WRITING INSTRUMENTS

THE NATIONAL COLLEGE OF ART AND DESIGN

WRITING INSTRUMENTS FROM THE REED-PEN TO THE ROLLER-BALL PEN

A THESIS SUBMITTED TO:

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BY

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Introduction

Writing as we know it is a system of communication, whereby collective memory can be maintained and information stored by means of 'conventional' visible marks. To write involves a complex combination of cognitive and physical acts, by which a writer manipulates an 'instrument' capable of leaving a series of meaningful marks on a surface.

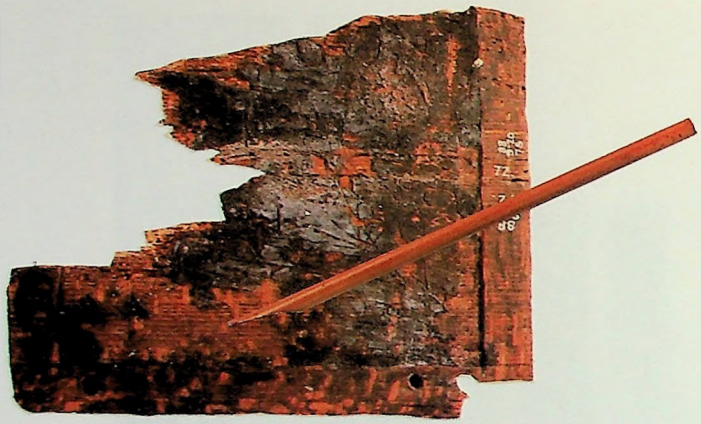
It is this 'Writing Instrument', how it developed over the last 5,000 years, to the mass-produced product of the 20th century, which I hope to examine during the course of my thesis.

Brief History of Writing

Writing was invented by the Sumerians in the Southern Mesopotamian Valley (modern Iraq) some 5,000 years ago, but their system was complicated with perhaps no more than one per cent of the population literate. The invention did, however, mark the beginning of the transition from oral literature (songs and stories) to written forms.

The use of a wedge stylus in clay was a slow manual technique of making records, it may have encouraged the Sumerians to develop a simpler writing system.

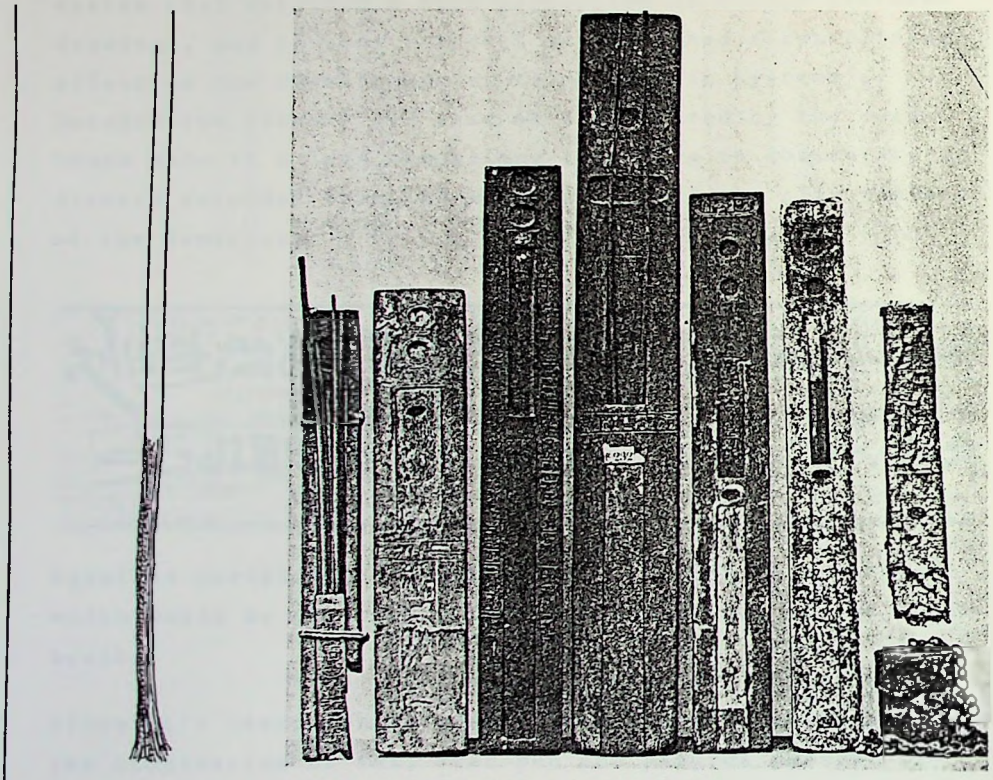
About I,600 B.C., the Semetic alphabet was developed in the biblical land of Canaan, where it came into widespread use and was eventually transmitted to the Greeks by the Phonians. The Romans adopted it to their language and developed the 'Latin' alphabet which in turn 'mothered' the national alphabet of Europe.



The wax tablet developed by the Romans, comprised of a wooden base, rebated with raised edges and the hollow filled with a sheet of wax on which letters could be 'scribed' with an iron or wooden stylus. The tablet could be erased by using the handle to polish the letter.

The Reed-Brush Pen

The Egyptian brush-pen, developed sometime after 3500 B.C.; was made from a thirsty, thin-stemmed rush plant called 'Juncus Maritimus', cut to a length of around 23 cm. When chewed or hammered soft at one end, it's vascular structure easily frayed, enabling it to absorb ink made from fine soot, water and a binding agent such as gum.



The scribes palette was an object of status, as well as a working tool.

Because the tip of the reed was soft, it was possible to write on rough surfaces such as papyrus; in any direction, with relative ease. In fact it was possible to write on both horizontal and vertical surfaces, because of the absorbency inherant in it's vascular structure.

With the necessary adjustments made to the writing tip it was possible to draw a range of line thicknesses from fine to broad. Similar to that of modern fibre-tipped pens. In fact the modern 'fibre-tip drawing pen' is little more than a sophisticated machine-produced version of the reed-pen.

As a writing instrument it was superbly, suited to a writing system that retained a high proportion of linear picture-drawings, and in some respects may have had a restraining effect on the development of 'Alphanumeric Systems', because the fluency and ease of use offered by the reed-brush made it a less compelling incentive to abbreviate or discard outmoded forms of writing, as did the clay tablets of the Sumerians.

Egyptian script has the quickly-written characteristics which would be expected from the habitual use of the reed-brush.

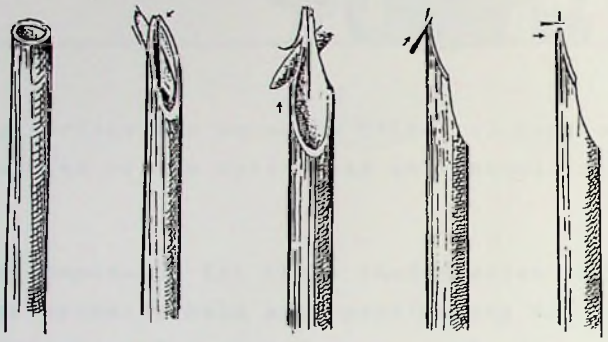
Since it's inception virtually five-thousand years ago, the combination of ink, reed-pen and papyrus brought about by the Egyptians was such a revoluntionary step, that it remains the fundamental basis of most hand-written communication.

The Split-reed pen:

By 1500 B.C., the Greek's had introduced a more durable and versatile, writing instrument called the Split-reed pen.

Cut from one of the hard-skinned, hollow-stemmed species of reed such as 'Genera', 'Calamus' or 'Arundo'.

It was originally 23 cm in length, with a point or nib that was 'cut' and when worn out, 're-cut' until it became difficult to hold, where-upon it was discarded.



Making a Split-reed pen, required exacting skill.

The Split-reed pen as it's name suggests, was produced with a slit in it's nib; primarily for flexibility, however, as a direct consequence of this, the nib became more responsive to varying pressures of the hand - producing a modulated line beyond that of the reed-brush.

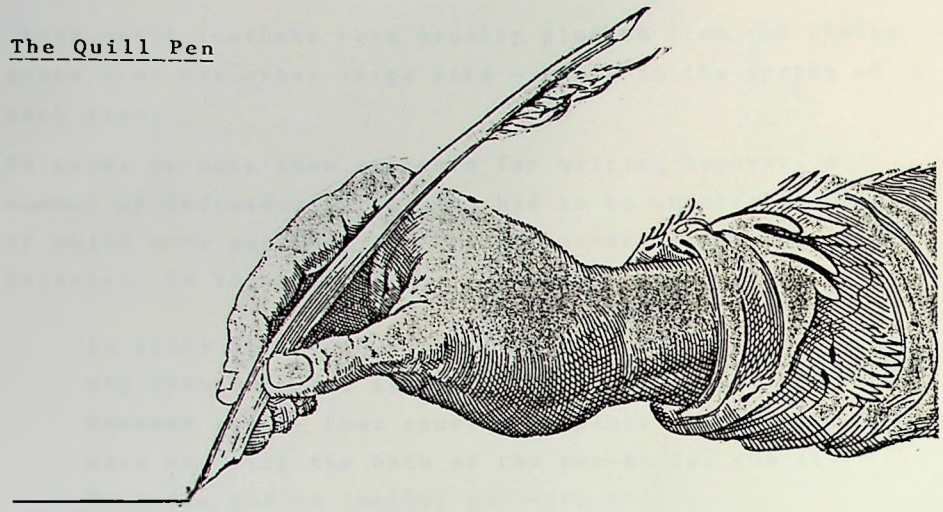
Unlike the reed-brush which depended on the 'absorbency' of it's structure to slow-down and control ink-flow. The Split-reed brought about newer operational constraints, because it relied on the less effective combination of 'surface tension; in liquids and 'resistance to flow' - caused by friction that exists between ink and the internal surface of the hollow reed - in controlling 'ink leagage'.

