



*Magic*Happens*

An **ink** is a liquid containing various pigments and/or dyes used for coloring a surface to render an image or text. Ink is used for drawing or writing with a pen or brush. Thicker inks, in a paste form, are used extensively in letterpress and lithographic printing.



Inkpots with penholder

Indian ink

Indian ink (or **India ink** in American English), also called **Chinese ink**, is a simple black ink once widely used for writing and printing, and now more commonly used for drawing, especially when inking comics. Indian ink is usually not suitable for fountain pens: it will readily clog the pen. An exception to this is Pelikan Fount India, which does not contain shellac.

History

Early treatises on the arts refer to black carbon ink that was prepared by the ancient Chinese and Egyptians. Originally designed for blacking the surfaces of raised stone-carved hieroglyphics, the basis of the ink was a black carbon pigment in an aqueous adhesive or binding medium; for example, a mixture of soot from pine smoke and lamp oil mixed with the gelatin of donkey skin and musk. The ink invented according to legend by the Chinese philosopher, Tien-Lcheu (2697 B.C.), became common by the year 1200 B.C.

Sometime before the 12th century, Eraclius, in his *De Coloribus et Artibus Romanorum*, presented a set of directions for making several types of carbon inks, including one similar to the Indian ink of China, made from the soot of burning resin or wood. Different types of wood will create different-colored inks. In an English volume on handwriting of 1581, Theophilus presented a recipe for a carbon ink:

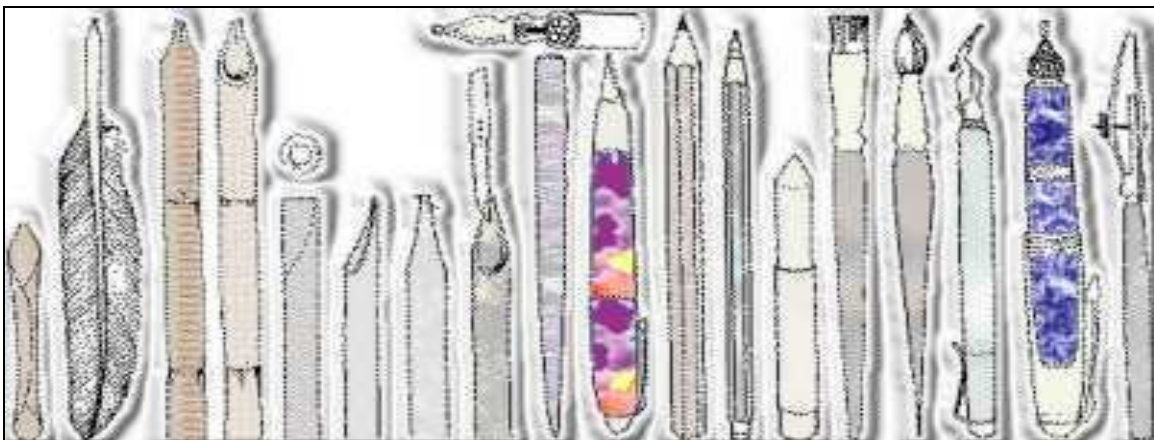
To make Inke in haste.
In hast, for a shift when ye have a great neede,
Take woll, or wollen to stand you in steede,
Which burnt in the fyre, the powder beate small:
With vinegar, or water make Inke withall.

As the recipe shows, no binder material is necessary: the carbon molecules are in colloidal suspension and form a waterproof layer after drying; often waterproof shellac is added though.

Indian ink replaced the previously widespread Iron-gall nut ink in the opening years of the 20th century.

A Brief History of Writing Instruments

From cave paintings to the quill pen -- how ink, paper and pens were all invented.



Ancient writing instruments - From left to right: quills, bamboo, pen sharpeners, fountain pens, pencils, brushes.

The history of writing instruments by which humans have recorded and conveyed thoughts, feelings and grocery lists, is the history of civilization itself. This is how we know the story of us, by the drawings, signs and words we have recorded.

The cave man's first inventions were the hunting club (not the auto security device) and the handy sharpened-stone, the all-purpose skinning and killing tool. The latter was adapted into the first writing instrument. The cave man scratched pictures with the sharpened-stone tool onto the walls of his cave dwelling. The cave drawings represented events in daily life such as the planting of crops or hunting victories.

With time, the record-keepers developed systematized symbols from their drawings. These symbols represented words and sentences, but were easier and faster to draw and universally recognized for meaning. The discovery of clay made portable records possible (you can't carry a cave wall around with you). Early merchants used clay tokens with pictographs to record the quantities of materials traded or shipped. These tokens date back to about 8,500 B.C. With the high volume of and the repetition inherent in record keeping, pictographs evolved and slowly lost their picture detail. They became abstract-figures representing sounds in spoken communication. The alphabet replaced pictographs between 1700 and 1500 B.C. in the Sinaitic world. The current Hebrew alphabet and writing became popular around 600 B.C. About 400 B.C. the Greek alphabet was developed. Greek was the first script written from left to right. From Greek followed the Byzantine and the Roman (later Latin) writings. In the beginning, all writing systems had only uppercase letters, when the writing instruments were refined enough for detailed faces, lowercase was used as well (around 600 A.D.)

