), such as Jander's treatments. However, caretakers of Jander's treated materials should still consider cold or frozen storage for cellulose nitrate at or below 40°F and 30%–50%RH (Adelstein 2004). Reversal of Jander's treatments might present a more thorough and economical preservation strategy.

A third, fundamental problem with Jander's treatment is the way it changes the nature of treated paper. Paper is made of strands of cellulose; the natural gaps that occur between these fibers contribute to the opacity and surface texture of the material. By filling these gaps with varnish, Jander changed the paper's refractive index, causing the increased translucency he noted. Jander saw this change as an improvement, making reproduction easier via blueprint or photostat. Modern conservation ethics argue conversely that such a fundamental structural change constitutes an unnecessarily invasive treatment. Specifically, modern treatment should be "suitable to the preservation of the aesthetic, conceptual, and physical characteristics of the cultural property" (AIC 1994).

Jander does not seem to have had direct training or experience in preservation, libraries, or archives. Despite this, he did use materials and mimicked practices that had precedent and relevance in document preservation in his era.

Today, conservators practice new solutions to many of the same preservation challenges Jander tackled in the 1940s and 1950s. Ultimately, modern treatments are best distinguished from those of Jander by the conservation tenet of reversibility. Should today's best practice become tomorrow's embrittled plastic, reversibility helps ensure the ongoing preservation of cultural materials.

ACKNOWLEDGMENTS

Special thanks to Daniel Alonzo and the Texas General Land Office, Richard Newman and Michele Derrick at the Museum of Fine Arts, Boston, and Chris Stavroudis and Michael Lee for sharing their thoughts during the authors' initial research.

NOTES

1. Meth-Prep 2 is a reagent widely utilized in the cultural heritage field consisting of a 0.2-N methanolic solution of m-trifluoromethylphenyl trimethylammonium hydroxide. The purpose of this solution is to methylate oils, fats, waxes, and some components of natural resins. This GC-MS method would not be able to detect any proteins, cellulose nitrate, or cellulose acetate, if they were present.
2. Compounds in the coating were identified by their retention time in GC-MS. In some cases, this was confirmed by comparing the peaks to known peaks from the MFA's in-house spectral library or the National Institute of Standards and Technology/Wiley Mass Spectral Library (Newman and Derrick 2020).

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SARAH NORRIS

Assistant Professor of Practice in Library and Archives
Conservation and Preservation

University of Texas at Austin, School of Information
Austin, TX

sarah.norris@ischool.utexas.edu

KATHRYN BOODLE

Associate Paper Conservator

Northeast Document Conservation Center

Andover, MA

kboodle@nedcc.org