The writing surface was normally tilted to compensate for the inadequacies of the split-reed in controlling 'ink leakage'.

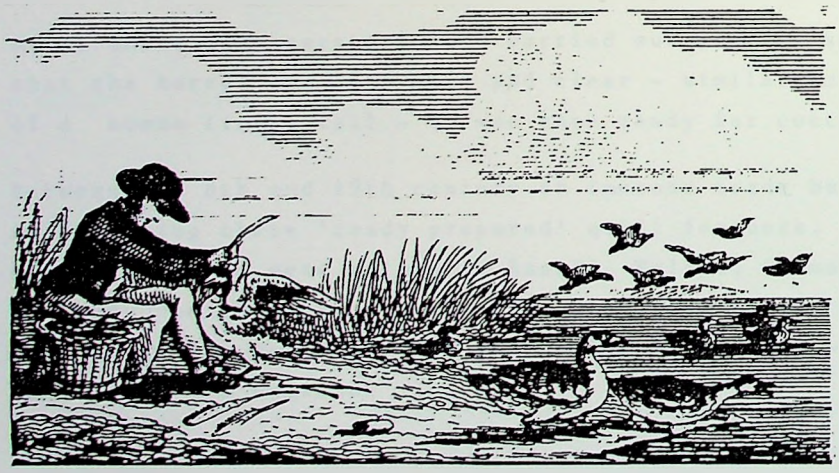
In order to compensate for these inadequacies the Split-reed pen was normally held at approximately 45° to the vertical, and the writing surface was tilted to achieve the desired angle of incidence between the nib and papyrus surface; as shown in the illustration above.

It was not until 500 A.D. by which time leather and parchment had been introduced as writing surfaces, because they were smoother and consequently more sympathetic to the harder writing nib of the Split-reed pen, that a further 'form' of writing instrument was developed called the 'quill pen'. Based on similar principles to that of the hollow-reed it was capable of producing fine and accurate lines.

The Quill Pen



The Quill Pen, originally developed in the Dark Ages, around 500 A.D.; superseded the 'Reed Pen'; primarily because of it's greater availability in Western Europe and the improvements offered by the introduction of parchment and vellum as writing surfaces.



The word 'pen' denoting a 'writing instrument' originally came from the latin word 'penna' meaning 'feather'.

These quill feathers were usually plucked from the living goose - or any other large bird - early in the spring of each year.

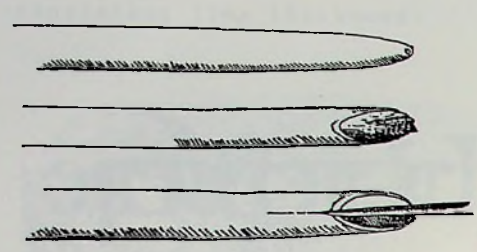
In order to make them suitable for writing however, a number of individual processes had to be undertaken, some of which were outlined in 'The Dictionary of Art and Sciences' in 1754:

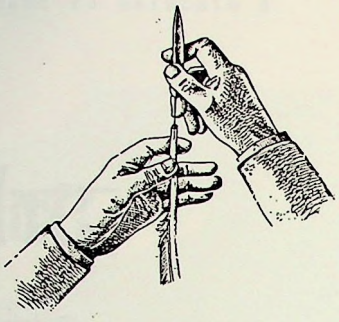
> In order to harden a quill that is soft place the stem into hot ashes, stir it until it becomes soft - then remove and place on your knee and with the back of the pen-knife, rub it from one end to another to 'warp it'.
>
> If you have a number to harden, put some water and slack on the fire and while it is generating steam place a handful of quills, the barrels only, for one minute, then remove and trim the barbs.

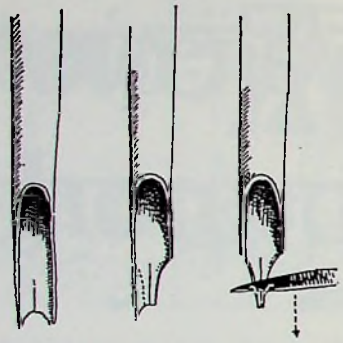
Other similar recipes for preparing the stem and removing unwanted barbs are given elsewhere and presumably there has been little change in these methods over the centuries.

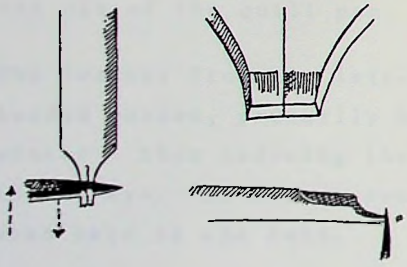
After these processes had been carried out and checked that the barrel was both hard and clear - similar to that of a human finger nail - it was then ready for cutting.

Between the 8th and 19th century an immense trade built up in supplying these 'ready prepared' quill feathers. Vast flocks of geese were raised in Russia, Poland, Germany and Holland. In a single year for example: some twenty seven million quills were exported from Saint Petersburg - now Leningrad - to England.







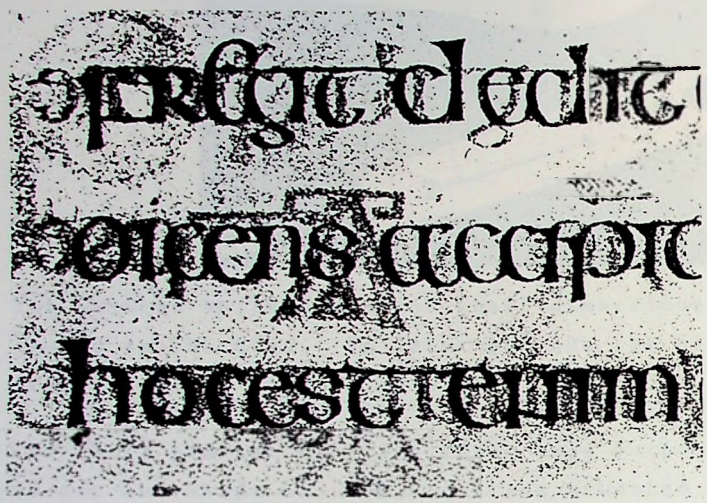


Cutting a Quill Pen:

The 'nib' could be pared to any thickness or to any angle to suit ——— individual preferance or style of writing.

The result was a tool which was both flexible and responsive in a skilled hand; capable of producing lush, thick down-strokes and delicate traceries on the lightened up-strokes. The Book of Kells executed about 700 A.D. testify to the beauty of work which the quill pen could produce. However, in order to ensure continuous high performance the nib

required constant and skilful adjustment to maintain a consistant line thickness.



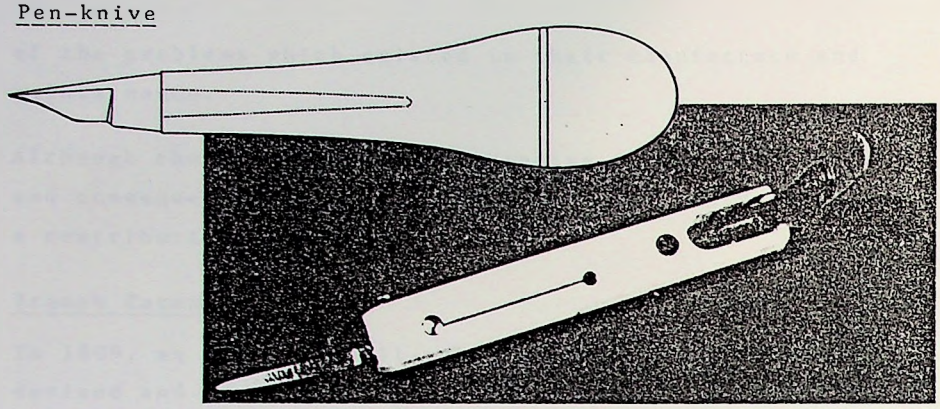
This illustration from 'The Book of Kells' demonstrates the obvious technical skills necessary in the preparation and use of the quill pen.

The feather from the left-wing of a bird suited a right-handed person, primarily because it curved away from the writer - thus reducing the possibility of stabbing oneself in the eye. It also prevented the barrel from twisting when held in the hand.

