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David A. Black

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## FIBER TIPPED PENS

DAVID A. BLACK

The author is an examiner of questioned documents in Los Angeles, California, where for over 25 years he has been associated with Clark Sellers. Mr. Black is a well known expert in questioned documents. He is a former President of the American Society of Questioned Document Examiners and has published several articles in this Journal.—EDITOR.

A new type of pen appeared in 1964 called usually the fiber tip pen, although it is also known as the nylon tip pen, acrylic tip pen, synthetic tip pen, reed pen, bamboo pen, and felt tip pen. In August, 1964 Newsweek Magazine referred to these pens with such terms as "selling phenomenally", "runaway success", "boom", "demand far exceeding supply". In December 1964 Time Magazine used such terms as "hottest counter-top item in years", "producing 500,000 a day and falling behind", and "no advertising necessary". Other terms used in predictions of sales of these pens are "revolution in writing instruments", "will supplant the ball pen", and "unbelievable explosion". If there is any truth to these representations—and there seems to be a certain amount—then document examiners will be seeing more and more of the written product of these pens—perhaps soon as questioned writings—and should therefore know something about them.

### DESCRIPTIONS OF PENS

In the past few years felt marking pens, produced in great quantities in the USA and in Japan, have been undergoing improvements and refinements aimed at making them a more sensitive, delicate, reliable instrument. Some brands have veered toward producing a thinner or narrower line, more like a writing instrument. In Japan, where these markers were suited to making the Japanese ideographic characters long made with a brush, the Japan Stationery Company, Ltd., apparently reasoned if a similar instrument could be made with a fine point, an ideal and popular writing instrument for general use would result. The upshot was their Pentel Sign Pen, and its phenomenal sales, not only in Japan but particularly in the USA, have proved their perspicacity. They now have six plants, and production still cannot keep up with demand. Other Japanese and American manufacturers have rushed in to

capitalize on the popularity of this type of pen. There are now about thirty firms making similar pens in Japan and about a dozen in the USA. Some of these firms have capitalized on the idea by making the tips of their felt markers harder and sharper, to approximate the fiber tip.

The writing tips or points of these pens are of course the most significant part of them. In this respect the Japanese products appear to fall into three categories. Though the manufacturers are reticent about the composition of their products, the original Pentel tip is admitted to be made of a man-made substance not unlike nylon. Dissection of the pen shows the tip to be a round rod or cylinder about  $1\frac{1}{4}$  inches long, the writing end of which is shaped to a round tapered point and encased in a tapered metal housing similar to a ball pen. The other end extends up into a reservoir of ink. Microscopic examination reveals that this rod is actually a compressed bundle of extremely fine thread-like fibers or filaments running lengthwise, held together by some binder or adhesive. At the same time this rod, while being firm or hard enough to form a suitable writing point, is not solid, but porous. So that ink is drawn by capillary attraction from the reservoir, through the rod, to the point. Other Japanese brands are similar to the Pentel type.

Another Japanese type of point appears to be (as some are advertised) a piece of bamboo wood shaped into a round rod with a pointed writing end, matching in form the fiber rods. Again, the upper end of this extends into an ink reservoir. The bamboo rod appears to be impregnated with a hardening agent which, as with the previously described fiber tip, may also be an ink-attractant substance. The printed inscription accompanying one brand refers to the "acrylic point". The bamboo rod is porous, having minute lengthwise tubules down which the ink flows by capillarity.

