

*Ordway Hilton,<sup>1</sup> M.A.*

## Identification of Work from a Selectric II Typewriter

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On July 31, 1961 IBM introduced the Selectric or Model 72 typewriter. This machine constituted a radical departure from the conventional typewriter. It was designed as a high speed printer and was developed in part as a print out unit for IBM computers. The conventional type bars were completely eliminated, and in their place a type element consisting of a removable type ball was substituted [1]. The machine has proven to be a high quality typewriter giving excellent service and producing unusually uniform work. In September 1971 IBM introduced the Selectric II, an advanced model of their Selectric machine.

The Selectric II incorporates the same engineering designs as the original model, that is, the ability to produce the high speed typing, the interchangeable type elements which allow the use of several type fonts on a single machine, and the various other features which are unique to the Selectric typewriter. Three new features have been built into the Selectric II: dual escapement, a half space key, and a new type ribbon cartridge. Other engineering modifications have been made; but, except that they may produce longer trouble free work, they are not of as much concern to the document examiner as the dual escapement, half spacing, and the new ribbon.

### **New Features of Selectric II**

#### *Dual Escapement*

The dual escapement of the Selectric II permits typing of 10 and 12 pitch fonts (2.54 and 2.12 mm escapement) on a single document. A manually operated lever provides for changing the escapement, and the full utilization of the two escapements can be achieved by simultaneously changing the type element, for example, removing the 10 pitch element and replacing it with a 12 pitch unit. This results in a single page of continuous typewriting which incorporates two escapements and possibly several type designs. The Selectric I permits the mixture of fonts with continuous typewriting, but the presence of two escapements establishes that the document was prepared on a Selectric II machine.

#### *The Tech 3 Ribbon*

The new ribbon, known as Tech 3, produces a relatively sharp outline comparable to the work of a single use carbon-plastic film ribbon, but the cartridge is designed to utilize a single ribbon area for three impressions. The impressions do not entirely overlap within a

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<sup>1</sup> Examiner of Questioned Documents, New York, N.Y. 10038.

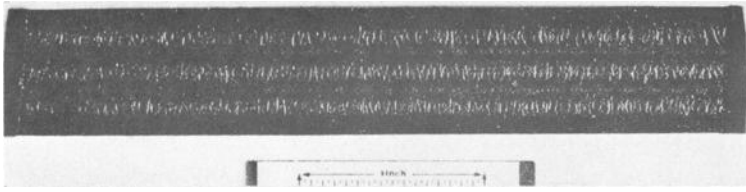


FIG. 1—A segment of a Selectric II Tech 3 ribbon showing the three lines of partially stacked type impressions.

particular area. Instead the ribbon moves forward a fraction of the width of the letter with each typing. Successive characters strike the ribbon at three different levels from top to bottom. Thus, the impressions form a continuous series of “v’s” (see Fig. 1). The ribbon has a polyethelene base treated with a fluid ink which has a degree of recovery comparable to a cloth ribbon. With visual inspection of the document under magnification, it is difficult to distinguish between the work of this ribbon and that of a standard carbon coated ribbon. Letter impressions through a Tech 3 ribbon are slightly wider than through the IBM single use carbon-film ribbon, but typewriting with some other carbon ribbons of poorer quality may not differ much in this respect from the work of a Tech 3 ribbon.

The type impression through a Tech 3 ribbon is sharp and should reveal delicate flaws or breaks in the type face readily. However, such defects are extremely rare with the Selectric typewriter so that this becomes more of a theoretical consideration than a practical one.

The Tech 2 carbon ribbon cartridge designed for the Selectric I can also be used on the Selectric II. This is a single impression carbon ribbon. The only advantage in using this older Tech 2 ribbon cartridge is that it is available in colors other than black, whereas, at the present time the Tech 3 ribbon is manufactured only with black ink. The ribbon cartridges can be interchanged easily on the Selectric II machine without removing or disturbing the paper.

### *Half Spacing*

The other new feature of the Selectric II is a manual half spacing device which provides for easy insertion of letters in a half space, that is 1.27 mm or 1.06 mm. This causes the letters to overlap, of course, but does permit the insertion or crowding in of an omitted letter in a completed line of typewriting. If the half spacer is used frequently in a document it would point to the use of the Selectric II since this device is not found on the other model of Selectric typewriters. Technical men have indicated that it is possible to manually half space with a Selectric I, but consistent centering is difficult as the positioning must be done without any mechanical aid simply by holding the typing unit by hand in the half space position, an approximation at best.