Besides these basic functional and ergonomic requirements: quill pens came with little choice of design, though contemporary records suggest that there were fashions or personal fads which dictated whether the feather was stripped completely, partly left, or reduced to a mere tuft on the end.

So quickly were they worn-out when used on a regular basis, any embellishment would have been wasted, although for ceremonial or home use, the stems were sometimes decorated with dyes or a binding of coloured threads.

Pen-knive



The pointed knife-blade was small dimensioned and held easily in the hand. In later periods the blade was 'retractable'.

The early pen-knife served three main purposes, firstly to cut and shape the nib, to erase unwanted text and finally to burnish the writing surface.

The quill was an enormously successful instrument which dominated writing for more than a thousand years, however, the essential skills in cutting, slicing and shaping were too exacting and time-consuming for general school and office use; the demand for a more convenient and durable writing instrument built-up, particularly in the mid 18th century.

Although the quill had been a successful writing instrument for many centuries after it superseded the reed pen in the early days of Christianity in the west, it's supremecy had not always been unchallenged. The Romans, we know, made pens out of various metals.

Over the centuries individual inventors and manufacturers in different countries had attempted to make some form or other of metal substitute to the quill.

It is hardly surprising however, that strenuous efforts should have been made to overthrow the 'quill pen' because

of the problems which existed in their manufacture and maintainence.

Although the introduction of printing in the 15th century and consequently the increase of literacy would have had a contributing factor.

Bramah Patent Pen:

In 1809, an English quill-maker called Joseph Bramah, devised and later patented a machine for cutting the quill stems into separate nibs, which in turn were slipped into a standard holder for writing.

It was a significant advance over previous writing instruments in that it enabled standardised nibs to be mass produced with repeated precision and with an economy of labour and material; unobtainable using conventional hand-produced methods.

Throughout the next forty years, various nibs were produced from materials such as steel, softened tortoiseshell and horn, tipped with gold, diamond, ruby and other gemstones, in order to achieve greater durability.

By the mid-1880's, steel nibs were perfected with the desired flexibility to finally liberate writers from the pen-knife and so end the reign of the long-lived quill.

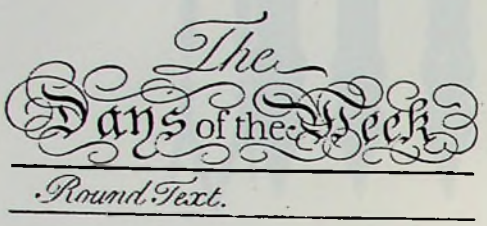
The Steel Pen:

The development of the Steel-pen and it's gradual rise to almost universal use in a period of less than half a century was a remarkable feat in view of the long established reign of the quill. However, anyone who used a quill for long periods, inevitably became aware of it's disadvantages. The carefully made point soon wore down. The nib needed frequent renewal in ink; thus creating necessary pauses in the flow of writing and formation of letters. It was not surprising therefore that for purely practical reasons many attempts would have been made to find a more efficient writing instrument.

History is not clear as to who first invented the Steel-pen. As often happens, invention quickly followed upon the heels of necessity in several places simultaneously. However, there were a number of claims to the title of 'first inventor'. A manuscript book of 1748 placed on record the claim of Jahann Jantssen, a magistrate of Aix-la-chapelle (Aachen), who felt that he might 'without boasting, claim the honour of having invented a new pen. It is perhaps no accident that God should have inspired me at the present time with the idea of making steel pens'.

'The Boston Mechanic' in August 1835, however, published a note that the inventor of steel-pens (in 1800) was an American, 'a well-known resident of our city, Mr. Peregrine Williamson ..... Regardless of the inventor, the English borrowed the invention and eventually realised immense fortunes.

Like virtually all new inventions, the steel pen was not greatly favoured; imitating the design of existing quills, they were still, inflexible and susceptible to the corrosive agents in ink.

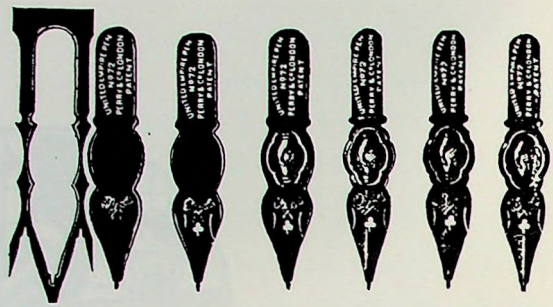


Sunday. - Saturday.

As the style of writing changed, the flexibility of the pen became more, rather than less important - the 'thick and thin' strokes of the typical late 18th century English round-hand, required a particularly adaptable nib similar to that of the quill.

At first each nib was laboriously and often somewhat crudely handcrafted to shape. The most difficult process in the early days was to make the right kind of slit. The method usually adopted was to hammer a thin strip of metal into a tube shape, so that as the outer edges came together, the slit was formed. The underside of the tube was then scooped away just like a quill and the point was filed to shape. Another technique was to punch the shape of the nib out of a flat strip of soft steel and then to round this to shape by hammering it over a circular rod of wood. When the steel hardened this dent was forced to crack along it's length. The end of which was then ground and shaped by wheel or file to create the required point.

The breakthrough was the invention of the screwpress - or more correctly the adaption of the screwpress from it's original application in button and buckle manufacture to nib manufacture by John Mithcell, during the early 1820's.



Each stamp was placed accurately beside it's neighbour, so as to waste as little steel as possible - the blanks were then marked, pierced, embossed, raised, grinded and eventually slit.

The machine he developed could stamp out accurate shape, from thin strips of soft metal and could be adapted to pierce the slots, emboss a raised design and to press the nib into the rounded shape necessary to fit the nib-holder. When the nibs had been hardened, a second press fitted with an upper and lower cutter made the final clean slit in the centre of the nib. Any roughness left by these operations was finally removed by 'tumbling' them for several hours in barrels with mild abrasives such as walnut shells; they were then polished in the same way with sawdust. The nibs were coloured by heating them in cylinders over coke fires until they achieved the required tint. They were then lacquered to prevent rusting, dried and packed.

PIERCING.

Over 28,000 pen nibs were manufactured each day in the Birmingham factories.

By the late 1828's, James Perry and Joseph Mason both steel-pen manufacturers, improved the machinery developed by Mitchell and began manufacturing their patented steel-pen, with a central slit.

Joseph Gillott, another Birmingham manufacturer, whose name long remained synonymous with pen nibs, was also credited with improving flexibility, by making three slits as opposed to one in the nib.

It was these general improvements, coupled with the development of methods in mass production, that brought about a reduction in cost, not only giving rise to increased sales, but the fact that the average pen could be purchased so cheaply meant that the user was more inclined to discard a worn-out or corroded pen-nib and buy a new one.

Inborn Obsolescence:

The ink-formulation of tannic and gallic which had suited the quill-pen perfectly for centuries, produced a powerful chemical reaction with steel-nibs making them rapidly unusable.

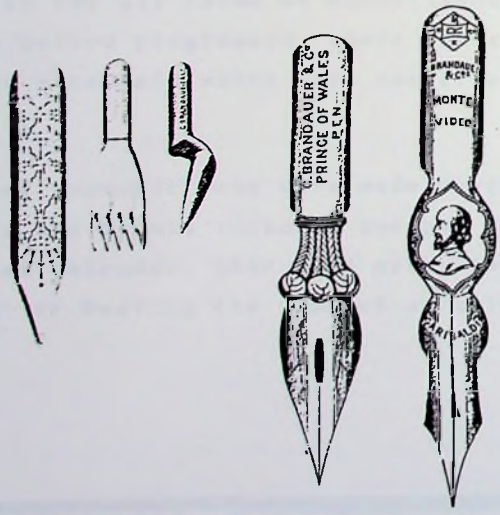
This meant that either the steel-nib required special treatment or a less-corrosive ink had to be developed to overcome these problems.

Although stainless-steel nibs had been introduced by the mid-1820's, they proved too expensive as a 'throw-away' commodity.

Therefore, great efforts were made to develop a new form of ink, which 'reduced' as opposed to 'totally eliminate' these corrosive properties, after all this inborn-obsolesence worked to the manufacturers' advantage.

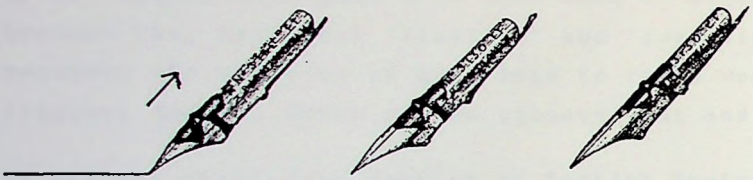
Novelty, sourvenir:

Once the essential functional and production criteria had been established, there was scope for creativity in the shape and finish of pens. Manufacturers vied with each other, producing novelty and souvenir nibs and holders.



Nibs were produced with relief portraits of famous people, others for ruling musical staves.

