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The Effect of Interchanging Segments Between Two Typewriters: A Unique Criminal Defense Defeated

Typewriting problems can take unusual turns in some cases. Routinely we identify machines and at times are called upon to make some estimate of the date of typewriting or of its continuity. To this writer's knowledge, however, no one has been faced with the problem of showing that a typewriter involved in a criminal case had actually been rebuilt during trial in an endeavor to substantiate the authenticity of fraudulent documents.

In a recent New Jersey trial the segments of two IBM typewriters were interchanged. The ultimate proof of the manipulation was made by technical men on the IBM staff. But by study of typewriting from the machines it was also possible to show some relationship between the altered machine and its original state, despite the fact that the altered machine typed differently from either typewriter after the segments had been interchanged. (The second was assembled in only a semioperative condition and only limited but important testimony was produced concerning it.) As the case developed it became unimportant to present expert evidence concerning the basic differences between the altered machine and the questioned material, even though a defense expert had testified they were identical, but this could easily have been done. In this paper consideration will be given to the differences and similarities between the altered and original machines.

Significant Case History

A few brief facts will set the stage:

1. The criminal prosecution in the *State of New Jersey v. Yormark and others*² involved two lawyers and two doctors who were accused of insurance frauds. However, Yormark, an attorney, was the chief defendant.
2. There had been a series of these frauds committed by lawyers and insurance company representatives filing and processing false accident claims.
3. In this case there were in question the typewriting of several carbon copies of typewritten letters, three carbon copies of three general releases, as well as three typewritten cancelled checks made payable to false claimants in Yormark's files. All were dated in 1967. (Other document problems involving forged signatures will not be further considered in this paper.)

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²The trial lasted three months, from mid-September through December 1970, and was heard by jury; Judge Fusco presided; and Alan Silber, Assistant Prosecutor, Essex County, N.J. supervised the investigation of the case and handled the trial presentation for the State.

The prosecution suspected that the Yormark file contained several copies of fictitious letters inserted to bolster the defense. Among the defendant's documents a 1967 letter to an employee of one insurance company appeared to be authentic. So were the three checks on Yormark's account which were cashed shortly after they were drawn. These four documents and copies of the general releases and two file cards were all typed on the same machine and constituted the 1967 documents. A second group of "fictitious" letters, including two to claimants, were prepared on a second typewriter. These, too, were dated in 1967 but their dates were suspect. It was this group that the prosecution set about to challenge.

The field investigation was extensive and thorough. The defendant attorney had a very active practice, and a quantity of his 1967 to 1969 pleadings were withdrawn from the court files. In addition, correspondence with other insurance companies, especially in the 1969 period, was assembled. With this supply of authentic typewriting it was possible to show that the group designated above as the 1967 documents had been prepared on a typewriter in use in 1967 and throughout the ensuing years. The standards revealed at least six other typewriters which were used during part of the period under consideration.

Work from the second typewriter (that is, the fictitious letters) did not appear among the known documents until 5 Aug. 1969. The investigation of this case began in the early part of 1970. By itself this was a strong suggestion that this group of documents had been manufactured for the defense of the case.

Additional field investigation, coupled with the testimony of Yormark's chief secretary-office manager, established a list of all typewriters with their serial numbers used in that office during 1967 to 1970. It is reproduced in Table 1. Only one of the three typewriters in the office in 1967 was still there in the fall of 1969. It had been used to prepare the 1967 documents, some of which were known to have been written on their dates. The other two 1967 typewriters had been stolen and the date of theft recorded by the Newark police.

After the theft of the third machine in 1969 (Table 1), two new replacement typewriters were ordered during the spring of 1969, one delivered in April and one in June. Among the known documents, work from a new machine appeared in May 1969 and then from a second machine in August 1969. It was this latter machine which typed the second (fictitious) group of papers in the Yormark file, which the State set about to prove were fraudulently inserted.