The third type of Japanese tip is referred to as

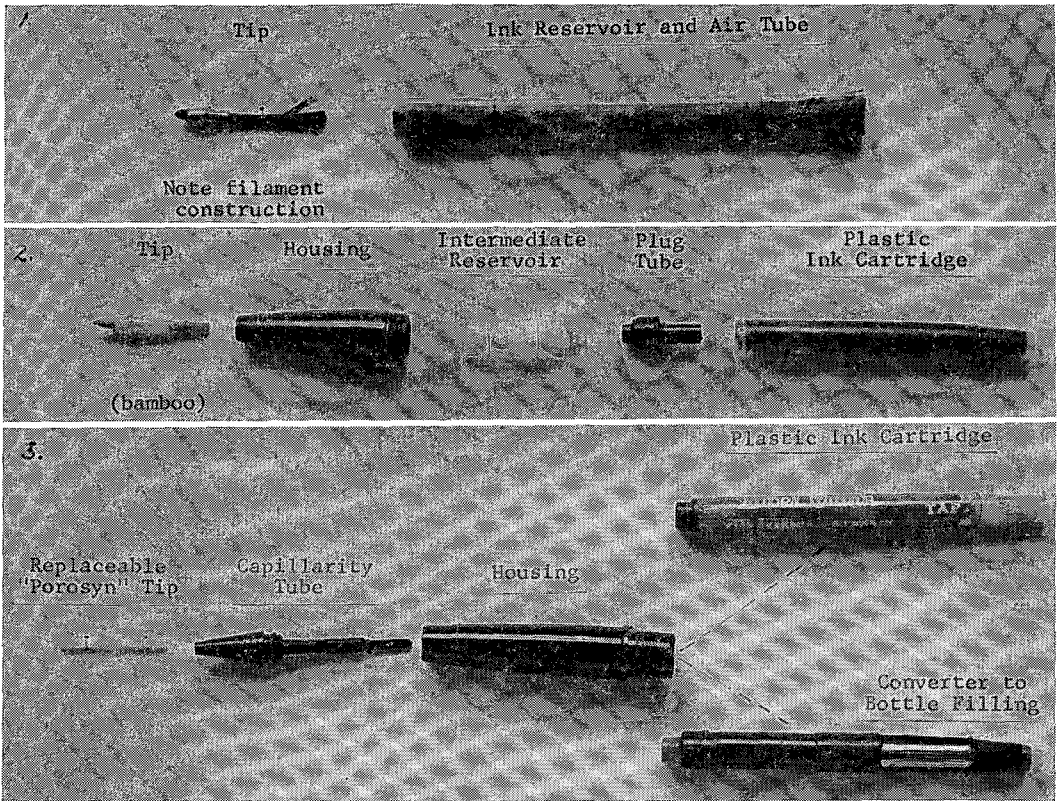


FIGURE 1  
Working Parts of Three Types of Fiber Tipped Pens

The three types of fiber tipped pens are shown above. The tip and ink sets and reservoir units have been removed from the barrel. 1. Shows the construction of a Pentel (Japanese) pen of the throw-away type. The ink reservoir cannot be refilled. 2. A Gem refillable (Japanese) pen showing the plastic ink cartridge, and 3. an Ever-sharp Tip-Wic (convertible) pen. With this type of pen either the plastic cartridge can be used or a reservoir which is filled from the ordinary ink bottle can be used.

a "felt" tip; but if it is felt, it is not obviously felt like the original familiar markers, but is reprocessed, reconstituted, or homogenized in some way which makes it hard and smooth for a fine-pointed, round-tapered writing tip. It is of course porous to provide for ink flow.

The American brands appear to come in two types of tips. One is similar to the Pentel type, with a bundle of fine synthetic fibers or filaments running the length of a rod formed by the fused or bonded fibers and having capillarity which draws ink from a reservoir to the tip, encased in a metal housing. The other type is often called a "felt" tip, but does not look like felt. It is similar in appearance and characteristics to the Japanese "felt" tip, and appears to be reconstituted or processed to form a firm writing point. Under the microscope this tip has the appearance of a compressed mass of tiny, shiny plastic beads.

So far, no U. S.-made bamboo tip has been encountered.

In both Japanese and American pens there are two types with respect to ink supply. They might be called the "throw-away" and the "refillable". See fig. 1. In the former, which includes the original Pentel, the ink reservoir is a round cylinder of relatively loosely-packed cotton or cotton-like fibers, sometimes encased in a thin tissue-paper-like covering. This holds a supply of ink. The pen is non-refillable and is intended to be discarded when exhausted. The other type accommodates plastic refill cartridges similar to those in use for fountain pens for some time. It would seem that the life of the tip might be limited to three to six of these cartridges, due to the increasing flexibility of the tip with use, ending in unusability. In this refillable type of pen the lower end of the housing in some contains a short cotton-like

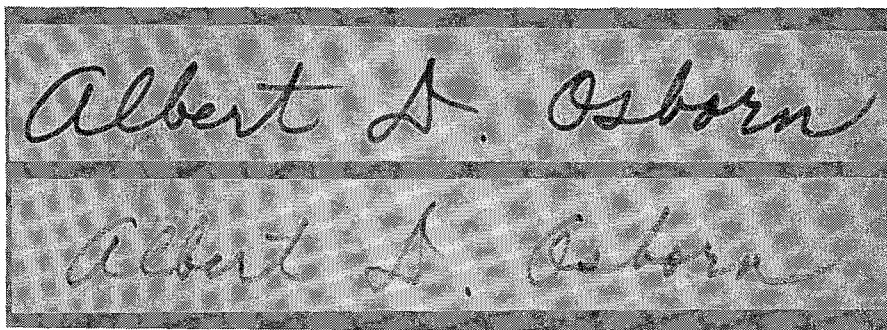


FIGURE 2

## Variation in Writing Strokes of Different Pens

The upper specimen was made with a properly operating pen showing solid dark strokes. The lower specimen contains charcoal-like strokes of an improperly made or poorly operating pen.

reservoir into which extends a tube-plug at the cartridge end and the tiprod at the other. In another there is a capillarity baffle between the tip and the body of the pen.