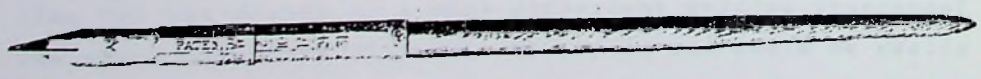
Despite their simple shape pen-nibs were produced in endless variety. The Birmingham firm of C. Brandaver & Co., manufactured more than a thousand different kinds of nibs with relief portraits of famous people such as Goethe, Bismark and Garibaldi; in order to stimulate sales abroad. Other nibs were developed for writing script that runs from right-to-left, some had three points for ruling cash columns, while others had five points for ruling musical staves. By the mid-1850's there were thirteen principle pen factories in Birmingham producing an estimated 175 million nibs each year.



The Perrgian 'regulating spring slide nib was made around 1843, by moving the spring slide 'up or down' varying degrees of flexibility could be obtained, other models had a thin band around the nib for the same purpose.

The nib-holder required much less ingenuity in it's manufacture than did the steel-nib; therefore, it provided opportunity for all forms of embellishment and as the Victorian period progressed, there seems to have been few shapes and materials which were not tried out at one time or another.

Novelty and souvenir pens were made in the shape of umbrellas, keys, guns and tennis rackets, one pen was even designed as a perpetual calendar, that came marked with 'a present from ....' or bearing the name of an enterprising advertiser.



More expensive pen-holders were made in engraved mother of pearl, silver, gold, porcelain and even glass.

Barley-sugar twist nib-holders were popular during the Victorian period.

By the mid-1850's, gold nibs were used in high-quality pens, because they were both 'flexible' and 'corrosion-proof'. However, the softness of gold lead to rapid wear, necessitating frequent repair, which proved inconvenient and expensive.

It was not until John Hawkins an English Engineer introduced an alloy called 'iridium', which was used to form a strong and long-lasting pen-point, that gold-nibs came into widespread use.

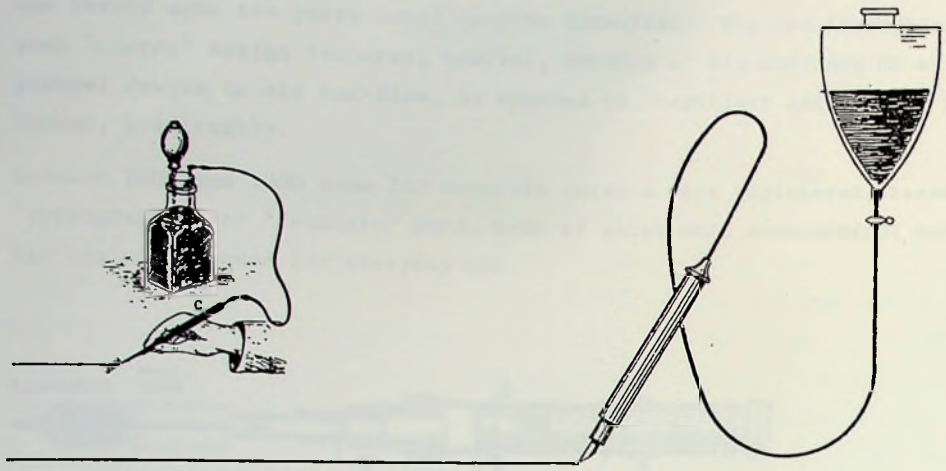
The demand for a more convenient writing instrument:

In spite of all these improvements in manufacture and material finish, the steel-pen was fundamentally, a 'jumped-up' version of the quill-pen. It had to be held - side up and at an angle in order to prevent it from leaking.

One of the great disadvantages with the steel-pen, however, was it's constant need for replenishment in ink. This inevitably broke the flow of writing - which conveniently, the writing masters recommended to their pupils as a 'desirable acquirement' - equally inconvenient, however, was the break in thought, which might occur as the pen made it's way from ink-pot and back again.

These inadequacies generated a further consumer demand - this time for the design of a more convenient writing instrument - one which contained it's own ink-source and could be easily transported.

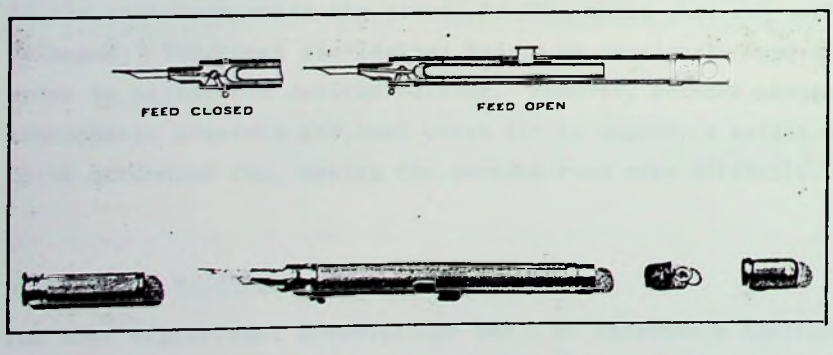
The Reservoir/Fountain Pen



Early suggestions for providing a constant ink-supply.
From "Resevoir, Fountain and Stylographic Pens".

The late I9th century saw numerous attempts to devise a pen which contained its own resevoir of ink, and even as far back as the IOth Century the 'Caliph-al-mu'izz' ordered craftsmen to make a Resevoir/ Fountain pen of pure gold, However, contemporary records do not suggest how successful it was.

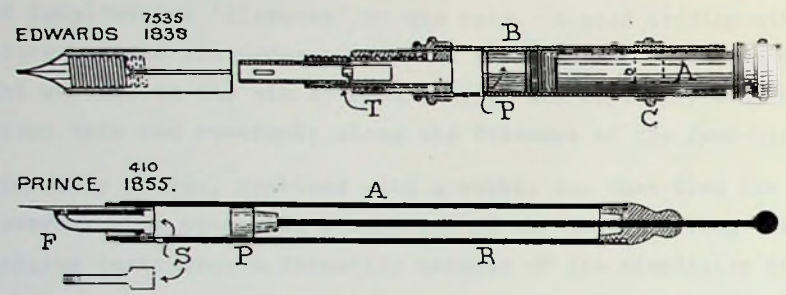
Other attempts were made in the I8th Century; Chamber's enclopedia published some 2I6 years ago, supposedly gives some very definate information on the subject including detailed diagrams.



John Scheaffer's design for a 'Penographic' fountainn pen in I8I9.

The first two British patents were taken out in I809. The third patent was issued some ten years later to John Scheaffer. His pen incorporated some 'clever' design features, however, because of his reliance on a plunger device to aid ink-flow, as opposed to 'capillary action' his pen leaked, predictably.

Between I809 and I900 some I42 seperate patents were registered, termed 'sytlographic' or 'fountain' pens, most of which were unsuccessful and far too complicated for everyday use.



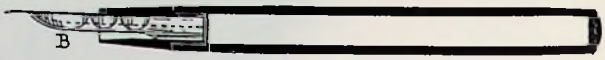
Most of these early designers appreciated the advantages associated with storing ink in the barrel of the pen holder.

The design and manufacture of a nib, reservoir and holder presented no major problems. The challange lay in the design of a feed mechanism; where forces of gravity, inertia, capillary attraction, air-pressure, friction and viscosity had to be balanced.

If air could not enter the reservoir this meant that ink could not be released. Therefore air leakage had to be cautiously controlled in order to strike the desired balance. However, because changes in atmospheric pressure and heat cause air to expand, a safety margin had to be accounted for, making the problem even more difficult to solve.

Lewis Edson Waterman

The most significant breakthrough was L.E. Waterman's American patent of I884 which slowed down and controlled ink-flow by a simple capillary-feed system.

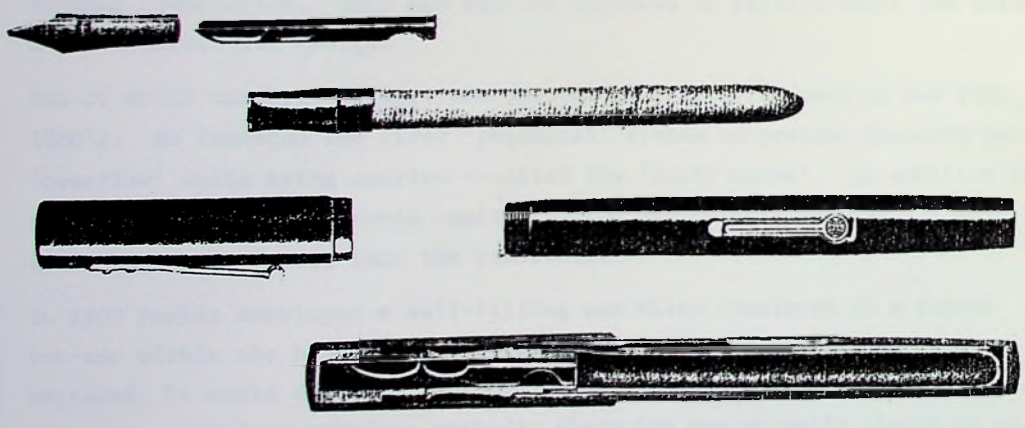


The Waterman

The Waterman 'Ideal' was originally manufactured by hand, using vulcanised rubber, a process introduced by Charles Goodyear in I839.