### **Selectric II Identification**

The basic identification of the Selectric II must follow the same pattern as the identification of the Selectric I machine. Document examiners should be familiar with the four row and eleven column arrangement of the various characters around the hemisphere of a typing element with the capital letters and characters embossed on the opposite hemisphere. Positioning of a particular character to print involves a twist movement up to five units right or left of the rest position and a tilt movement of from 0 to 3 rows. This

twisting and tilting is automatically activated when a key is depressed and occurs immediately before, but virtually simultaneously with, the moving of the type element forward as it strikes against the ribbon and paper.

As with the Selectric I this new model has a fixed platen and a typing unit which moves from left to right across it. When the return key is depressed the typing unit moves back to the left margin, and the platen revolves one or two spaces depending upon the line space setting.

The first step in identifying the work of any Selectric typewriter is to determine that the document was in fact prepared on this kind of machine. This step is a must since identification rules and procedures are unique. At the present time Selectric type fonts are distinctive and differ from similar fonts used on type bar machines, and even from other model IBMs. One distinctive Selectric type characteristic is the narrow numeral forms, but there are a few fonts in which this is not a sure means of differentiation. Of course, if the document contains more than one font of type on a single page and shows no evidence of having been removed from the machine during preparation, a Selectric must have been used. If the type fonts are of different escapement, then we are dealing with work from a Selectric II. Having once determined that the document was written on a Selectric typewriter, we are ready to proceed to identify the individual typing unit—the typing unit, of course, being a given machine combined with a particular type element.

Type face damage, that is, broken or chipped type, is extremely rare with the Selectric, and this remains true after several years of use. None of the new features of the Selectric II should change this situation or introduce a new cause of wear or damage to the type. Consequently, identification must rest on alignment defects and variables in the typed impressions.

Alignment results from a combination of the machine's adjustment and the condition of the teeth on the type element. Tilt is controlled by a unit within the machine, and the final positioning is made by a detent or wedge moving into the proper notch. The combination of these actions control base line alignment. The fine adjustment or centering of right or left alignment is controlled by another detent slipping into one of the notches along the bottom of the type element after the machine has activated the basic right or left twist of the element. Wear in these notches or in the detent can cause right or left malalignment. Thus, identification is not that of a machine but of a typing unit, the combination of a certain machine with a particular type element. Right and left alignment may differ between two type elements on the same machine if there is a difference in the degree of wear in the notches on the two elements. Often malalignment appears as a variable factor since wear introduces greater play rather than a new fixed position.

While theoretically letters should not print with any twist, the action of the detent moving into the base of the type element coupled with a slight looseness of the element due to wear can produce a slight twist of the printed character. Most likely this will be a variable factor.

Uneven impressions in characters for the most part are the result of a basic malalignment of the element and the platen. The condition is reflected in a number of letters if not all of them. The defect can be corrected by adjustment which realigns the two units. Occasionally, due to wear in the detents or the element itself certain letters may show a tendency to print unevenly. From either of these sources, the defect is a variable factor and not necessarily repeated in each impression.

Thus, we find that there is a definite correlation between characters on the same row of the type bar when dealing with the base line alignment, and a definite correlation between characters in the same vertical column of the type element when dealing with left or right

alignment. These facts limit significantly the number of factors which make up the identification formula for a Selectric typewriter, and the Selectric II is no exception.

### Special Selectric II Problems

One of the most challenging problems ahead is that of determining whether pica and elite escapement work produced on a single page were typed by a Selectric II in one continuous operation, or whether one or the other of the portions was substituted or added after the paper had originally been taken from the machine. IBM reports that the left margin at the zero point of both the pica and elite rack is adjusted to the same point within tolerances of 0.004 in. If one analyzes the two escapements, he finds that the left edge of every sixth elite space coincides with the left edge of every fifth pica space across the entire platen. The Selectric spacing is controlled mechanically by pawls catching in the notches of the rack, and these pawls are designed to work effectively with both the 10 or 12 pitch racks.