Thus, with the data from Table 1 and the dated standards it was possible to designate the serial numbers of the machines which prepared the authentic Yormark documents and the fraudulent documents. It was assumed that the typewriters listed were the only ones in use in Yormark's office. The defense cross-examined extensively on this point, making sure that the two machine numbers were carefully attached to each group of documents. Then a typewriter was brought into the courtroom for the purpose of further cross-examination. The defense wanted the State's witness to type on it and to examine the machine and its work. The trial judge ruled, however, that until proper proof or testimony was produced to show that this machine was in fact pertinent to the case, he would not admit it in testimony or permit further cross-examination on it.

The Typewriting Identification

Both typewriters used were standard typebar machines equipped with IBM Prestige pica. It was established that the older machine (IBM No. 1711956), which will be referred to as the 1967 machine despite its earlier date of manufacture, was equipped with a carbon film ribbon which was clearly revealed by examination of the three questioned checks and the known specimens. The chief questioned documents, however, were carbon copies which, of course, tell nothing about the kind of typewriter ribbon on

TABLE 1—Yormark typewriters derived from Exhibit S-210, all equipped with Prestige pica type.

Typewriter	Disposition
IBM Model C 1666757, purchased used March 1967	stolen 14 April 1969
IBM Model C 1711956 (DW-137), purchased used July 1967	
IBM Selectric 5475113, purchased 23 Feb. 1967	stolen 1 July 1968
IBM Selectric 5520701, purchased July 1968	stolen 12 April 1969
IBM Model D 6281100, installed 5 April 1969	
IBM Model D 6314938 (S-280), installed 25 June 1969	
IBM Selectric 5567487, installed 6 Jan. 1970	

the machine. This typewriter was highly individual, with a number of alignment defects and a unique combination of damaged typefaces including the "A," "d," "h," "k," "r," "s," and "v," and some letters which typed without defects (see Fig. 1). The shift motion was in good adjustment, and the escapement was exactly 1/10 in. The identification of this machine by the State's expert was never challenged, although ultimately a challenge did come forward on the serial number, which had been developed by induction.

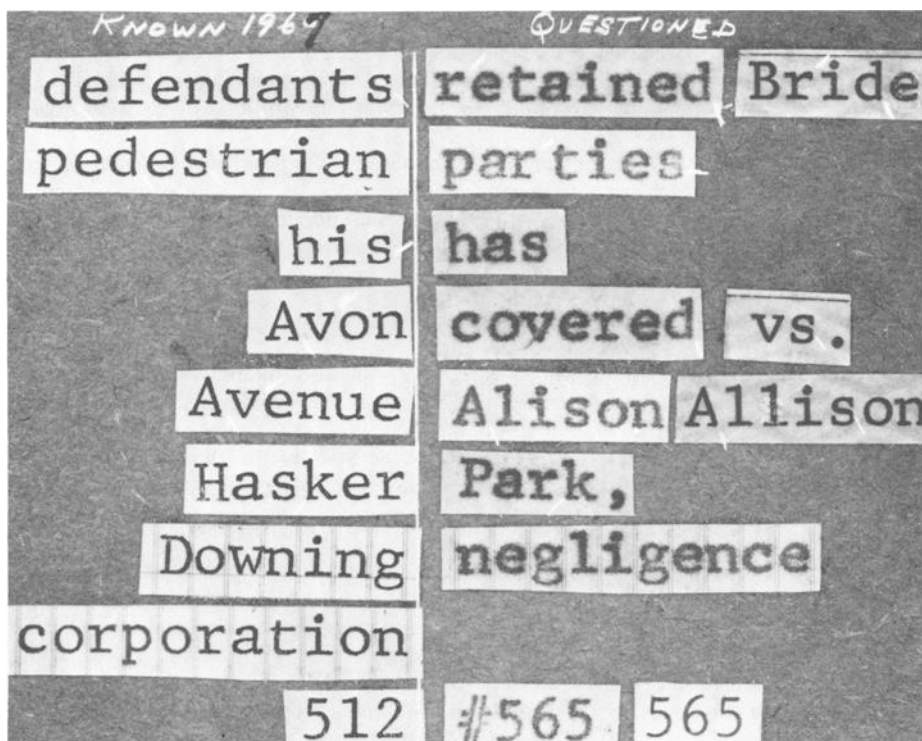


FIG. 1—Identification of typewriting from 1967 machine. All damaged typefaces listed in the text are illustrated and the defects indicated except for the "h." Alignment defects shown are the "c" printing to the left, the "g" to the right, and the "r" leaning to the left (see "Downing," "corporation," "negligence," and "covered").