Waterman's pen called 'Ideal' consisted of a barrel which acted as a resevoir of ink; this in turn carried the point section and feed-bar. An ink duct was formed along the upper part of the feed-bar which consisted of longitudinal 'fissures' or saw cuts. A gold iridium nib was held in place between the upper surface of the feed mechanism and point section. Ink was fed to the nib by both gravity and capillary action while air was drawn into the reservoir along the fissures of the feed-bar.

His early design, combined with a rubber sac that drew ink into the resevoir when squeezed, became one of the most enduring versions of the writing instrument — Primarily because of its simplicity in design.



The principle parts of the 'Ideal' set the basis for modern fountain pen design.

George Safford Parker

From Waterman's invention in I884 to I9I0 were years of experiment and intense competition. Many men started business to exploit their own ideas about fountain pen design.

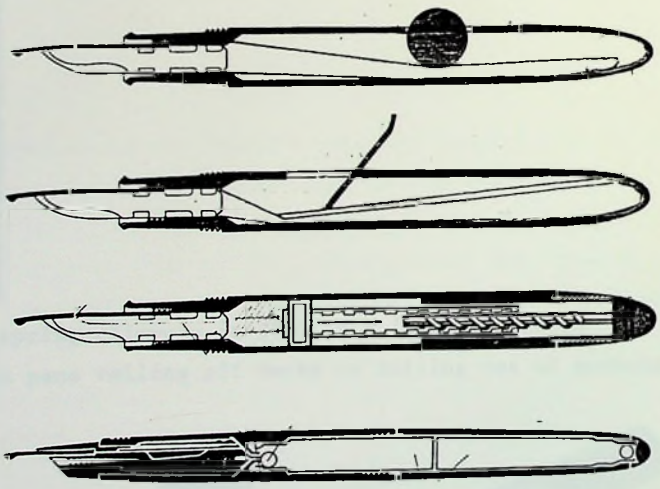
One of which was G.S. Parker, who started manufacturing pens in the late I880's. He invented the first 'practical' system to prevent fountain pen 'overflow' while being carried - called the 'lucky curve'. In addition to this he introduced a reverse capillary flow device that enabled ink to drain back more freely into the reservoir.

In I903 Parker developed a self-filling pen which consisted of a rubber ink-sac within the barrel, when pressed the sac would deflate and when released, it would draw ink up to fill the vacuum. It was a major technical advance compared to previous methods; where ink was normally placed in the reservoir using an eyedropper.

Filling Mechanisms

Filling mechanisms became the object of intensive research, resulting in such operating methods as in the 'Condin Pen', where the sac was depressed by inserting a coin through a slot in the barrel. Followed by W.A. Sheaffer's lever-fill pen in 1908, based again on the vacuum principal, using a pressure bar, which was operated by a lever at the side of the reservoir.

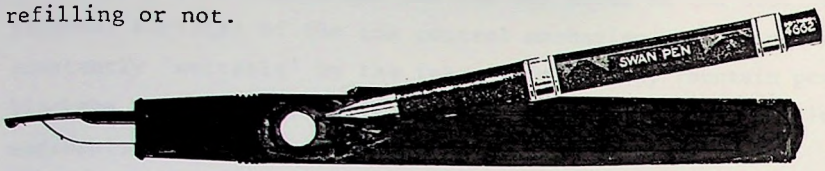
Other devices such as pressure buttons, U-shaped springs, sacless pens which worked using various pump mechanisms and the eventual introduction of the disposable ink-cartridge in 1955 by Sheaffer. The advantage of which meant that a fresh supply of ink could be safely carried in a pocket or handbag, without the inconvenience associated with previous filling mechanisms.



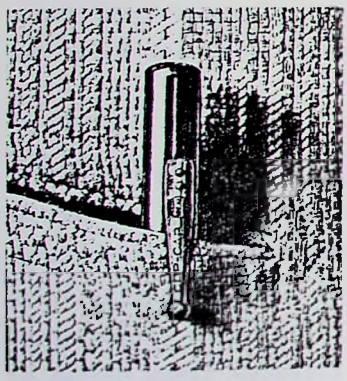
Filling methods: Top-Bottom, Coin Insert, Lever-fill, Piston-type and Cartridge-type

Other Developments

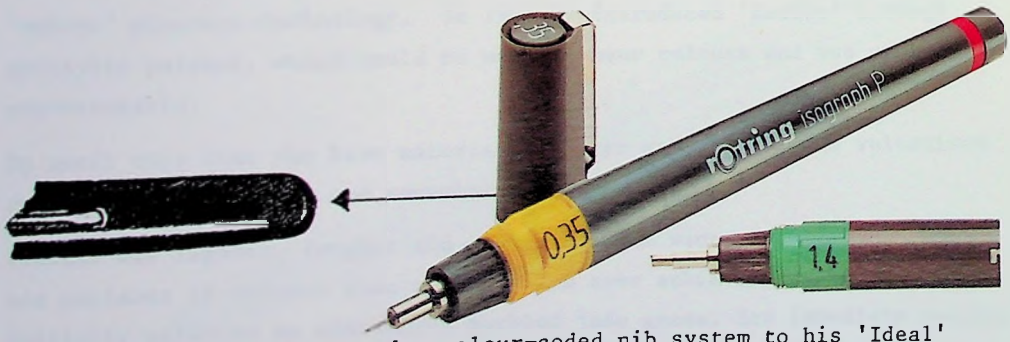
Swan, an English company, introduced an 'ink-sight' into their pens in 1913. It comprised of a small glass lense, fitted into the side of the barrel, whereby the ink-supply was seen reflected against a thin strip of 'opaline' fixed longitudinally on the inside of the reservoir. It enabled the operator to ascertain whether the fountain pen needed refilling or not.



Swan introduced the ink-sight in 1913



Waterman introduced the spring clip-cap in 1920 as a 'safety feature' in order to prevent fountain pens rolling off desks or falling out of pockets.



In 1921, Waterman introduced a colour-coded nib system to his 'Ideal' fountain pen range. This was eventually used in technical pens to identify various line-thicknesses.

Ink

An effective ink must possess a range of essential properties, some of which in practice conflict with each other.

A fountain pen ink must meet very demanding requirements. Firstly, a pen must lay ink on the paper at the first attempt, even though it may have been left uncapped and the ink has dried on the nib. Secondly, the internal surfaces of the ink control mechanism must be readily and constantly 'wettable' by the ink. Thirdly, any fountain pen is prone to blockage and malfunction if the ink contains any appreciable amount of undissolved particles.

In I922 Scheaffer made a significant step towards the achievements of these objectives. When they introduced the first non-sediment ink called 'Skrip'.

By the addition of a solvent, they prevented ink drying completely on the nib. This obviously involved striking the right balance, otherwise the ink would not dry on paper either.

New Design Strategy

By the mid twenties the technology of fountain pens had reached a point of development sufficient to satisfy the most discerning critic. Pens that wrote effectively and reliabely could be taken for granted. Technical improvements could still be make, but manufacturers now had the freedom to switch their emphasis to styling, materials and market image - in order to attract customers.

As early as I920 Scheaffer invested large sums of money developing 'embryo' plastics technology. In I924 he introduced 'Radite' a tough pyroxylin polymer, which could be made in many colours and was virtually non-breakable.

Up until this time the base material for caps and barrels was vulcanised rubber, which was hard and somewhat brittle.

Plastic was lighter, tougher and enabled a much wider range of colours and patterns of colours than rubber could ever achieve. Scheaffer initially selected an attractive marbled jade green. Its immediate success on the market forced other manufacturers to respond quickly.

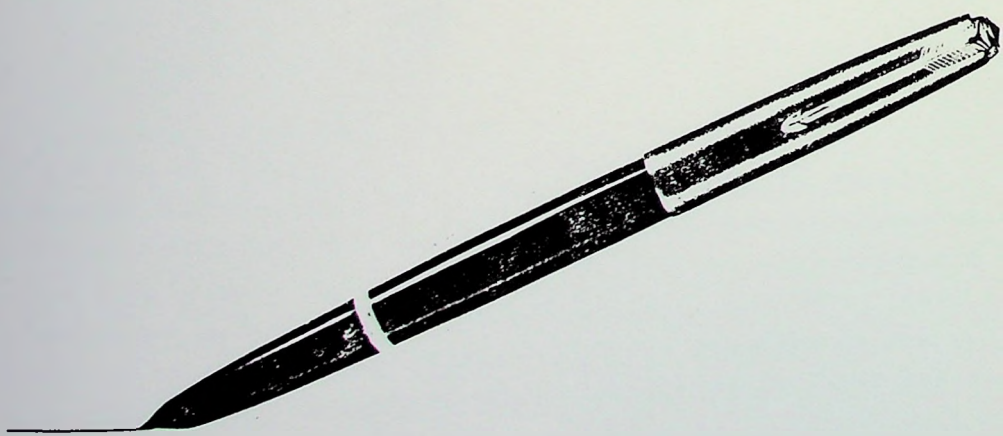
A new material was developed by the Dupont Company under the trade name 'Pyralin' in I924. It was supplied in bar form which was subsequently cut, drilled, machined and polished.