To answer the question whether two sections of a page, one pica and one elite, were typed in a continuous operation requires the use of special typewriting grids or test plates. Horizontal alignment and parallelism of the lines can be verified with a standard parallel ruled test plate which measures the line spacing and discloses simultaneously whether the lines are parallel or not (see Figs. 2 and 3). Vertical alignment, because of the dual escapement, requires a specially designed test plate combining both pica and elite rulings. For this purpose a compound plate has been designed the upper half of which contains rulings

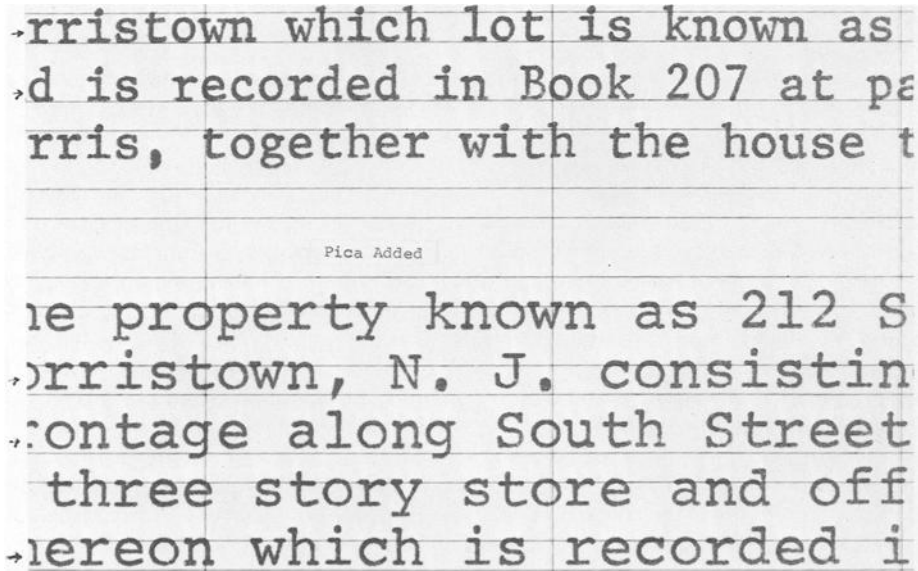


FIG. 2—Added pica typewriting.

*The pica typewriting which makes up the last three lines of this illustration was added to the document after all of the elite typewriting had been completed and the paper removed from the machine. The horizontal test plate used consist of parallel lines ruled alternately 1/12th and 1/6th of an inch apart. The arrows along the left margin in the upper portion indicate the two lines of elite typewriting which were aligned so as to rest on the ruled base line. Pica typewriting is spaced less than the proper units of 1/6th of an inch below the elite typewriting and thus prints above the ruled lines. Further, there is a slight lack of parallelism with the lefthand typewriting closer to the ruled line than the righthand.*

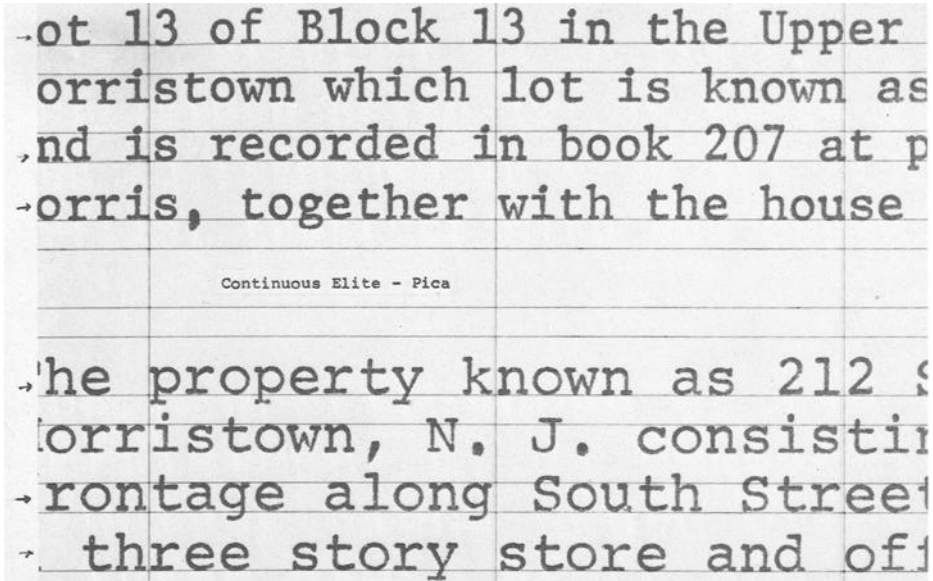


FIG. 3—Continuous elite and pica typewriting.