The new (1969) machine (IBM No. 5314938) was equipped with a cloth ribbon. All the questioned work from it consisted of carbon copies. The machine was distinctive in that it had a unique combination of typing peculiarities, letters which typed properly, and machine defects. The machine defects included an overspacing of letters (that is, slightly greater than 1/10 in.) and improper shift motion so that capital letters typed low. There were limited typeface defects appearing in the "h," the "k," the "p," and the "v," but a number of important and significant alignment defects made possible a positive demonstration that this machine had typed three of the questioned documents (see Fig.2).

The Altered Machine

Following the State's case the defense succeeded in marking IBM No. 1711956 in evidence as Exhibit DW-137 which, of course, made it available for full examination by the prosecution. A cursory inspection plus the facts surrounding its introduction made it highly suspect. It was a Model C IBM with 43 keys. The segment had 44 spaces for typebars so that one was vacant. The keyboard was a legal keyboard, which meant that the character over the "6" was a section symbol. But when the shift key was depressed the key printed a cent sign.

The prosecutor subpoenaed the two Yormark typewriters purchased in 1969. IBM No. 6314938, which had been designated by induction as the second of the two machines used to type some of the questioned material, was also in a suspicious condition. Despite the fact that it was under IBM service contract and was slightly over a year old, it did not operate properly. The underscore failed to print, and it typed irregularly. It was a Model D typewriter with 44 keys, and the segment had typebars for all 44 slots. The keyboard showed a cent mark over the "6," but when the shift key was depressed a section symbol printed.

A local IBM field manager for service³ examined both typewriters. He advised that both contained parts which were different from those used at the date of manufacture. Significant details were discussed with the prosecutor and upon the service manager's advice, arrangements were made to call a factory supervisor with special knowledge of IBM's manufacturing changes. This plan was put into action.

Expert Testimony for Defense

The defense called a typewriting expert who was also qualified as a typewriter rebuilder. The main thrust of his testimony was that the typing specimens prepared under his direction on the altered 1967 machine, DW-137, were identical to the typewriting found in the three letters attributed by the State to the 1969 machine. In his testimony he pointed out alleged similarities and completely disregarded significant differences. For illustrations he projected slides from which the jury could perceive little detail.

Cross examination ignored details of his identification. His experience as a typewriter rebuilder was emphasized, as was his mechanical knowledge of typewriters. The prosecutor had learned from the IBM field service manager the mechanical irregularities present in machine DW-137 and their significance. The witness was asked about mechanical differences between the machine in evidence, DW-137, and these features as they appeared on machines of the same period of manufacture (that is, having serial numbers very close to 1711956). Differences in characteristics of parts had no meaning to him. He was not concerned that the segment had 44 slots and the machine only 43 keys and typebars. The witness testified that the machine before him had a carbon ribbon, but he drew no significance from the fact that the 1967 checks were typed with a carbon

