Typewriter Inks: An Annotated Bibliography

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Technology and Structure of Records Materials

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December 6, 2006

Introduction

The typewriter was a widely used mechanism for committing text to paper for approximately 100 years, from about 1880 to 1980. Although still in limited use today, typewriters were largely eclipsed by affordable personal computers and word processing programs in the 1980s. Because the typewriter's heyday was a time of great change in the composition of both papers and inks, it is valuable to have a basic understanding of the typewriter inks that may be included in archival collections.

Information about the inks used in typewriter ribbons is scarce, and much of it is proprietary. As a result, the following annotated bibliography is divided into two sections. The first section focuses on typewriter inks, specifically their composition and testing, while the second focuses more generally on ink chemistry. It is hoped that future research on typewriter inks will open the door to effective usage of the ink chemistry resources.

The following is a brief summary of the findings of this research, as well as some of the author's conclusions about their significance for collections care:

- Typewriter inks are composed of a pigment, a vehicle, and other, proprietary components. Because of this basic formulation, they share general characteristics with printing inks.
- The pigment component is highly varied. Carbon black appears commonly and seems to be relatively lightfast and stable, but other pigments may display signature deterioration patterns. Some mentioned colorants include nigrosine, Ceres dyes, Prussian blue, methylene blue, malachite green, aniline dyes, and even iron gall pigments.

- The vehicle component is usually oil-based. Mentioned vehicles include glycerine, vegetable oils, castor oil, and even whale oil. A high oil content may cause yellowing and embrittlement of cellulose, especially in modern papers.
- Other ink components that may be present on a proprietary, case-by-case basis include plasticizers, aluminum powder, a Pyroxylin layer, additional oil, and others. These are the least-understood components of typewriter inks and could lead to unknown conservation issues.
- Typewriter ribbons were made of cotton through the early 1950s, when nylon was introduced to accommodate the increased wear caused by electric machines.
- Thin-layer chromatography is an effective testing method for separating typewriter ink components and attempting to identify both those components and the ink.

Typewriter Ink Resources

Brown, C.W. & Kirk, P.L. (1956). "Identification of Typewriter Ribbons." *The Journal of Criminal Law, Criminology, and Police Science 46*(6), 882-85.

Two criminologists seek a method to distinguish between inks in 10 typewriter samples. They wish to sample actual typed script in a minimally invasive way, rather than sampling ribbon itself. They establish that several-fiber samples placed in a capillary tube can be distinguished by color change with two reagents, acetone and ethylene chlorohydrin. The authors recognize two main components of typewriter ink, pigment and vehicle. While older inks were made of solid aniline dyes and glycerine, more contemporary inks contain ground pigments like lampblack, coal-tar dye lakes, Prussian blue, methyl violet, methylene blue, malachite green, safranite, nigrosine, Ceres dyes, oil soluble dyes, iron gall pigments, and others. Vehicles can include oleic acid, castor oil, whale oil, Vaseline, soap, and glycerine. Plasticizers like tricresyl phosphate and high molecular alcohols may also be present.

Brunelle, R.L.; Negri, J.F.; Cantu, A.A.; Lyter, A.H., III (1977). "Comparison of Typewriter Ribbon Inks by Thin-Layer Chromatography." *Journal of Forensic Sciences 22*(4), 807-14.

Forensics researchers demonstrate that thin-layer chromatography can reliably distinguish between typewriter inks, though it cannot link an ink sample to a specific manufacturer. Ink samples of the same color from different manufacturers demonstrate very different TLC results due to the presence of different dye components. (This phenomenon is shared with ballpoint and other writing inks.) Further, ink samples of different colors from the same manufacturer also show different TLC results. Surprisingly, different TLC results also manifest in different batches of the same color ink from the same manufacturer. The authors find that in many cases, less that one typewritten character is required for an effective test, and that none of the seven manufacturers whose ribbons were tested produced matching ink formulations (note discrepancy with Varshney below.)

Doyle, A.M. (1906). "Notes on Typewriter Ribbons." *Journal of the American Chemical Society 28*(6), 706-14.

A chemist at the US Department of Agriculture collects new and used typewriter ribbons from within his department to examine the durability of the ribbons, the composition of the inks, and the permanence of the type when exposed to sunlight and other chemical stressors. 43 ribbon brands from 19 manufacturers are represented. The study divides the ribbons into the following types: record ribbons ("mainly black record,") and copy ribbons (including indelible copy, black copy blue, blue copy, purple copy, and an "other" category.) Components separated from the inks include ash, lampblack (record and copy,) dye, and oil. The author seems to expect to find these components, as he is not testing for their existence, but instead

for their percent presence in each sample. He also notes that fabric quality affects ribbon longevity. Samples produced by records ribbons and copy ribbons with a high percentage of lampblack demonstrate high permanence, but copy ribbons with a high percentage of dye fade almost completely in sunlight.