During the late twenties and thirties pens were produced in a wide variety of colours, shapes and sizes. They came in gleaming red, jet black, blue, hundreds of combinations, marbled, mottled with laminated rings of pearl and black. The overall form of the pen changed from its basic cylindrical form to a tapered, bullet shaped configeration. In fact, styling became as important in selling pens as it was in selling automobiles.

The Parker '5I'

In I94I, Parker introduced the '5I' fountain pen to commemorate their fifty first anniversary. The pen grew out of research into quick-drying inks, which slowed down evaporation and increased penetration when writing.

In order to achieve this, however, the ink-formulation needed a high alkali content - which tended to rot conventional rubber sacs - therefore a new synthetic material called 'Lucite' was adopted.



The nib of the Parker '5I' was partly covered by a special hood to prevent solvent evaporation in the ink.

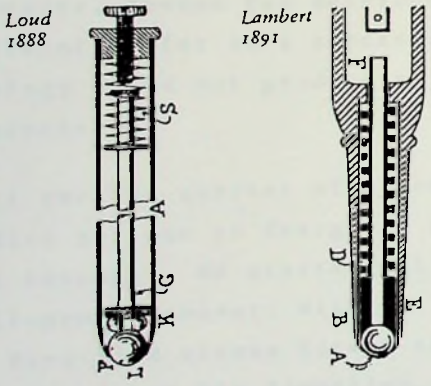
Contemporary Parker progaganda stresses that the 'lucite' barrel was designed on ergonomic principles. However, it is more likely that its elegant form was brought about by established technology. It has become a 'classic' of modern American design which is featured in standard tutelary texts, such as Laszlo Moholy-Nagy's "Vision in Motion" and an example is in the collection of the 'Neve Sammlung' in Munich, one of Germany's leading museums of design.

Ball-point Pen:

The originating concepts of most developments lie in investigations patented many years earlier. They remained unexploited either because nobody appreciated their full potential at the time, or in most cases because the material and production technology necessary were not available.

The first patent for a Ball-point pen was issued to an American inventor John Loud in 1888. It was designed as a marking instrument for leather, cardboard and other rough surfaces.

The pen consisted primarily of a tiny rotatable ball, which rotated freely in the mouth of a tube. This in turn was held in position by two smaller balls and a spring loaded plunger, which screwed down to control ink leakage.



Early Ball-point pen designs.

Another version of Loud's idea was patented in 1891 by Mr. J. Lambert. His improved feed mechanism incorporated six tiny channels on the inside of the barrel; which fed ink under gravity to the revolving spherical ball. This method of slowing down and controlling the flow of ink by increasing the surface area over which the ink must travel,

is used extensively in modern fountain/technical pen design.

Four years later, G.A. Warner and A.W. Askey patented a ball-point, which was actually produced and marketed for a short period, using an ink made from lampblack and castor oil. (However, it was eventually withdrawn from the market because of ink feed problems).

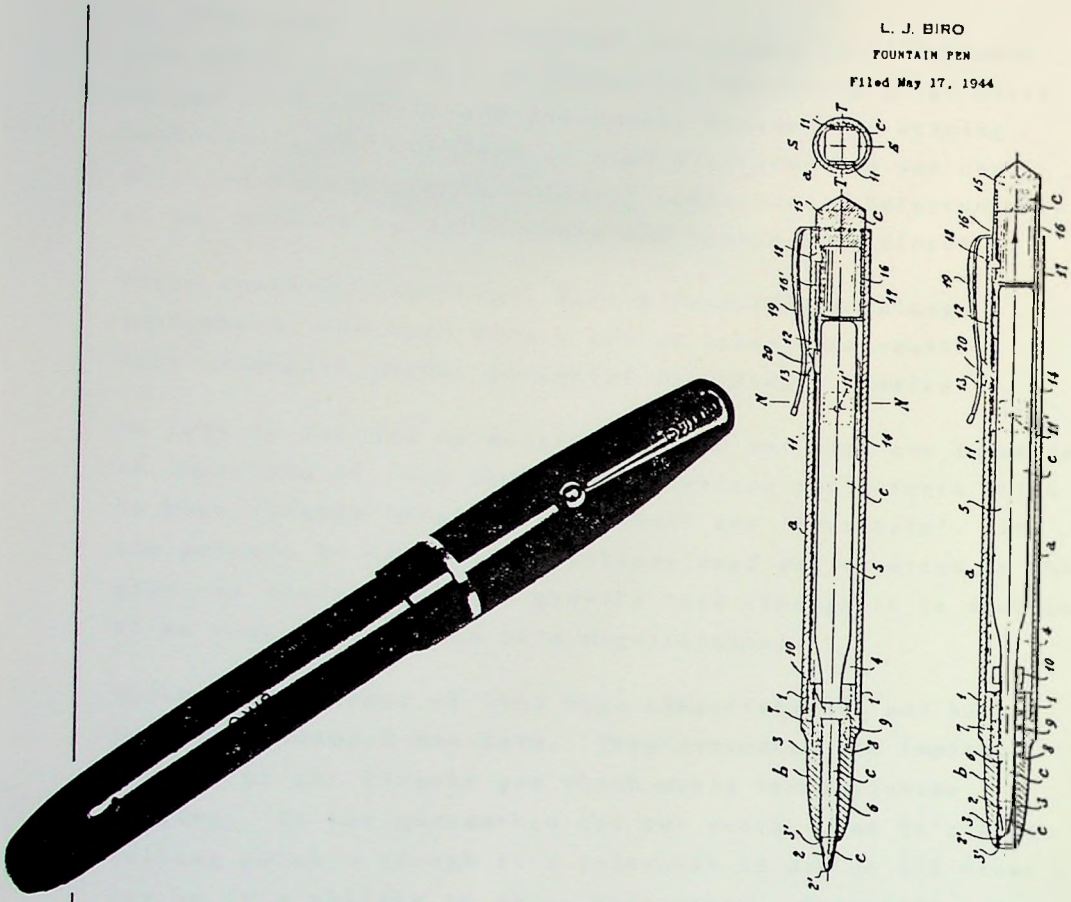
Again in 1916, Van Vechten Reisberg developed another version of Loud's basic concept.

As in all pens which provide a reservoir of ink, one of the greatest problems was to bring the ink supply to the point of writing in the correct amount when required. The underlying problem with early ball-point pens was to find an ink of the right viscosity.

Hence, all these patents were allowed to expire without exploitation because, no-one had developed the pastelike ink which was essential for it's success. Furthermore, existing technology could not produce so small a ball of the necessary precision.

It was not until another quarter of a century later that Laszlo Jozsef Biro set out to design an improvement on Loud's original concept. He started out by making simple models of a ball-pen. However, with the outbreak of World-War Two, Biro fled across Europe stopping off long enough in Paris to patent his invention.

In 1940 in Buenos Aires, he found sufficient sources of finance to develop his invention, design the production machinery, set up factories and train his labour force. The most important development was his appreciation of the inadequacies of gravity feed and his switch to a capillary action ink feed, (whereby liquids when confined to a narrow channel will ignore gravity).



Biro's original patent drawing for a ball-point pen.

His first ball-point pen called the 'Etherpen' was on sale in Argentina in 1943, styled to look like a conventional fountain pen. It depended upon a tiny ball, accurately ground to precise measurements. The socket was formed by pressing the ball into a piece of pre-formed brass, to take-up it's own individual impression.

In 1943, Biro approached J.C. Mosser, the President of Ebhard Faber, with a view to selling Edhard the American rights to his invention. Musser did not at first appreciate the significance of what was to become a multi-million dollar industry.

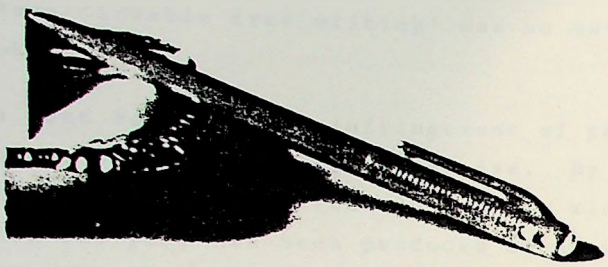
In 1940, Ebhard Faber obtained the rights to sell Biro's ball-point pen in U.S.A. alongside 'Eversharp'; at first it was sold to military personnel, because the writing instrument, did not leak at high altitudes and was not affected by changes in climatic conditions. Unfortunately, it was erratic in performance and leaked unpredictably.

While visiting Argentina, Milton Reynolds, a Chicago entrepeneur had seen Biro's pen in stores and realised it's extensive market potential in post-war America.