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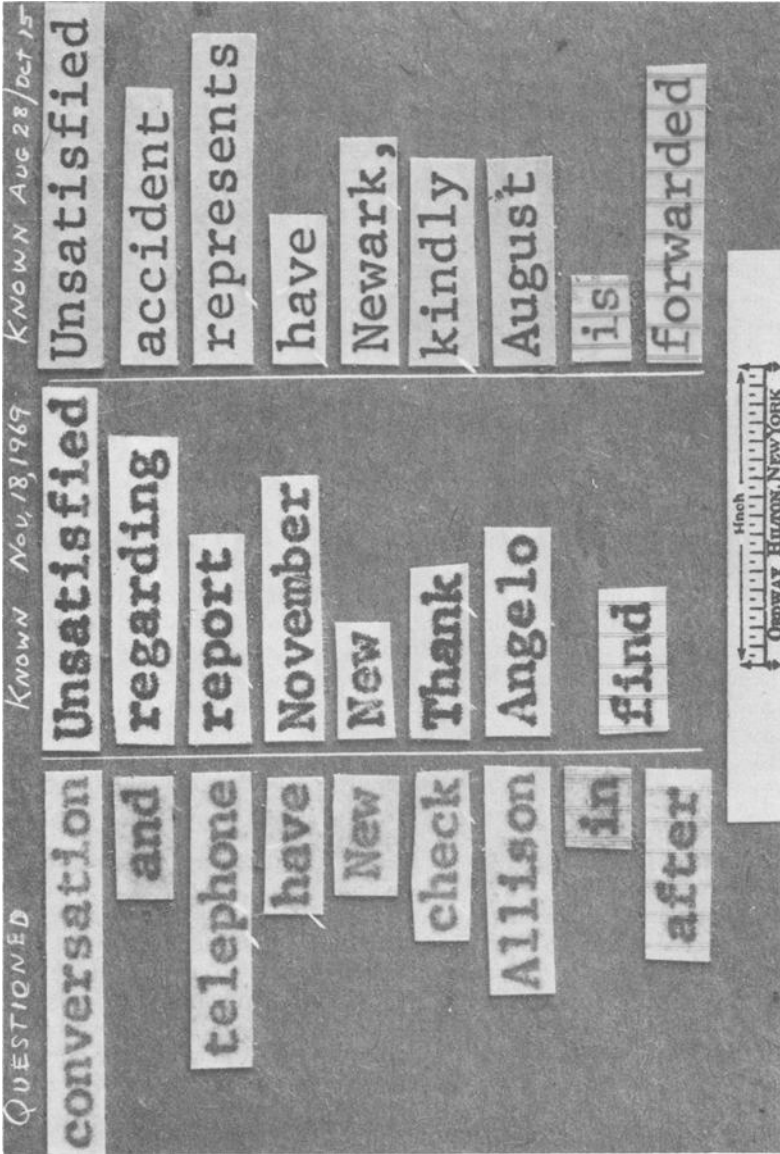


FIG. 2.—Identification of the misdated material. Typeface defects shown include damage to the lower left serif of the "p" (Line 3), the "h" (Lines 3, 4, and 6), and the "k" (Line 6), and to the left serif of the "v" (Line 4). The capital letters "N" and "A" print low compared to the letters next to them in Lines 5 and 7, respectively. Alignment defects include the "i" and the "j" printing to the right.

ribbon. He merely stated that he had not found among the defendant's typewriters the machine which typed these checks and the other documents with similar typing characteristics. For the jury's benefit he was asked to describe the marking on the key which controlled the number "6," a "6" and a section sign, and to strike the key, which printed a "6" and the cent sign. The exhibit was shown to the jury.

The prosecutor offered in evidence the second machine, which had been subpoenaed from the Yorkmark office as Exhibit S-280. The witness noted that on this machine the "6" key was marked with a "6" and a cent sign, but typed a section sign instead. Again the witness, despite his mechanical qualifications, was ignorant of the meaning of certain characteristics of parts found on this machine. When asked if the segments might have been interchanged between these two machines he dismissed the proposition with the reply, "That is a science fiction idea."

Rebuttal—The Fraud Revealed

A factory engineer supervisor from the IBM Lexington factory was called by the State in rebuttal to the defense's testimony.⁴ After inspecting the defense's typewriter, Exhibit DW-137, he testified to the following facts:

1. The serial number, 1711956, indicated that it was manufactured in June 1963. At that time all IBM standard typewriters were equipped with ground typebars in which part of the typebar was ground down 0.004 in. (Fig.3).

2. In January 1964, with the production of machine No. 1768319, the segment was changed⁵ and the typebars supplied were unground; that is, they were thicker than the old ones and the new segment slots were wider than the earlier segment slots. Since that date unground typebars have been in continual use. Exhibit DW-137, a 1963 machine, had unground typebars on it.