In both the above types of pen the body is a case of plastic material and the tip end is furnished with a friction-held cover or cap to prevent fluid evaporation when not in use.

## INK AND WRITING LINE

The ink in all of these pens or markers which are intended for writing on paper (in addition to other surfaces) is aqueous or water-soluble, for the reason that other synthetic or organic solvents (such as are found in many of the felt markers) penetrate the paper immediately and show through on the opposite side—an undesirable effect. The aqueous ink used appears identical to the familiar washable fountain pen ink, consisting of one or more organic dyes dissolved in water.

The colors at first supplied were blue, black, and red. But both Japanese and American pens may now be obtained in all colors. One Japanese brand contains greyish-black ink. It is labeled "Pencil" rather than "Pen".

The writing tips of these "fiber" pens will clog due to evaporation of water if the tip is left exposed for any length of time without using. The black-ink pens are particularly susceptible to this because of the heavy concentration of dye(s) used to give a dense jet black stroke. The cure for clogging according to the instructions accompanying some pens, is to soak the tip in water for a number of minutes.

Related to the clogging problem is the tendency of some of the black-ink pens to gradually write a lighter line at a particular sitting, due to the more sluggish feed rate of the heavier concentration of

ink. This same concentration of ink also causes some of the black inks to have a tendency to smudge on the paper, such as if a damp finger touches or rubs across it.

The appearance of the writing line of these pens is striking when first viewed. Compared to the writing line of a ball pen or fountain pen the strokes of the fiber tip pen, when operating properly, are broad, solid, and ribbon-like. While the line is generally solid and uniform with a properly operating pen, there may be a streaking or brushing effect on fast strokes or with a pen with poor ink feed. This often results in a mottled-appearing line, and in pronounced cases the effect is of charcoal strokes (fig. 2). Although the distribution of ink cross-wise of the stroke is usually uniform some of these pens produce a stroke with the ink deposit somewhat heavier on one side than on the other, though evenly graduated. However there is no marginal ridge, or linear concentration of ink along the margins of strokes, such as is often found with metal nib-pen writing. There will sometimes be found a fine hair-like sister line accompanying the main stroke, on the under side or toward the body of the pen. This is apparently due to a small fiber or fragment of the tip sticking out from the main body of the tip.

Beginning strokes and ending strokes, even moving endings, tend to be blunter and squarer than with fountain pens or ball pens. There is no indentation or furrowing into the paper due to the relatively soft and broad tip, and of course no gooping as with ball pens.

CONSIDERATIONS RELATING TO  
DOCUMENT EXAMINATION

A number of considerations intrigue the document examiner when he first sees writing done

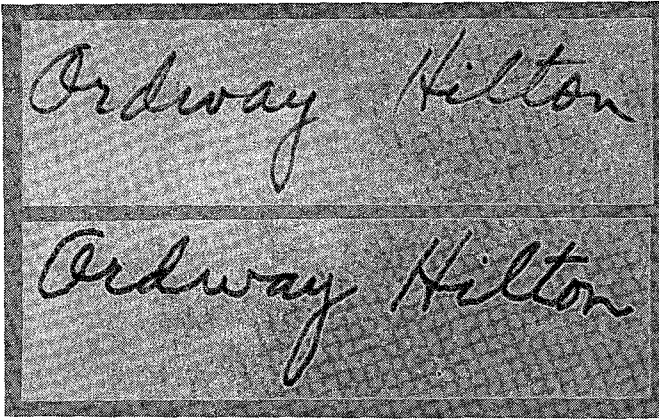


FIGURE 3

## Contrasting Line Qualities of Genuine and Forged Writing

The upper specimen contains smooth, firm strokes of genuine writing, while the lower specimen contains labored, tremulous strokes typical of traced writing.

with one of these new type pens. One of the foremost of these is whether and how it will affect the detection of forgery. Considerable experimentation leads the writer to the conclusion that for the large part the evidences of genuineness and of forgery in fiber pen writings are not significantly different from those in fountain pen and ball pen writing. The degree to which certain evidence will appear is perhaps somewhat different, but the specific evidences themselves will still be present. It would appear that the situation is comparable to that when the ball pen was introduced after the nib pen had been in use for so long. The evidences of the nature of the writing act in both genuine and forged writings with the fiber pen—as with the ball pen after the nib pen—continue to be present, but in slightly altered manifestations. The “line quality” of each is still determinable.