Ellis, Carleton (1940). *Printing Inks*. New York: Reinhold Publishing Corporation. 412, 16-17.

An industrial research chemist attempts to summarize chemical information about printing inks in order to fill an observed gap in the literature. Topics include ink components, like driers and pigments, and ink types, such as intaglio, transfer, and emulsion. Two brief sections on typewriter and ribbon inks note their similarity to printing inks (under the larger umbrella of "duplicating inks") and stamp-pad inks (which are non-drying and very diffusible into paper fibers.) To prevent excessive solvent evaporation and ink loss on the paper during typing, ribbons may include a coating of aluminum powder, a Pyroxylin layer, or additional oil. Ribbon ink may be prepared by mixing ammonium salt (like chloride or carbonate) with wax, oleomargarine, or stearin, and a coloring substance like carmine or cochineal. Another possible recipe includes salt of copper, iron, manganese, or aluminum added to a solution of aniline dye in resin soap, dissolved in turpentine. Other ingredients may include castor oil or whale oil to retard drying, ultramarine to enhance absorption and decrease smudging, and tricresyl phosphate and higher molecular alcohols as plasticizers.

Lehner, Sigmund (1926). *Ink Manufacture, Including Writing, Copying, Lithographic, Marking, Stamping, Typewriting and Laundry Inks.* London: Scott, Greenwood & Son. 93-96.

A German author describes the history and manufacture of multiple kinds of inks. Typewriter inks are described as similar to printing inks. These inks should not include acids and alkaline elements so as not to attack the metal type. A brief history states that older inks contained aniline dyes and glycerine, but over time the glycerine absorbed moisture and the impression blurred. Later, oil-soluble dyes were used. Older pigments for black ink included oil-soluble nigrosine, while colors employed Ceres dyes. Later inks used lampblack, coal-tar dye lakes, Prussian blue, zinc white, methyl violet, methylene blue, malachite green, and safranin. Several recipes are given; all include oil or glycerine, and some are linked to German patent numbers. The author also states that chemical processes are used to create ferrogallic typewriter inks.

Mitchell, C.A. & Hepworth, T.P. (1916). *Inks, Their Composition and Manufacture*. London: Charles Griffin & Company, Ltd. 2nd ed. 233-4.

The authors provide contemporary information on inks and their history, materials, recipes, and chemistry. Typewriter ribbon inks are stated to be less permanent than iron gall inks, but those with carbon pigments will resist the effects of chemical

agents. Common varieties are found to include strong solutions of aniline dyes in water and glycerine to prevent drying. Other common ingredients are nigrosene, methyl violet, methylene blue, and induline blues. A given recipe calls for 100 grams of dye heated with equal parts glycerine and water until dissolved. The ink is cooled and if dye crystallizes, more glycerine is added and the mixture is heated. The process is repeated until a cold saturated solution is achieved. Weak type may be caused by too little glycerine. Blurring and smudging may be caused by too much glycerine. Dirty, gritty, or irregular type may indicate that the dye is not fully dissolved.

Report of the Commissioner of Public Records, vol.2 (1890). Boston: The Commonwealth of Massachusetts, 28-33.

A Massachusetts state report from 1890 examines the stability and permanence of public records created with a typewriter, and features the comments of Thomas Antisell, Examiner of the Chemical Division in the state. Antisell speaks with an unidentified manufacturer of typewriter ribbons and several local records clerks. He finds that black typewriter ribbons produce type that is resistant to fading in light, but that colored type is light-fugitive. This is confirmed by tests conducted by local records clerks who purposely left typewritten samples outdoors for observation. Typewritten text is considered more durable than handwritten text because it is more firmly pressed into the paper. It is found to withstand steam moderately well, while handwritten text runs immediately. Antisell also believes that writing inks are more likely to contain acidic components than typing inks, and states that aniline-based inks should be avoided due to their tendency to fade.

Richlin, Milton & Felipe, Martin (1987). "Vehicles for Printer Ribbon Inks." *American Ink Maker 65*(5), 14, 16, 18, 48.

This short study establishes that oxygenated vegetable oils (made from rapeseed, castor, soya, and linseed) may be used as liquid vehicles for ribbon inks for use in printers or typewriters. The research is sponsored by The Degen Co., a processor of raw and polymerized vegetable oils. The article provides a brief history of the materials used in typewriter ribbons and establishes that the liquid vehicle is the unifying requirement of different kinds of typewriter inks. It also demonstrates several ways in which typewriter ribbons may be tested, such as comparison of pigment paste viscosities, comparison of oil viscosities after accelerated aging, comparison of print density between different ink formulations after accelerated aging, and comparison of different ink formulations made with specified liquid vehicles.

Tholl, Joseph (1970). "Applied Thin-Layer Chromatography in Documented Examination." *Police 14*(4), 6-16.