3. The segment bore a number U-269. The U indicated unground typebars, and 269 were the last three digits of the part number. This part number called for 44 slots to accommodate 44 unground typebars, but the Model C, 1963 machine would have been equipped with a 43-slot segment when it left the factory. It had only 43 keys.

4. The designation U-269 was marked on the left edge of the segment for the first time in February 1964. In March 1968 the number was moved to the right edge, where it appeared on the segment found on the DW-137 machine. Thus, this segment could not have been placed on the machine prior to March 1968.

In the opinion of the factory engineer supervisor, all of this evidence indicated that the machine had been substantially altered after it left the factory, in particular, sometime after March 1968.

He also examined and testified concerning the second typewriter in evidence, Exhibit S-280. Its serial number, 6314938, established its date of manufacture in 1969. The witness testified that 43 of the 44 typebars were ground typebars. The 44th, in the zero position in the extreme left slot, was unground and contained the numeral "1" and the exclamation point. The segment, however, was an unground segment, with wider slots necessary for the unground typebars so that the bar in the zero position was the only one for which the segment slots had been properly designed. In 1969 no typewriter was factory equipped with ground typebars, such as the 43 found on this machine. The segment bore the number U-269 along the left edge, indicating that it had been manufactured prior to March 1968. Thus, in respect to this machine, he concluded that

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⁵The typewriter segment is a semicircular casting which contains slots for each typebar and the pivot rod or wire around which the typebars rotate as they swing from their rest position upward against the ribbon and paper in the typing process.

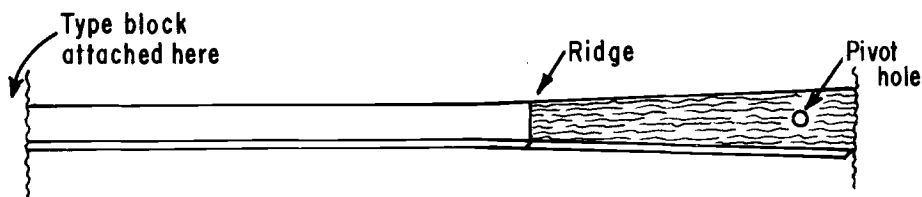


FIG. 3—Ground typebars. A sectional drawing (not to scale) of the shaft of the typebar is shown. With ground typebars, used by IBM prior to 1964, the shaded portion of both broad faces of the bar was smoothed by grinding, which reduced the thickness of that portion of the typebar by 0.004 in. A slight ridge could be detected at the end of this grinding. The ground portion fits within the segment slots. When grinding was abandoned and only unground typebars were used, the shaded portion of the typebar was wider than the unground bars by 0.004 in. and the surface was not as smooth. Note that in ground typebars the narrow edges were not machined.

it had not left the factory with the combination of segment and type bars which were on it at the time of trial.

The IBM field service manager who had previously been consulted was called as a second witness. He testified from his records that a machine bearing serial number 1711956 had been under an IBM service contract since 1967 when it was purchased for the Yorkmark office. These records revealed that the only part which had been replaced under this service contract was a power roller. He further testified that in his opinion a qualified mechanic could interchange segments between two machines in about four or five hours, and that this was "not science fiction."

On this note the State rested its case.

How the Machines Typed After the Segment Changes

Neither machine typed as it had before the segments and typebars were interchanged. Furthermore, neither machine typed like the one from which the segment or typebars had been removed. In other words, correct expert testimony would show that the defense's machine, Exhibit DW-137, could not have typed any document from the Yorkmark file. Three things about DW-137 were like the machine which typed the 1967 documents in the Yorkmark file, the general releases, and the checks: (1) it had a carbon ribbon, (2) the shift motion was correct, and (3) the escapement was proper. None of the typewriting in any exhibit would reveal whether the other character on the "6" typebar was a cent sign or a section sign, but the keyboard did not agree with the type. None of the three listed items individualizes a typewriter, but the last two were inconsistent with the DW-137 having typed the three fraudulent questioned letters which the defense expert stated were written on it, and for which it was apparently created.