On this he decided to modify the pen, not with any intention of improving it, but simply to side-step the patents which he knew already belonged to 'Faber' and 'Eversharp'. In the process he lost the capilliary feed and reverted to the previous inadequacies of gravity feed (though it is doubtful if he ever appreciated it's significance).

Through the summer of 1945 huge advertisements and banner headlines swamped New York. They announced the imminent arrival of the miracle pen which would revolutionise writing. It was guaranteed for two years. But it's great selling point - though it's relevance is not at all clear - lay in it's ability to write underwater. Reynold's apparently discovered this attribute by accident when he was doodling on a soggy newspaper. It's selling price was fixed at $12.50; after all miracles don't happen for less.

With only three weeks to debut day, Reynolds leased a section of a machine shop in Chicago, hiring three hundred workers and with a total investment of $26,000 stamped out in a hit or miss fashion over 50,000 pens made mainly of war-surplus aluminium, they cost less than a dollar per pen to manufacture.



Reynold's ball-point pen was the first to be marketed in volume.

The frantic rise of the ball-point pen, began typically enough with a riot.

At 9.30 on the morning of October 29th 1945, some 5,000 men and women squeezed through the doors of 'Gimbels' department store in New York City, clutching wads of cash and pleading to buy what Gimbels had advertised as the 'fantastic miraculous fountain pen ..... guaranteed to write for two years'.

Reynold's ball-point pen was the first to be marketed in volume in the United States and indeed anywhere else.

Gimbels sold 30,000 pens in the first five days and another eight-million within twelve months. Reynolds profits were estimated at a staggering $2,500,000 within the first year.

By Spring 1946, however, disenchantment was setting in, many pens stopped writing, others leaked ruining clothes.

Bankers advised against using ball-points on cheques because of fading ink, and the Police reported that forgers were 'delirious with joy' after discovering that a ball-point signature could be lifted on a thumb and imprinted on another sheet of paper. In only seven months, 104,000 Reynold's pens were returned to the factory with complaints.

The ball-point lost all customers esteem and a guarantee of two years 'trouble free writing' was no more than a 'sour' joke.

Eversharp sued Reynolds for infringement of patent - but Loud's patent of 1888 weakened it's case. By the end of 1946 it had been estimated that in America alone, some 150 million ballpens had been produced by an industry that had not yet developed the sophisticated and highly automated precision machinery required to produce a completely trouble-free product. This factor contributed it's part to the demise of the ball-point, but poor ink which contained undissolved particles caused inconsistant flow and the necessary lubricant to enable free movement of the spherical ball are generally acknowledged to be the reason for failure.

The Second Generation ball-point

Although the ballpen was little more than a dirty word in the market place; the underlying ball-point principle was basically sound if only an ink could be formulated that would enable it to function properly.

Intrigued by the possibility inherent in the ball-point principle, and the possibility of making a few 'bucks'; Fran Seech, a Hungarian Chemist living in Los Angeles believed that ball-points would function properly, provided modifications were made to the ink formulation.

He began experimenting with various dyes and additives. After several months he contacted a small company called 'Papermate' and told them that he was close to perfecting an ink for ball-point pens, but needed more money to continue his research.

Having received money, Seech perfected the ink by 1950 and was turning out enough of it to earn him $25,000 a month in royalties.

Papermate introduced the first retractable ball-point pen in 1951 with ink that did not fade on paper. Since it dried quickly, signatures could not be 'lifted' easily. It flowed freely, without clogging or leaking (this was achieved primarily by using glycol as a solvent) and the use of an oil base that acted as a lubricant). 'It was unique in that it did not look like an inbred first-cousin to the fountain pen'.

In 1952, Seech after a quarrel with Pat Frawley owner of 'Papermate' sold his formula to a rival company called 'Scripto' for $100,000.

However, Frawley 'cracked' Seech's formula within a few months, which fortunately for Frawley had never been patented.

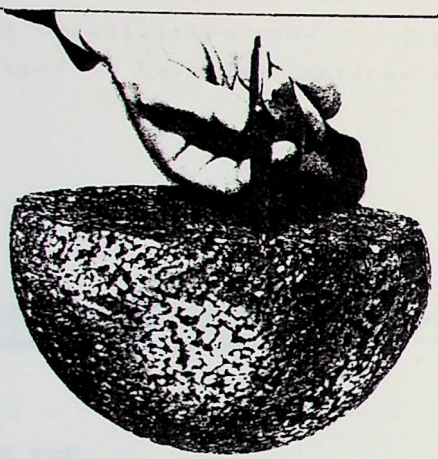
With the necessary technical experience acquired, mass production techniques for precision writing tips developed, and the first smooth-writing, quick-drying permanent pen inks at last available. The industry in the 1950's began the slow, arduous climb back to public favour.

Ball-points, however, remained a high-priced rarity until Marcel Bich, turned it into a mass-produced throw-away item in the mid 1950's.

He achieved this by the use of new plastics which allowed for bright colours (never before available) and the development of highly automated equipment capable of mass-producing cartridges and writing tips with the necessary precision. A direct consequence of these improvements came lower prices, (always an avenue for greater public acceptance); in fact Bich was the first to reap really substantial rewards from Loud's and Biro's invention.

Parker T-Ball:

A technical improvement in the ball-pen was later introduced in 1957 by the Parker pen company, with the introduction of a textured tungsten carbide ball called the 'T-ball'. The T-ball surface comprised of some 50,000 pits, which enabled it to grip rough and greasy writing surfaces.



The T-ball, developed by Parker, magnified thousands of times.

Fitting the Parker product image of 'quality and longevity' Parker had entered the ball-pen market some three years earlier with a retractable ball-pen. The unique retraction system comprised of a nylon ratchet that turned the point every time it was retracted; thus avoiding uneven ball wear.

Pressurised Ink Cartridge

In 1969 Paul Fisher developed a ball-point pen that would write under completely weightless conditions.

He achieved this through a pressurised ink cartridge, using specifically formulated visco-elastic ink, similar in consistency to that of chewing gum.

Fisher used nitrogen pressure at 50 PSI to force ink to the ball-point, which in turn liquified for application to a writing surface.

The pen was designed with the capability of writing at any angle - even up-side down, under-water, at 50 degrees below freezing, although this might be difficult; what is more the shelf-life is predicted at 100 years as opposed to two years for conventional ink cartridges. For most people, however, these capabilities remain redundant, although the pen has been used in both the American and Russian space programme.

Fishers' space pen.

Erasable ink ball-point pen:

An innovation which did introduce a fundamental change to the ball-point pen was the introduction in 1979 of a product called 'Eraser mate' by the Gillette company.

Originally marketed as a refillable product it's advantage over previous ball-points lay in it's ability to erase what it had previously written.

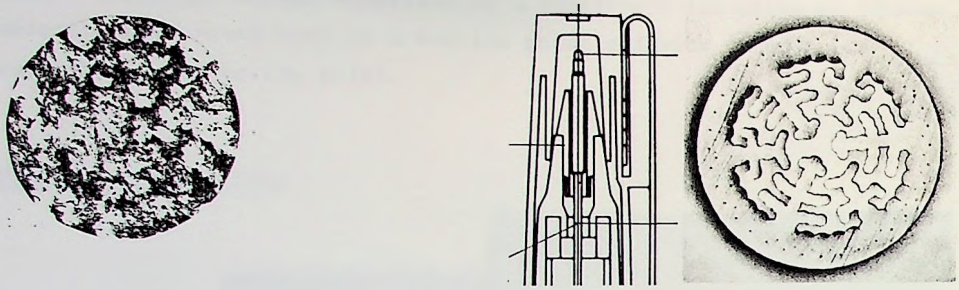
This was achieved through the ink's ability to resist full absorbtion by the paper for periods up to one month - until which, it could be erased by means of a pencil-like eraser - while still maintaining the bold appearance and permanence of conventional ink.

Despite this advantage, erasable ink pens have consistently failed to take off. It is generally assumed that the main reason for this failure is caused by the conflicting requirements of ink permanence and erasability.

The elasticity of the Eraser-mate ink is one million times denser than that of water.

The Fibre-tip Pen

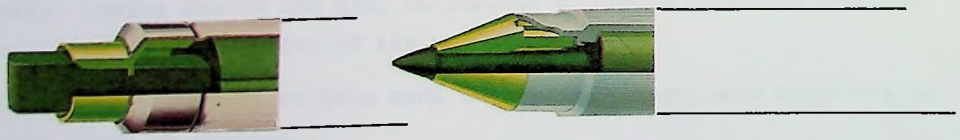
Modern fibre-tip pens differ very little in principle to the 'reed-brush' used by the Egyptians some five thousand years ago.



Sectional view through reed-plant and modern fibre-tip pens.

Both pens rely on 'similar' absorbent reservoirs of ink, in order to control the rate of capillary action - whereby 'surface tension' in ink causes it to cling to an absorbent surface - and is only released when a slightly greater pressure is applied to overcome its inherent 'elastized' force.

