J Forensic Sci, Oct. 1973, Vol. 18, No. 4

J. F. McCarthy,[1] *M.S. and Janis Winchester,*[1] *B.A.*

The Autopen

Throughout history the problem of affixing signatures to numerous documents has been solved in many ways. Roman emperors, Spanish kings, and others used a metal stamp to affix their marks to a document. The monarchs of France began the practice of employing secretaries for this purpose. Presidents of the United States have also seen fit to empower amanuensis, stamps, and the "Autopen" to aid them is signing their voluminous work load. It has been stated that Andrew Johnson was the first president to have a facsimile of his signature printed on a document. He also authorized the signing of his signature on land grants, and the use of a rubber stamp signature for commissions and other documents not signed by his secretaries [*1*].

In the eighteenth century, a Friedrich von Knaus allegedly invented a "successful writing machine" which with the aid of a pen simulated genuine signatures. Others to experiment with such a machine were Robert Houdin, the French magician, and P. T. Barnum, the circus impressario. In 1916 P. M. Durand patented a machine known as the "Signo" and in 1946 M. F. Wiesendanger devised an instrument which could write whole sentences and affix signatures [*2*].

In 1958 R. M. De Shazo invented a machine capable of affixing 3000 signatures in an eight hour day. This machine, called the "Autopen," is the subject of this investigation.

The Autopen originally presented problems to autograph collectors; however, this group has long been aware of the existence of these "genuine forgeries" and has cataloged the most important [*3*].

The apparent authenticity of Autopen signatures adds still another dimension to the scope of information required by the Examiner. The document examiner must now be aware of the existence of this instrument and the appearance of the signatures it produces.

The Autopen is a relatively common machine. According to its manufacturers it is used not only by governmental agencies and public officials, but is also used by insurance companies, airlines, fund raising organizations, etc. The State of Florida, for example, has two such machines, one of which was purchased in 1971 at the cost of $1,290.00. In addition to the machine, the only other items necessary to affix signatures are a matrix, containing an impression of the signature desired, and a writing instrument. A nib pen is supplied with the machine but other types can be and are being used. The matrices are purchased at a cost of $60.00 for heavy duty or metal disks, and $40.00 for a signature recording on a plastic matrix. The Secretary of State of the State of Florida, the Honorable Richard (Dick) Stone, has nine different matrices capable of producing his signature in nine different ways.

Presented to the Document Section at the 24th Annual Meeting of the American Academy of Forensic Sciences, Atlanta, Georgia, 3 March 1972. Received for publication 11 Dec. 1972; accepted for publication 1 Feb. 1973.

[1] Document examiners, Crime Laboratory, Florida Department of Law Enforcement, Tallahassee, Fla.

Optional equipment is available with the machine (for example, a storage locker for the matrices and a counter to record the number of signatures which have been affixed). Both of these are apparently intended to provide some security to the process.

The firm manufacturer (International Autopen, Arlington, Va.) also provides a service contract (for $200.00 a year) which includes semiannual checking of all parts and aligning of the machine. The effect on the written signature of this service is not definitely known at this time nor is the effect of wear between the first signature affixed by the matrix and the last.

To obtain a matrix containing a facsimile of one's signature, the Autopen Company provides forms requesting two signature samples and the authorization to cut a signature recording by the individual. The purpose of the two signatures is not known. However, matrices of both signatures can be cut.

Operation of the Autopen

The model reported on in this paper is Model M-60 of the International Autopen Company bearing Serial #78871 (see Fig. 1).

The document to be signed is placed over a transmitted light source (used to position signatures on documents) and under a guide which holds the paper firm at one end. The other end of the paper is held by the operator. The pen supplied with the machine is a fountain pen with an Esterbrook 2668 Firm, Medium Solid Duracrome point. However, fiber-type pens, ball-point pens, pencils, and even carbon paper can be used to effect signatures.

A matrix containing the signature is placed on a circular turntable about 2 ft in diameter which revolves at optional speeds. The instrument can be set to affix a single signature or can be placed on Automatic and will continue to sign at brief intervals as fast as the operator can push documents under the pen.