In addition, comparison of the questioned letters with specimens typed on the defense's altered machine, Exhibit DW-137, revealed important differences which are illustrated in Fig. 4. The word "Covering" revealed an "o" typing to the left on DW-137 but more nearly centered or slightly to the right in the questioned letter; and the "n" seriously twisted to the left in DW-137 but more nearly properly aligned in the questioned letter. The word "Jersey" showed clearly the improper shift motion, with the capital "J" printing low on the questioned letter but printing on the same line with the lower case letters in the specimen from DW-137. The small "s" in the questioned letter printed slightly low, but was more properly aligned in the specimen from DW-137. The "y" in the questioned typing was twisted so that the serifs ran downhill, but they were

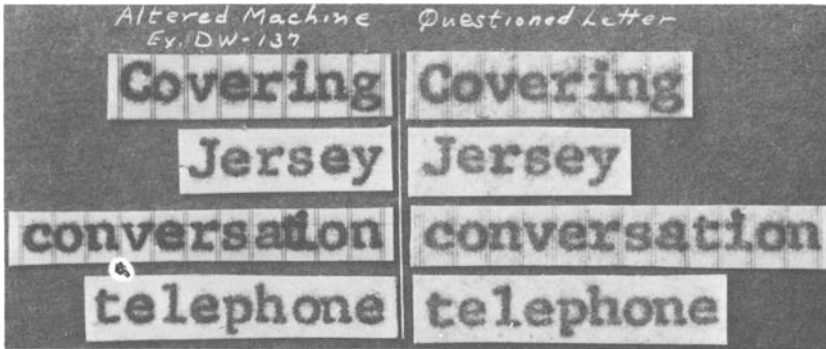


FIG. 4—Differences between altered typewriter (DW-137) and fraudulent letters. A discussion of the illustrated differences is set forth in the text.

properly aligned in the specimen from DW-137. The word “conversation” again shows the differences in the “o,” “n,” and “s” and in addition shows a different left-right alignment of the “c,” which is to the right in the questioned typing and to the left in DW-137, and the “a,” which leans to the right in the questioned typing and is properly aligned in DW-137. The alignment of the “a” varies in the questioned typewriting, with a number of instances in which it leans as illustrated, but this condition is not found in typing from the defense’s typewriter. The “v” prints very light on the left side in the DW-137 specimen and more nearly even in the questioned letter. The word “telephone” reveals a difference in the small “h.” The upper left serif shows damage in the typewriting from DW-137 but prints properly in the questioned letter. The lower left serif is somewhat worn in both impressions. The first three words were specifically referred to by the defense’s expert as examples of perfect duplication between the two specimens, but the alignment differences referred to are consistent throughout the two specimens and do not represent chance variations.

How the Alterations Were Effected

Undoubtedly, in altering the typewriter exhibit DW-137 the segment and typebar from the newer IBM machine (Exhibit S-280) had been removed and inserted as a unit in DW-137. The presence and position of the number U-269 was consistent with its 1969 date of manufacture. Since DW-137 is a Model C with only 43 keys, one typebar had to be removed, the one in the zero position which contained the numeral “1” and an exclamation point. Otherwise it can be assumed that none of the typebars had to be disturbed. The presence of four damaged typefaces was common to the 1969 machine and DW-137 (that is, the “k,” “p,” “v,” and base serif of the “h”). It must be assumed that the upper serif had become worn after November 1969, the date of the last available specimen from the 1969 machine. However, alignment of the “n,” “o,” “c,” “a,” “y,” and “v” was modified during the segment transfer.