A documents examiner and forensics specialist discusses the suitability of thin-layer chromatography for identifying unique ink samples. Several methods are discussed,

as well as TLC's applicability to typewriter inks. TLC should take place on silica gel, with an acetone extraction solvent and a developing solvent of 85 parts acetone to 15 parts chloroform. Multiple tests may be required due to the small test samples, and airtight testing jars are required to avoid evaporation. Spot tests on alumina, silica gel, and cellulose layers are effective. Typewriter inks may reveal surprisingly complex separation patterns.

Varshney, K.M.; Jettappa, Tonni; Mehrotra, V.K.; Baggi, T.R. (1995). "Ink Analysis from Typed Script of Electronic Typewriters by High Performance Thin Layer Chromatography." *Forensic Science International 72*(2), 107-15.

A forensics study conducted in India attempts to establish thin layer chromatography as a method for identifying an electronic typewriter by analyzing its script. The study examines script samples from seven typewriters and finds that all but one of the samples, the one from the National Panasonic R machine, display the same spectral patterns. This leads the authors to infer that major manufacturers in India may obtain their ink ribbons from only two suppliers. They note that a similar trend may exist in other countries, though the small number of suppliers may exceed two in those places.

Wich, Emil A. (1966). "Dyes for Inks." *American Ink Maker 44*(2), 30-2, 34-6, 66.

The author, from Sandoz Laboratories, conducts a survey of the kinds of dyes used in varying types of inks. The first section of the paper focuses broadly on types of dyes and their characteristics, including acid dyes, basic dyes, and solvent soluble dyes. The second section very briefly examines specific ink applications, including, among others, typewriter ribbon inks. The author states that these inks are made mostly of carbon black shaded with nigrosine and induline bases, which are dissolved in oleic or some other type of fatty acid. Dyes used to shade blue, violet, and red ribbons are Victoria Blue Base, Methyl Violet Base, and Rhodamine Base. Other ink applications discussed include ball point pen inks, gravure inks, printing inks, and stamp pad inks.

Ink Chemistry Resources

Flick, Ernest W. (2005). "Paint & Ink Formulations Database." CD-ROM. Norwich, New York: William Andrew Publishing.

This CD-ROM database includes entries for many categories of paints and inks, including enamels, primers, stains, and printing inks. Information is categorized in four ways: products, suppliers, chemical category, and ingredients. Most provided information is cross-linked within the database. Clicking on an entry leads to a list of its other appearances in the database. The information is augmented by searching, sorting, and filtering tools.

Flick, Ernest W. (1985). *Printing Ink Formulations*. Park Ridge, New Jersey: Noyes Publications.

Flick's 1985 work is a collection of 319 ink formulations supplied by industrial companies. Most entries include a listing of raw materials, the percent weight of each raw material, formulation notes, key properties, and the formulations source. Sections of the book focus in types of inks, such as gravure, letterpress, offset, and others. Later sections provide chemical descriptions of trademarked raw materials and contact information for the suppliers of these materials.

Kunjappu, Joy T. (2001). *Essays in Ink Chemistry (For Paints and Coatings Too)*. New York: Nova Science Publishers, Inc.

A chemist collects 15 of his articles written for the ink and paint industries. Some of these articles originally appeared in journals such as *American Ink Maker*. Topics focus on the chemistry of ink composition, and include surfactants, polymers, pigments, colloids, fluorescence, and foaming, among others. Works cited are included. Chemical formulae and illustrations accompany the text. This source does not aim to present an inclusive explanation of ink chemistry, but simply to offer insight on several important and sometimes overlapping topics.

Laden, Patrick (Ed.) (1997). *Chemistry and Technology of Water Based Inks*. New York: Blackie Academic & Professional.

Contributors from the ink making industry supply essays on specific topics in water based ink chemistry. Foci include environmental impact of ink production, methods for calculating and expressing color difference, ink components (such as pigments, solvents, and additives,) types of ink (such as flexographic and carbon black,) and issues of pigment particle size and viscocity. Diagrams demonstrate testing apparati, chemical structures, and testing results. Appendices offer an ink maker's trouble-shooting guide for common problems in ink performance, as well as ink formulation information supplied by Ernest Flick.

Wells, Andrew M. (1976). *Printing Inks: Recent Developments*. Park Ridge, New Jersey: Noyes Data Corporation.

A patent-based survey of printing ink information provides an alternative source of patent information that is more conveniently accessible than actual patent records. The survey focuses on the years 1965 – 1976. The content is organized both by ink components and types of ink. Ink types are linked with specific applications where possible, like newspaper inks and jet printing, but not typewriters or ribbon inks. Entries first provide a brief description of their basic concept or process, and then present summaries of relevant patent information, with patent holders' names, patent numbers, and patent dates provided. Indices allow searching by company name, inventor name, and patent number.