The matrix is a metal or plastic strip about 3 to 4 in. in width molded into an incomplete circle, also about 2 ft in diameter. The strip, which lies flat, has an irregularly wavy edge. Pegs on either side of the matrix are displaced by these waves as the matrix revolves between them. Each peg is attached to an arm, both of which are attached to the pen holder. Interaction of the two arms as the pegs are displaced causes the formation of letters.

Pen lifts for word spacing and diacritical marks are accomplished by means of a raised ridge on top of the matrix. As the matrix rotates, a trolley wheel runs along the ridge. Dips in the ridge cause the trolley wheel to drop, thus, by means of springs, pushing up a bar that lies underneath the writing apparatus. The upward motion of the bar lifts the pen from the paper.

Motion from left to right is accomplished by a special relationship of the turntable and the matrix. The circle described by the turntable is the fixed point of reference to the writing mechanism of the machine. The pegs that cause pen movement move only toward and away from the center of this circle. The trolley ridge on the matrix follows this circle. However, the circle described by the matrix itself does not coincide with the turntable circle. The two circles coincide at only two points—one at the apex of the horseshoe-shaped matrix and another on the other side. (The latter point is of no interest since the circle of the matrix is incomplete there.)

The significance of the fact that these circles are out of phase is that more of the matrix lies on one side of the reference circle than on the other. This causes the peg on that side to be more displaced and to push the pen to one side of the signature space. As the matrix rotates this displacement becomes less and less until, at the apex of the horseshoe, displacement is equal for the pegs and the pen is at the center of the line of writing. Then