Except for the six letters noted above, the balance of the malaligned and properly aligned letters which appeared in the questioned typewriting could be found in the work from Exhibit DW-137. This would indicate that these alignment defects were not disturbed by the moving of the segment from one machine to another. The only open question is the typeface damage to the upper left serif of the “h.” The latest specimens

of typewriting emanating from the Yorkmark office, which matched the typing of the questioned letters, were dated in early November 1969. Evidently, during the next nine to twelve months, the top of the "h" had become damaged. The segment interchange may not have been made until as late as October or November 1970, that is, during the course of trial after the defense made a change in document examiners. The result of this study, therefore, indicates that most alignment defects may not be modified when the segment is moved from one machine to another, as long as this interchange can be made without removing the typebars from the segment itself.

In respect to the second altered typewriter, Exhibit S-280, whose serial number 5314938 indicates that it was manufactured in 1969, a more extensive alteration was necessary. The typebars on it, with the exception of one, were all ground typebars, but the segment was slotted for unground bars. An unground segment was needed since the machine, a Model D, had 44 keys and one unground typebar had to be retained from the segment which had been removed. (It is not known whether a 44-slot segment had been manufactured for ground typebars.) Unground typebars are thicker than the ground typebars and do not fit in the slots of a ground typebar segment, even if one could be obtained with 44 slots. The ground segment from the Model C machine provided for only 43 typebars. The result was that the reconstructed machine had thinner typebars in the wider unground slots, which led to greater play in their typing action. Several letters, especially the "a," varied their typing positions or slants.

The cloth ribbon, the proper escapement of exactly 1/10 in., and the defective motion in which the capitals all printed low in comparison to their lower case counterpart were similar to the 1969 machine (No. 6314938). In this instance some of the 1967 material in the Yorkmark file—the three checks—were ribbon typing, and consequently the machine clearly did not agree with the 1967 typing. The checks were typed through a carbon film ribbon, and the capitals were in proper alignment with the lower case letters.

In what respect did the machine agree with the known typewriting prepared on IBM No. 1711956 in 1967 and in subsequent years? There were seven typefaces on this machine which revealed substantial damage—the capital "A" and lower case letters "a," "h," "k," "r," "s," and "v." All of these letters printed with the same defects on the altered machine, Exhibit S-280. In this respect its work was like the authentic 1967 typing in the Yorkmark files, the checks, the general releases, and the basic letter to the insurance company (See Fig. 5).

Assuming that the typebars had originally been on the 1967 Model C machine, then they must have been removed from the segment and placed in a different segment. Thus, one might expect substantial change in alignment. The wider slots of the unground segment could lead to unusual variation in typing. Such conditions did exist when the work of the altered machine was compared with known typewriting or the questioned documents which had been typed on the same machine. Work from the altered machine shows that the "a" varies widely in its printing position, often low to the right and twisted. The twisted condition also prevailed in examples which typed closer to the proper baseline alignment. Other letters which aligned differently were the "b," "e," "g," "o," "p," "r," "s," and "t." The differences were slight but consistent. In general there was a tendency for letters to print with more variation than either machine showed in its known work. It is interesting to note that the balance of the letters typed in virtually the same alignment as before the interchange of segments and typebars, but several were without this class of defect. All experts who examined this altered machine agreed that it did not type like the questioned checks, general releases, or key insurance company letter which the State witness had originally described as being prepared on IBM No. 1711956 in 1967.