*The material shown in the illustration was typed continuously on a Selectric II without removing the paper from the machine. At the conclusion of the fourth line of elite typewriting shown in the illustration the escapement rack was changed to pica escapement and a pica type element was placed on the machine. It will be noted that the three lines of elite typewriting and the three lines of pica typewriting (indicated by arrows on the left) are parallel and spaced in units of 1/6th of an inch apart. This is the first of two tests necessary to establish that the pica and elite typewriting is continuous (see Fig. 5).*

for elite spacing (1/12 in.) and the lower half pica (1/10 in.). The two grids coincide with the rulings along the left hand margin. Both the horizontal and vertical test are needed to establish continuous typewriting; but interrupted, added typewriting may be established by revealing improper alignment through either test. From preliminary work with experimental problems involving an added insertion, it would appear that the horizontal alignment test is slightly more informative than the vertical test.

In using a dual escapement vertical typewriter grid, the application is simple if the left margin is known to coincide with the zero point of both pica and elite racks. This condition seldom prevails, however. It is necessary, therefore, to locate the second, third, fourth, or other left margin at which the pica and elite racks coincide. To accomplish this test, it is necessary to check five consecutive positions along the pica escapement or six consecutive positions along the elite. Of course, when any one position establishes continuous elite-pica alignment one must presume continuous typewriting as far as this test is concerned (see Fig. 4). But with an inserted paragraph each of six consecutive elite placements must be checked to reveal improper alignment although three at least will be obviously malaligned. A central position may suggest continuous alignment and require very critical study to disprove it (see Fig. 5). The test is not completely foolproof since we cannot determine the true zero rack positions relative to the typewriting on the page. It is possible, of course, when a document is reinserted in the machine to add pica to elite typewriting that the two fonts will align within allowable variances in a column which is not the zero



FIG. 4—Continuous pica elite typewriting under vertical test grid.

*The right-left alignment of both pica and elite typewriting is in exact agreement under a compound elite-pica test plate. The plate has been aligned with the zero point (continuous pica-elite column) to the left of the arrow. Comparison of the letters "town" in the second line of elite typewriting and the second line of pica typewriting gives an accurate comparison and shows proper alignment for the two portions of typewriting.*