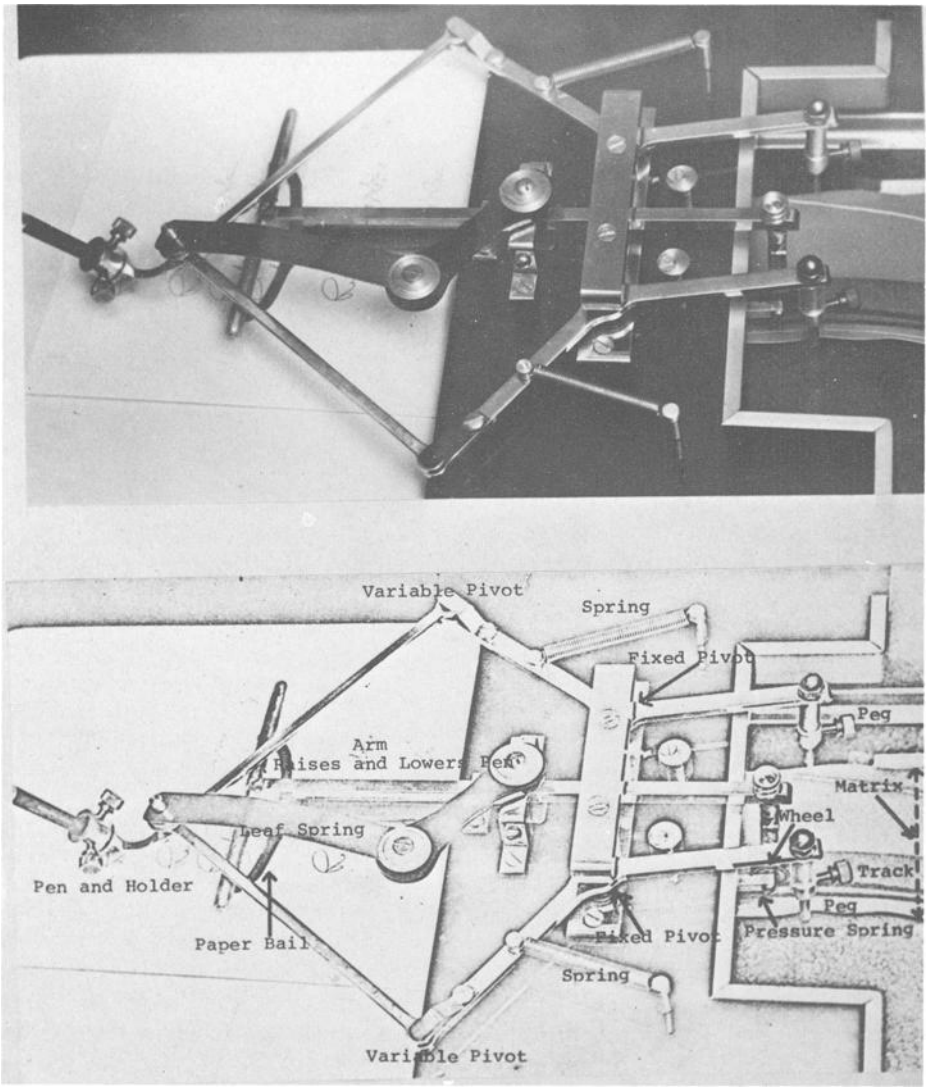

FIG. 1—(Upper) *The working parts of the Autopen*, (Lower) *nomenclature assigned by authors.*

displacement gradually becomes greater on the other peg and the pen continues on to the end of the signature.

Matrices capable of producing inverted signatures can also be obtained. These are employed to execute signatures near the bottoms of large documents. The position of the writing instrument with respect to the document is not changed. The direction of writing, however, is reversed. No adjustment of the machine is needed for use with an inverted signature matrix.

One effect of prolonged use of a matrix appears to be grinding off of the edges. Small pits and dents introduce an additional tremorous quality in the signature produced. It is

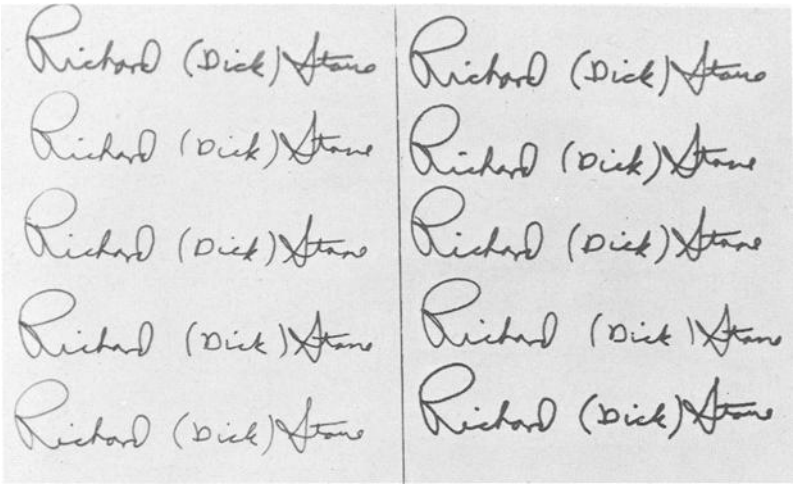

FIG. 2—*Singatures obtained from five different matrices on two different dates. Those in the right hand column were executed seven months after those in the left hand column. Note particularly the change during this period in the form of the loop at the top of the "S" in the two signatures in the bottom row.*

possible that as the edge wears away, letter forms change. This is most noticeable in loops, which may become larger or smaller, depending on which edge is wearing away (see Fig. 2).

Variations Obtainable with the Autopen

1. Any kind of writing instrument may be used.
2. Speed of execution—varying from about 10–20 s. (Note: The speed control of the instrument studied was not functioning properly. These speeds have been arbitrarily assigned numbers from 0 to 100 by the manufacturer.)
3. Single signature or "automatic" signature settings. (The latter provides a time lapse sufficient for the operator to remove one sheet of paper and insert another with the wheel in constant motion.)

The Signature Itself

None of the above variables, when employed, causes any significant change in the finished product. However, if the machine is working at top speed, the "o's" and the "a's" may fill in with ink.