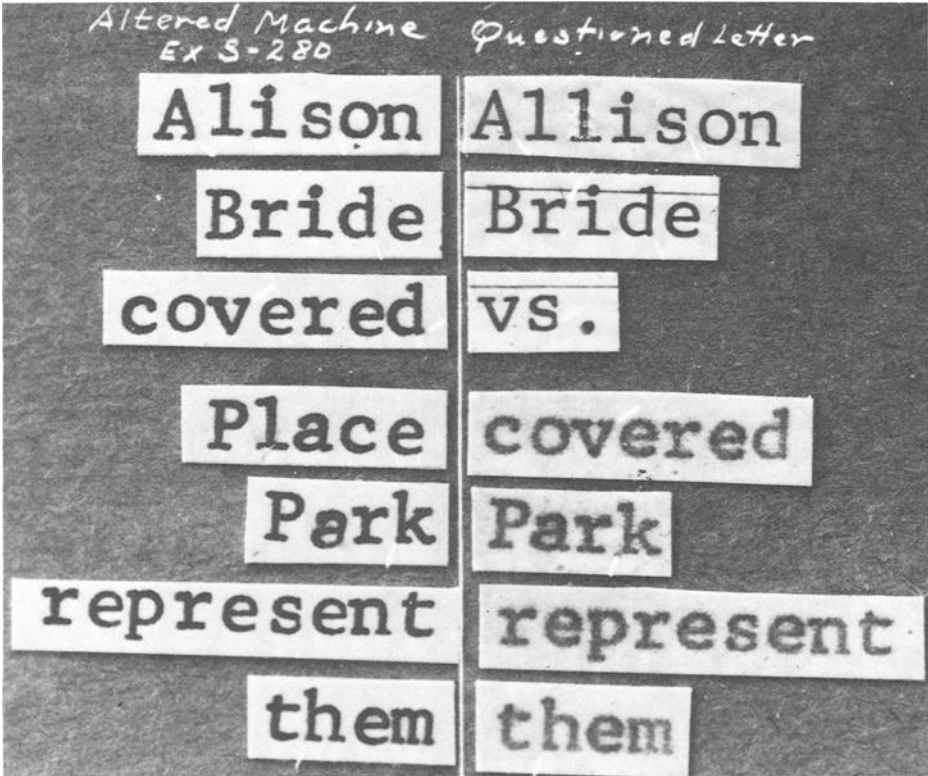


FIG. 5—Differences between second altered machine and work of 1967 typewriter. All typeface defects discussed in the text are illustrated. The wide variation of the "a" can be seen by comparing "Place" and "Park." Changes in alignment occur in the "s" (low in the altered machine and aligned properly in the questioned 1967 material) and "p" (high in the altered machine and aligned in the questioned material). Note differences in the "th" spacing in Line 7.

Conclusions

The result of the exchange of segments in typebars between two IBM typewriters did not bring about the results for which the defense had hoped. It did not interchange the typing characteristics between the two machines so that the altered old machine, Exhibit DW-137, would type exactly like the three letters in the Yormark file which the State had demonstrated were prepared on a machine first introduced in the Yormark office in 1969 (that is, well after their date). Instead, interchange of the segments and typebars created two new typewriters with a different combination of typing characteristics from either of the original machines. From a theoretical point of view this result would be expected. However, this practical example, produced under conditions in which every effort must have been made to create, in the time available, a duplicate typewriter with an early serial number which typed exactly like the 1969 machine, confirms the theoretical determination. This is the third known case in which a mechanic tried to create a duplicate typewriter and failed.⁶

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⁶Two previous cases have been reported in which a typewriter mechanic attempted to adjust or build a typewriter which would exactly duplicate the work of another.

The first involved Risley's defense in *People v. Risley* which was tried in Herkimer County, N.Y. in 1911. William J. Kinsley, a document examiner of New York City, was consulted by the prosecutor and demonstrated important differences between the forged typewriter and the questioned document. The forged typewriter had been adjusted by an experienced mechanic. The jury found the defendant guilty despite the attempted duplication of machines. The facts concerning the typewriting were published by Kinsley in the *Typewriter World*, New York (date not given) in an article entitled "Six Letters of the Alphabet Convict Lawyer in Typewriting Alteration Matter."

The second attempt in the early 1950s involved Alger Hiss's motion for a new trial following his conviction for perjury (*U.S. v. Hiss*, Southern District of New York). A typewriter rebuilder took approximately a year and a half in an effort to reconstruct a Woodstock typewriter so that it would exactly duplicate the typing of a Woodstock which the government had established belonged to Alger Hiss and had typed certain papers in evidence in his perjury trial. Judge Goddard, U.S. District Court, Southern District of New York, denied the motion for a new trial in *U.S. v. Hiss*, 107 F. Suppl. 128 (1952) and stated that the evidence before him showed that the defense's manufactured machine failed to duplicate the typing of the Hiss machine.