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IDENTIFICATION OF TYPEWRITER RIBBONS*

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Mrs. Charlotte L. Brown, a member of the staff of the School of Criminology, University of California, has collaborated with Dr. Kirk in the research and presentation of several articles that have appeared in this Journal during the last few years. Two of these, which appeared in volume 45, dealt with methods of identifying various types of writing inks.

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In the examination of typewritten documents it is frequently desirable to determine that a particular ribbon was used, that two or more documents were prepared with the same ribbon, or that more than one ribbon was used in preparing a single document. It is sometimes possible to identify an individual ribbon by thread count with magnification of the typed material. This procedure is often not possible, and at its best will not aid in the determination of the brand of manufacture of an unknown ribbon.

Typewriter ribbons are made by impregnating a thin silk, cotton, or Nylon ribbon with a mixture of colors in a vehicle so chosen as to avoid:

1. Clogging of the type,
2. Smearing, blurring, or feathering of the impression,
3. Drying on the ribbon,
4. Remaining wet on the paper, and
5. Fading or obliteration of typed material.

If the vehicle diffuses rapidly into the paper fibers and holds the pigment in a semi-moist condition, these requirements are approximately met. Solid aniline dyes and glycerine were used at one time, but led to blurring of the impression and have been replaced by various other mixtures (1, 2).

Pigments utilized in typewriter ribbons at present are largely *ground pigments*, and include lampblack, coal-tar dye lakes, Prussian blue, methyl violet, methylene blue, malachite green, safranin, etc. Nigrosine has been used, as have the Ceres dyes, oil soluble dyes, and iron-gall pigments (3). The vehicle is more critical to good results and includes a variety of combinations of non-drying constituents such as oleic acid, castor and whale oils, vaseline, soap, and glycerine. Tricresyl phosphate and high molecular alcohols are sometimes used as plasticisers, and it is probable that some newer synthetic compounds may be found in modern ribbons.

Because of the variability of the dyes and their ready detection and study, as compared with the vehicle, it is apparent that the characteristics of the dye mixture are more suitable for identification purposes than are those of the vehicle which are

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more difficult to study. Because the presence of the vehicle can modify any test method used, it is not possible to disregard it.

Experimental

A total of ten different ribbons was obtained for study. This does not represent all of the commercially available ones, but included all that could be found in the local market. It must further be remembered that ribbons are sometimes re-inked, and this will introduce complications in any testing that involves such ribbons. The ten ribbons, all black, were:

Bell	for	Royal portable
Progress		Royal 10
Miller		Smith-Corona office
Carter's Five O'Clock		Royal portable
Stafford Ser-Vus		Underwood
Grand Prize		Remington portable
Value		L. C. Smith
Progress 50		Underwood
Tagger		Royal
Colonial		—

Several approaches to the identification were tested. Reagents applied directly to typed material were found to distinguish the ribbons quite well. The tests were not studied completely because significant defacement invariably resulted. Paper chromatography was attempted since the type of system would seem very suitable for this approach. It was found impossible to remove enough ink from the typed material to apply this technique without serious defacement. On the other hand, chromatography proved to be an excellent method of carrying out fundamental studies of the constituents of the ink when small pieces of the original ribbon were used. Since this is important information, such a study was made of the ribbons themselves. Furfural was found to be the most satisfactory solvent for removing the ink from the ribbon and transferring it to the paper. Horizontal circular paper chromatography as described previously (4) was employed with various developing solvents. The most satisfactory were ethyl acetate:ethyl alcohol:isobutyl alcohol (1:1:½) and o-toluidine:1,2-dichloroethane (1:1) acidified with HCl. All ribbons tested in this way gave characteristic patterns which were individual and served to identify the ribbon used.