An interesting by-product of a mechanical device for printing music was designed in I745. J. Ashew having experimented with various inking systems, developed a series of pens with 'spongy absorbent points' which were fitted into an ink-reservoir - giving him no small claim to the invention of the modern fibre-tip pen.



Felt-tip and fibre-tip details.

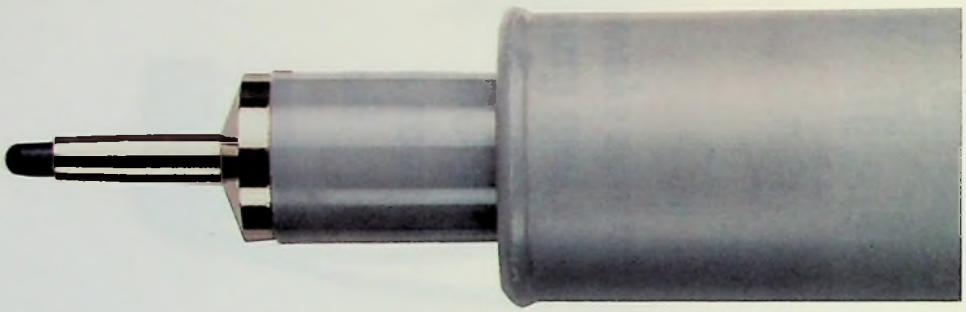
Pentel

Although some references have been made about felt-tip pens being developed during the I940's as an 'industrial marking device', it was

not until 'Pentel' a Japanese company introduced the felt-tip marker in I963 that it came into widespread use. Their pen called the 'sign pen' resulted from research into brush-like pens, which suited the essentially 'pictogram-based' characters of the Japanese language.

Their 'felt-tip' marker comprised of a relatively fat piece of fibrous material that acted both as a writing point and wick to draw its water-based ink to the point.

Fine-point Porus Pens



In the late I960's another Japanese company introduced a replacement for the felt-tip with a small piece of bamboo. This was much harder and consequently more durable. 'Pilot' introduced the fine-point porus pen in I973, which consisted of a rayon polyester, that had been processed into oriented fibers and bonded. The barrel contained a cellulose acetate core - similar to the filter material in cigarettes.

'Platignum', another Japanese company improved on this by placing a metal casing around the nib, to prevent or reduce premature splaying and increase visability of the writing point.

All these improvements have made the fibre-tip pen, more adaptable to most kinds of writing.

Other Developments

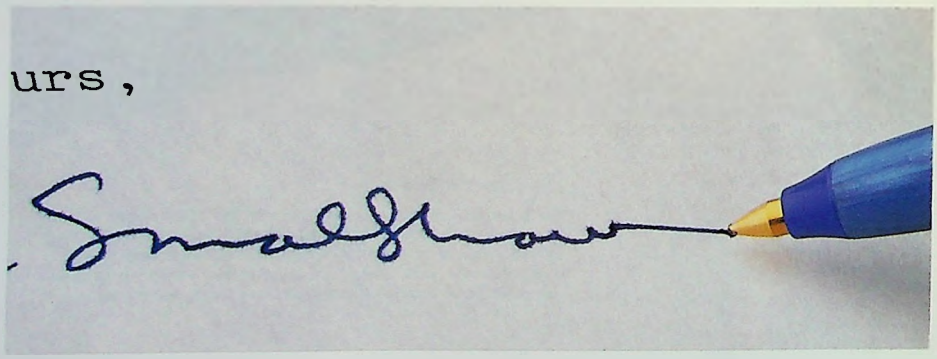
One of the latest developments in fibre-tip technology is the introduction of the ultra-violet pen, engineered originally for use by doctors, surgeons and X-ray technicians. It is used as a 'security' marking device.

The pen contains transparent gentian violet non-toxic marking ink, which glows visible as a pale blue mark under ultra-violet light.

The Roller-ball pen

In I966 'Pentel' of Japan introduced a new type of pen that avoided the problem of squashed or frayed fibre-points called the 'Rolling Writer'. It combined the best features of the ball-point - where it is possible to exert high pressures necessary for making sharp carbon copies, without damaging the point - with the free flowing water-based ink and wick-like delivery system of the fountain pen and fibre-tip pen, respectively.

Improvements have been made since they were mass marketed in the early I970's, such as the replacement of the polymeric ball with a carbide one, ranging in diameter from 0.I mm to I.0 mm. Also the recent introduction of a 'cushion socket' which is sensitive to varying writing pressures.



The rolling-ball produces a modulation of line somewhere between the ball-point and fountain pen.

However, one of its main disadvantages is that it only lasts one third as long as the ball-point with similar ink capacity, consequently making it more expensive.

Conclusion:-

The Threat of Electronic Communications

Expectations that the advent of electronic communications would mean the demise of personal writing instruments prove as ill-founded as other pessimistic forecasts following previous technological break throughs.

The invention of the printing press in 1445 followed by the introduction of the telephone in 1876, appeared to make letters obsolete and reduce the need for pens.

The advent of the typewriter, too, was thought to signal the end of the personal writing era. Writing instruments continue to be the essential tool, not only for signatures, phone messages and notes at meetings.

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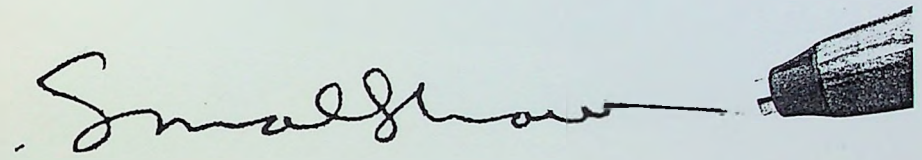
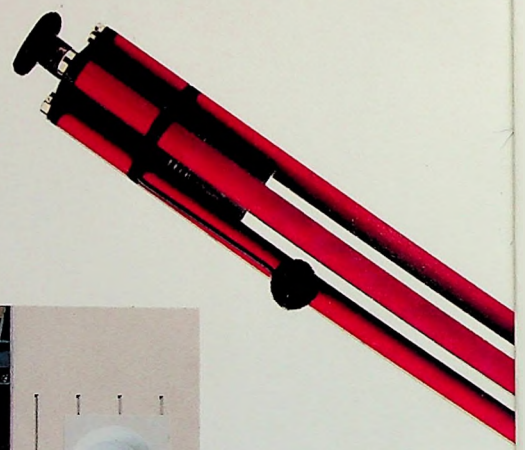


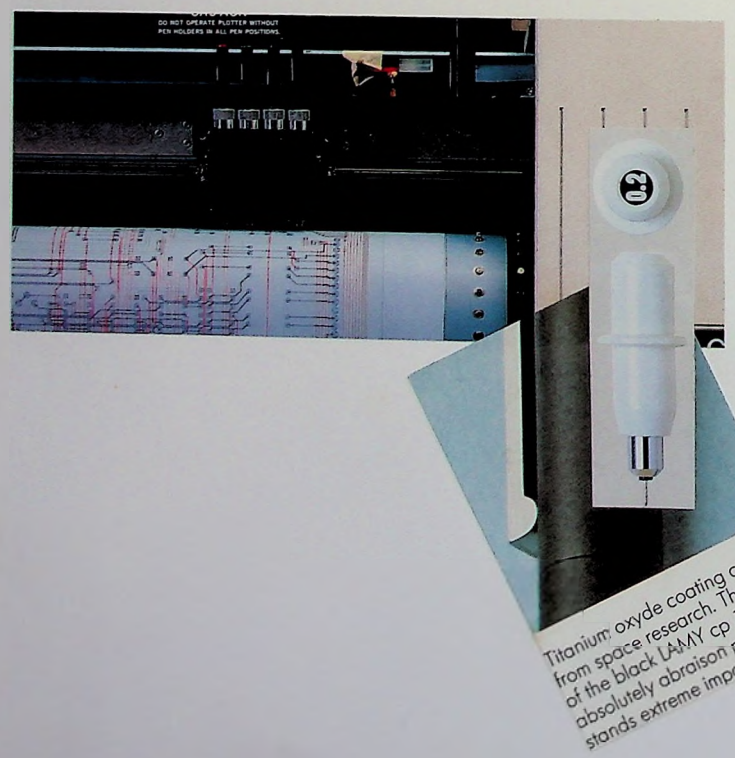
Even with the invention of the typewriter, letters continue to be hand-signed.

Electronic writing is neutral in appearance whether it is read from a a screen, printer or plotter. This may be adequate for general business communications, where the electronic system would provide distinct advantages in terms of speed. However, the 'personal' aspect of a writing instrument is a prime consideration in offsetting the depersonalizing effect of the deluge of machine communications.

The 'fallacy' of the too perfect impersonal communication is that it makes one wish for some sign of erasure, a penned correction or even a blot - just a signal that there is a living individual behind the communication and not just a machine.

As history has shown, we can be sure that there will continue to be new concepts that will further advance the writing instrument as a versatile and necessary tool for personal expression - no matter what method of communication comes next.





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