In the experimental writings made the evidence of smoothness, firmness, speed and spontaneity characterizing genuineness are observable. Flying beginning and ending strokes are detectable, although not as apparent as with fountain pens and ball pens. While the tapering effect is less pronounced it is nonetheless present, and the gradual lightening of the deposit of ink is also present. Moreover two effects not present in the flying ending of a ball pen or fountain pen stroke are often present in the flying ending of a fiber-tip pen stroke. These are a mottling of the ink coverage of the paper or the leaving of microscopic white areas of paper uncovered by ink, and a serrating or fragmenting of one or both margins of the stroke as it terminates.

High speed in interior strokes, evidenced by smoothness of strokes and regularity and uniformity of direction, may also be evidenced in fiber pen strokes by a similar mottling due to dotlike skipping within the body of strokes, caused by failure of the ink to flow fast enough to cover the paper solidly. It may also be evidenced by serrating or breaking of a margin of the stroke.

The delicately gradated variations in writing pressure from stroke to stroke characterizing genuineness and evidenced by changing line width and changing amount of ink deposited with fountain and ball pens is also discernible in fiber pen writing, although to a lesser degree. Again however conditions evidencing these pressure variations may be present which are not found in fountain and ball pen strokes: the brush effect producing minute dot-like blank areas within the stroke and the breaking or serrating of a margin of the stroke.

Such evidences of forgery or imitation in writing strokes as minute tremor, unsteadiness, lack of pressure variation characteristics, and blunt ending strokes are observable in writings copied or traced using the fiber pen (fig. 3). Pen stops, pen lifts, patching and retouching are also discernible. Where a fiber point rests on the paper momentarily there will often be an increased deposit of ink there, visible as a dot-like spot in the writing line. Pen stops within a line and blunt endings will often be so characterized. Patching, retouching and overlapped strokes will be characterized by areas of heavier, darker inking, thickened strokes and non-giving lines or margins.

The slow travel of a fiber pen over the paper in a forgery will result in a heavier deposit of ink on the paper than in a more rapid genuine writing. This does not occur with a ball pen, although it may with a nib pen. If the stroke of a fiber pen slows down almost to a stop this will result in a heavier deposit of ink than in adjacent portions.

In sum, it is predicted document examiners will have little trouble detecting forgeries with the fiber pen.

The strokes made by a fiber pen are normally uniformly inked from side to side (cross-wise). They do not have ridges or longitudinal concentrations of ink along the edges of the stroke as nib pen strokes often do. Neither is there any indenting, depressing, or furrowing into the paper. For these reasons it has been difficult or impossible for this writer so far to determine the order or sequence of two crossing or intersecting strokes made with these instruments, even of different colors. Sequence-of-strokes experiments made with fiber pens crossing or being crossed by other writing strokes and conditions have been extremely limited but indicate better prospects. For example, evidence of a fiber pen stroke crossing a fold is often quite prominent in the form of ink feathering out along the fold.

With respect to identification and differentiation of ink strokes on paper (that is, the question of whether identical to or different from other ink strokes on paper), the problem appears to be the same as it is with washable fountain pen inks, as the ink is of the same make-up. From the limited information obtained and observation made to date, some inks appear to be single dyes dissolved in water and others appear to be two or more dyes in water. Different shades or tints of the same basic color from one brand pen to another can often be distinguished visually with the microscope.

There are often marked differences in evidences of pen action or operating characteristics from one brand pen to another which alone would permit an opinion that two different pens were used, even if the shade of ink were identical. These evidences

are governed by composition of tip, size and shape of tip, rate of ink flow, and fluidity of ink. The evidences in the strokes on paper include width or thickness of stroke, degree of variation from thick to thin, heaviness of deposit of ink, and solidity and uniformity of ink coverage of paper.

Since the writing medium of these fiber pens is "washable" aqueous ink, the written line can be eradicated easily with a standard commercial fountain pen ink eradicator. While such an eradication is detectable and is often glaring in ultraviolet light, the writing eradicated is not often decipherable or restorable, and the writer has had very limited success in such efforts. Of the many tests made, decipherment was possible in only a few instances with the use of ultraviolet light, where the eradicated strokes fluoresced differently from the surrounding areas. The red inks in particular fell in this category.

As nearly as has been determined to date, the first of these pens (the Pentel) came out early in 1964. If therefore it can be ascertained that a writing is made with washable aqueous ink and has the characteristics of the fiber-tip pen strokes and not the wider strokes of the earlier-advent felt markers, then it would seem reasonable to conclude that such a writing could not have originated prior to 1964.

#### PROGNOSIS

While it is a long way from supplanting the ball pen, it seems likely that the fiber-tip pen will continue in popularity for quite some time and increase in prevalence in every-day writings. For the most part the dealers contacted expressed confidence in its increasing popularity and the users questioned indicated satisfaction and continued use. Moreover new and improved products of this type are being brought out from month to month.

The observation and study of fiber-tipped pens, inks and writings will therefore apparently be a necessary and continuing activity of the complete document examiner.