The greatest observable differences are those introduced by the operator of the machine (Fig. 3*b*). A pen placed too high in the clamp will not execute certain portions of the written line (Fig. 3*c*). A pen placed too low within the clamp will produce additional lines not noted when the pen is adjusted to the right height (Fig. 3*d*). Further, if the operator happens to move the paper during the production of the signature, different letter forms and spacings are introduced. If the paper upon which a signature has been affixed is not removed after the matrix has made one complete revolution, usually when the machine is on Automatic, a second signature will be affixed. If the paper has not been moved by the operator, the second signature will exactly superimpose over the first. However, any slight movement by the operator will result in unusual designs (Fig. 3*e*).

Before a signature is actually affixed to the paper, the manufacturer suggests that the operator make a trial run executing a sample signature on the illuminated glass. This trial

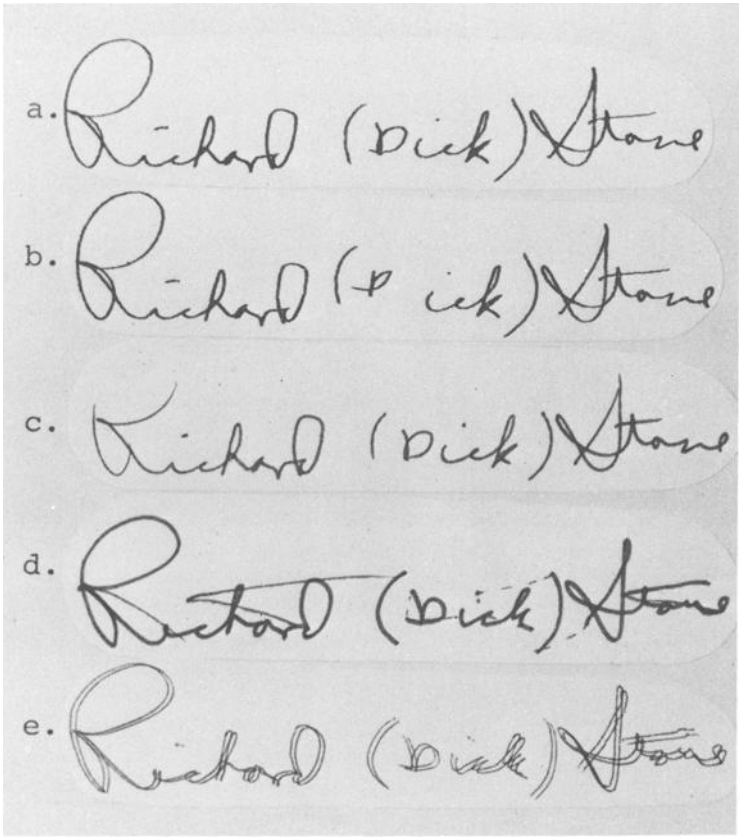

FIG. 3—*Some characteristics of operator mistakes.* (a) *Normal execution,* (b) *paper slipped during preparation of nickname,* (c) *pen too high in holder,* (d) *pen too low in holder,* (e) *failure to remove paper, but paper itself moved prior to execution of second signature. (Note: The two lower signatures are from a different matrix than the upper signatures).*

signature is visible through normal weight business paper and assists the operator in positioning the signature on the document to be signed. As a result of this procedure, traces of ink can often times be found on the backs of Autopen signatures, this ink originating from the ink deposit on the trial run.

One should bear in mind that the pen actually makes indentations in the paper not unlike that found in normal writing; thus, some picking up of paper fibers may appear in unusual places along the written line. When a ball point pen is used the usual tracks and "goop marks" do not appear or at least do not look "natural."

On certain of the signatures examined, the pen pressure and shading is unnatural. For example, it may appear equal on both upward and downward strokes.

The reason(s) for the appearance of shading in the completed signature is (are) not as obvious as the balance of the processes involved in the creation of a signature executed by this machine. One theory is that it is produced by the different vectorial forces applied by the leaf spring when the pen is being pushed forward on the writing surface as opposed to those applied when the motion of the pen is to the right or left or downward.