Zone electrophoresis on paper (5) has also been found valuable in the identification of writing inks and was tested with typewriter ribbons for this reason. As with chromatography, insufficient ink could be removed to yield satisfactory patterns except when small fragments of original ribbon were soaked in furfural and applied to Whatman # 1 paper. The presence of vehicle prevented normal results. The only method that gave interpretable patterns was to pass current through the sample with 0.01 M borate buffer for about 30 minutes with the paper exposed to open air, and then a drop of concentrated hydrochloric acid was added to the sample, after which rapid migration occurred. Application of the acid initially did not produce this effect. Five ribbons studied yielded individual patterns that would serve for direct identifica-

Table 1

COLORS IN VARIOUS SOLVENTS

Ribbon	Reagent			
	1,2-dichloro-Ethane	Acetone	Iso-butyl Alcohol	Ethylene Chlorohydrin
Bell	blue	blue	blue	turquoise
Carter's	lavender	lavender	lavender	blue
Grand Prize	blue*	lavender	lavender	purple
Progress	lavender*	—	lavender	purple
Miller	lavender*	—	lavender	blue*
Stafford	lavender*	—	—	blue
Value	lavender	lavender	—	turquoise
Progress 50	lavender	lavender	lavender	blue*
Colonial	light blue	light blue	lavender*	blue*
Tagger	light lavender	—	lavender	turquoise

* Denotes only faint color formation

tion of the ribbon. They would not serve for identification of ink removed from a document.

A simple solvent method was found which was applicable to very minute amounts of ink removed from a document, and which was sensitive enough to obtain definite identification of all ten ribbons studied. The sample was obtained by removing a few paper fibers carrying ink by means of jewelers fine tipped forceps. These could be taken from periods under the stereoscopic microscope and gave no visible defacement. Two or three of the fibers were placed in a capillary tube about 1 mm. in diameter and sealed on one end. A small drop of the appropriate solvent was added to the capillary and thrown to the closed end of the tube by a quick flip with the fingers. It was essential that only a little liquid and about the same amount for each tube be used in order to obtain sufficient color for accurate comparison. Four solvents were studied, 1,2-dichloroethane, acetone, iso-butyl alchol, and ethylene chlorohydrin. Table 1 shows the colors obtained with the various ribbons in these solvents.

Only two solvents, acetone and ethylene chlorohydrin, were necessary for complete identification of the ten ribbons studied. Standards of 1 week and 1 month in age

Table 2

IDENTIFICATION SYSTEM

	Ethylene chlorohydrin	Acetone
Bell	turquoise	blue
Value	turquoise	lavender
Tagger	turquoise	no effect
Carter's	blue	lavender
Stafford	blue	no effect
Grand Prize	purple	lavender
Progress	purple	no effect
Miller	slight effect	no effect
Progress 50	slight effect	lavender
Colonial	slight effect	light blue

yielded the same results. Utilizing only the colors obtained with these two solvents, the scheme shown in Table 2 was devised to apply to an unknown ribbon. It is desirable that blanks with known ribbons be run simultaneously in order to assure accurate appraisal of the colors produced.

Summary

A scheme is presented which allows for the individual identification of a typewriter ribbon by applying color tests to a few fibers pulled from the surface of typed material. The tests were performed on a very small scale so that the document was not visibly altered. A study made on 10 ribbons showed that each could be identified by the use of two reagents, acetone and ethylene chlorohydrin. Chromatographic and electrophoretic procedures are presented which are useful when actual ribbon is available for study.

REFERENCES

1. Ellis, Carleton, Printing Inks, Scranton, Pa., Reinhold Publ. Corp., 1940.
2. Mitchell, C. A., Inks, Their Composition and Manufacture, London, Chas. Griffin & Co., 1916.
3. Lehner, Sigmund, Ink Manufacture, London, Scott, Greenwood & Son, 1926.
4. Brown, C. L., and Kirk, P. L., J. Crim. Law, Criminol., & Pol. Sci., *45*, 334 (1954).
5. Brown, C. L., and Kirk, P. L., J. Crim. Law, Criminol., & Pol. Sci., *45*, 473 (1954).