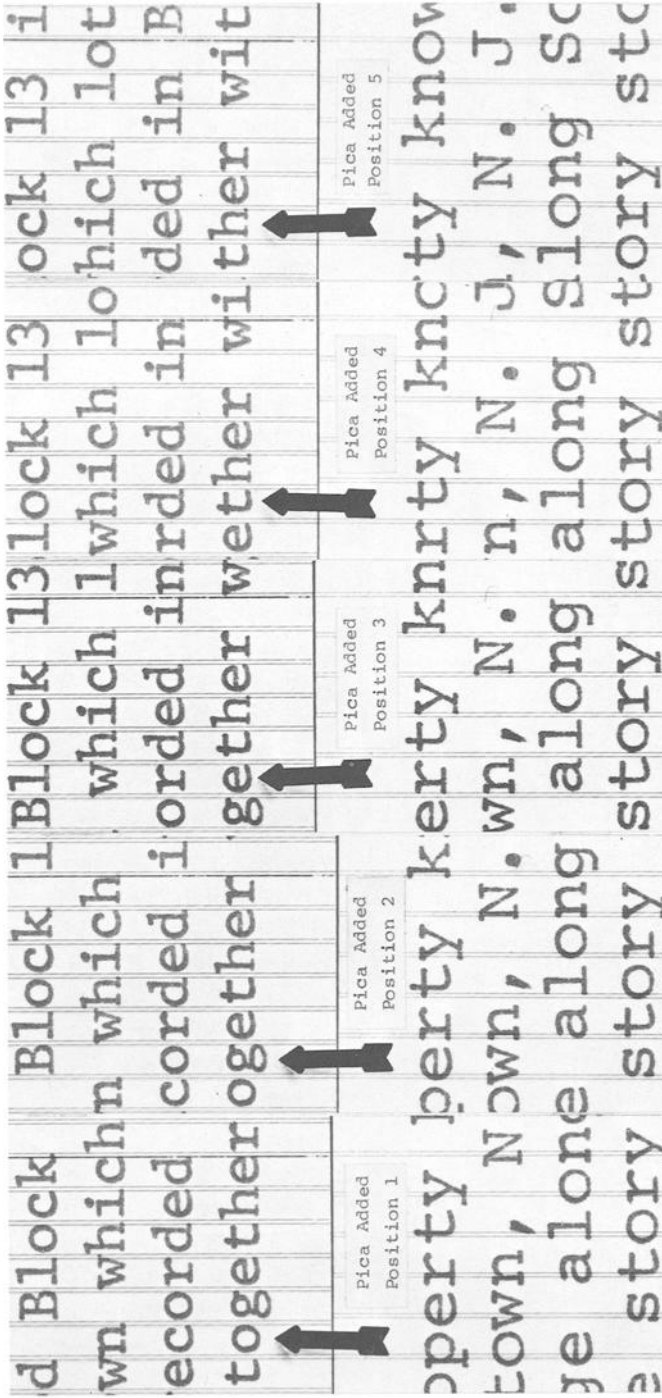


FIG. 5.—Added pica typewriting revealed by elite-pica grid.

Five of the six positions of the compound elite-pica typewriting grid are shown in a series of sectional photographs. The continuous, zero position line of the elite-pica plate is to the left of the arrow in each section. The positioning has been aligned on the elite segment of typewriting moving it one space to the right in each successive position as indicated by the arrows beneath the various letters of the word "together." The two outer positions are clearly not aligned and the sixth position which is not illustrated reveals an even more obvious malposition. Two and four are only moderately well aligned between pica and elite and very brief inspection reveals that neither could establish continuous typewriting. Position 3 is critical and requires close study. Careful study of the letters "o" and "r" in the elite section at the top reveals the letters to be accurately centered while in the pica typing below both letters are slightly off center to the left.

column or a multiple of it, that is,  $0 + 5n$  ( $n = 1, 2, 3, \dots$ ), on the pica grid. In other words the first coincidence might occur at space 6. With the zero point known pica alignment in columns 6, 11, 16, etc. would still be clear evidence of a reinsertion since continuous typewriting coincidence of pica and elite would only occur in the zero column and its multiples, that is, 5, 10, 15, etc. However, when there is no way to determine the true zero alignment pica and elite alignment in pica columns which are actually 1, 6, 11, etc., for example, leads to a false presumption of continuous typewriting. There appears to be no solution to this deficiency.

A further question, which is certain to arise once it has been established that pica and elite typewriting were placed on a document at two different times, is whether both were written on the same Selectric II. Of course, with other pica and elite typewriting from the machine, the question may be answered by comparison of each specimen with other work from this machine using the same elements. However, with only the questioned document at hand the problem is more complex. In all probability a definite affirmative answer is not possible. There are only a few factors which could be similar. Base line alignment is independent of the type element and depends entirely upon the tilt mechanism of the machine. Since there are only three tilt positions besides the zero or rest position there are at most only three possible defects. Capital and lower case alignment does not depend upon the motion of the type element as it does with a type bar machine but is accomplished by 180 degree rotation of the type element. Left and right alignment, as well as twist of characters if present, is solely a function of the type element, that is, the wedge action on the notches along the base of the type ball. A change from pica to elite type requires changing the element, thus modifying the left-right alignment. If letters print consistently "off their feet," the condition undoubtedly results from a machine defect, most likely improper alignment of the element relative to the center of the roller. The malalignment should be similar for all elements regardless of type size and for every character on the type ball. If there are any imperfections in letter spacing, these would be due to the rack, and a different rack is used for pica and elite escapement. Thus, we have four possible defects at the most, which is insufficient to say with certainty that both escapements came from a single machine. Differences in any one of these adjustments or alignment factors in the finished copy would establish two different machines; but, in the vast number of instances, it would appear that the question will remain unanswered.

### Conclusion

The Selectric II is a further challenge to the document examiner. At the present time the machine has unique features. They do introduce certain new problems, but these problems are not insurmountable. The principal identification problem with this machine is a carry-over from the Selectric I—the very challenging problem of identifying work of a particular combination of typewriter and type element. This problem is unchanged.

### Acknowledgment

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### References

- [1] Hilton, Ordway, "Identification of the Work from an IBM Selectric Typewriter," *Journal of Forensic Sciences*, JFSCA, Vol. 7, No. 3, July 1962, pp. 286-302.

15 Park Row  
New York, N.Y. 10038