As far as line quality is concerned, Autopen signatures exhibit a certain spidery or shaky appearance, but this is not sufficiently characteristic, insofar as this limited study is concerned, to form the basis of an opinion from an examination of a single sample that a signature was executed with an Autopen. Nevertheless, it is a strong cue as to the possible origin of the signature.

The spidery lines appear to be a function of the smoothness with which the pegs, arms, and levers move. Thus, if a signature requires many changes in direction such as, in the name Richard (Dick) Stone one is more apt to encounter an apparent tremor in the written line than is found when the matrix is only required to write the name Dick (Fig. 4). The reason for this lies in the fact that the Autopen takes as long to write the latter nickname as it takes to write the whole name. Therefore, since the changes in direction are less abrupt, there is a greater smoothness in the lines drawn by the pen.

Two basic identification problems can arise from Autopen signatures. The first involves the submission of Autopen signatures as known standards. If signatures from several matrices are used, the document examiner may not realize he has Autopen "standards." The use of such standards could, of course, lead to error.

Another question that can arise is whether a particular signature was executed by an Autopen and if so, whether it was made with a particular matrix. This is a relatively simple question to answer, if standards are available that were executed with the matrix at about the same time as the questioned signature. Signatures executed with the same matrix at the same time are superimposable. However, as noted previously, wear on a heavily used matrix can alter letter forms within a few months. Then the question becomes one of whether the differences noted can be explained away as due to wear, or whether they imply use of a different matrix.

It appears at this time that the only way to definitely prove that a single signature is an Autopen signature is by comparing it with another signature of the same pattern. This, of course, requires that the examiner be aware of the existence of the Autopen and the number of matrices manufactured containing an individual's signature.

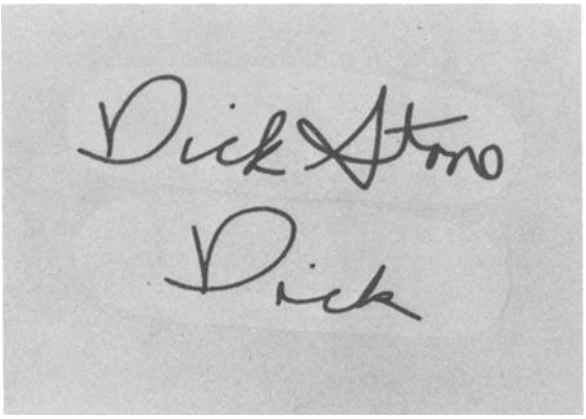

FIG. 4—*Specimens of signatures executed with two different matrices which write only portions of the formal signatures shown in Figs. 2 and 3. Note the improvement in line quality as the amount of writing decreases.*

Legality of Autopen Signatures

According to a brochure of the International Autopen Company, the robot writer "is as legal as though you signed the paper yourself." They cite as an example that a state bond issue was signed by the machine and the State's Attorney General passed upon the legality of the signature. It would appear, however, that the controlling factor in determining legality is one of consent on the part of the individual whose signature is being affixed just as it is with any other proxy signature.

Summary

The personal touch of a signature of the type produced by the Autopen is vastly superior in the mind of the recipient to that given by an obviously printed or stamped signature. Therefore, it is probable that in the near future form letters of charitable organizations, collection agencies, etc., may soon have a totally handwritten appearance.

It is noteworthy that the manufacturer represents the sameness of the signature as a safety feature since "no man ever signs his name precisely the same way twice."

The popularity of the Autopen will result in the creation of new problems for document examiners. For example, "Was this matrix used to effect this signature?," "Is this Autopen signature consistent with the date on the document?" are questions which will be presented by examiners in the immediate future.

References

[1] Hamilton, Charles, *Collecting Autographs and Manuscripts*, University of Oklahoma, Norman, 1961.
[2] Hamilton, Charles, *The Robot That Helped To Make A President*, Charles Hamilton Autographs, New York, 1965.
[3] Hamilton, Charles, *Scribblers and Scoundrels*, Paul S. Eriksson, New York, 1968.

Crime Laboratory
Florida Department of Law Enforcement
P.O. Box 1489
Tallahassee, Florida