The earliest means of writing that approached pen and paper as we know them today was developed by the Greeks. They employed a writing stylus, made of metal, bone or ivory, to place marks upon wax-coated tablets. The tablets made in hinged pairs, closed to protect the scribe's notes. The first examples of handwriting (purely text messages

made by hand) originated in Greece. The Grecian scholar, Cadmus invented the written letter - text messages on paper sent from one individual to another.

Writing was advancing beyond chiseling pictures into stone or wedging pictographs into wet clay. The Chinese invented and perfected 'Indian Ink'. Originally designed for blacking the surfaces of raised stone-carved hieroglyphics, the ink was a mixture of soot from pine smoke and lamp oil mixed with the gelatin of donkey skin and musk. The ink invented by the Chinese philosopher, Tien-Lcheu (2697 B.C.), became common by the year 1200 B.C. Other cultures developed inks using the natural dyes and colors derived from berries, plants and minerals. In early writings, different colored inks had ritual meaning attached to each color.

The invention of inks paralleled the introduction of paper. The early



Egyptians, Romans, Greeks and Hebrews, used papyrus and parchment papers. One of the oldest pieces of writing on papyrus known to us today is the Egyptian "Prisse Papyrus" which dates back to 2000 B.C. The Romans created a reed-pen perfect for parchment and ink, from the hollow tubular-stems of marsh grasses, especially from the jointed bamboo plant. They converted bamboo stems into a primitive form of fountain pen. They cut one end into the form of a pen nib or point. A writing fluid or ink filled the stem, squeezing the reed forced fluid to the nib.

By 400 A.D. a stable form of ink developed, a composite of iron-salts, nutgalls and gum, the basic formula, which was to remain in use for centuries. Its color when first applied to paper was a bluish-black, rapidly turning into a darker black and then over the years fading to the familiar dull brown color commonly seen in old documents. Wood-

fiber paper was invented in China in 105 A.D. but it only became known about (due to Chinese secrecy) in Japan around 700 A.D. and brought to Spain by the Arabs in 711 A.D. Paper was not widely used throughout Europe until paper mills were built in the late 14th century.

The writing instrument that dominated for the longest period in history (over one-thousand years) was the quill pen. Introduced around 700 A.D., the quill is a pen made from a bird feather. The strongest quills were those taken from living birds in the spring from the five outer left wing feathers. The left wing was favored because the feathers curved outward and away when used by a right-handed writer. Goose feathers were most common; swan feathers were of a premium grade being scarcer and more expensive. For making fine lines, crow feathers were the best, and then came the feathers of the eagle, owl, hawk and turkey.

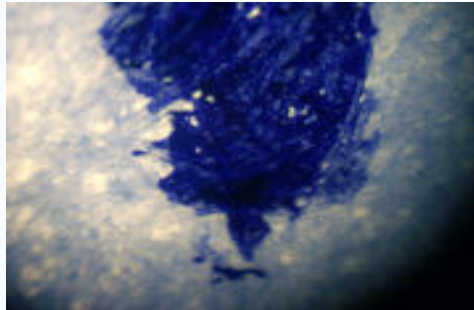
Quill pens lasted for only a week before it was necessary to replace them. There were other disadvantages associated with their use, including a lengthy preparation time. The early European writing parchments made from animal skins, required much scraping and cleaning. A lead and a ruler made margins. To sharpen the quill, the writer needed a special knife (origins of the term "pen-knife".) Beneath the writer's high-top desk was a coal stove, used to dry the ink as fast as possible.

Plant-fiber paper became the primary medium for writing after another dramatic invention took place: Johannes Gutenberg invented the printing press with replaceable wooden or metal letters in 1436. Simpler kinds of printing e.g. stamps with names, used much earlier in China, did not find their way to Europe. During the centuries, many newer printing technologies were developed based on Gutenberg's printing machine e.g. offset printing.

Articles written by hand had resembled printed letters until scholars began to change the form of writing, using capitals and small letters, writing with more of a slant and connecting letters. Gradually writing became more suitable to the speed the new writing instruments permitted. The credit of inventing Italian 'running hand' or cursive handwriting with its Roman capitals and small letters, goes to Aldus Manutius of Venice, who departed from the old set forms in 1495 A.D. By the end of the 16th century, the old Roman capitals and Greek letterforms transformed into the twenty-six alphabet letters we know today, both for upper and lower-case letters.

When writers had both better inks and paper, and handwriting had developed into both an art form and an everyday occurrence, man's inventive nature once again turned to improving the writing instrument, leading to the development of the modern fountain pen.

Types of ink



Line of a Fountain pen, 50-times magnified

Early varieties of ink include Egyptian ink, various natural dyes made from metals, the husk or outer covering of nuts or seeds, and sea creatures like the squid (known as sepia). India ink is black and originated in Asia. Walnut ink and iron-gall nut ink were made and used by many of the old masters to obtain ink for drawing, which over time has often faded to golden brown.

Pigmented inks

Pigmented inks contain other agents that ensure adhesion of the pigment to the surface and prevent it from being removed by mechanical abrasion. These materials are typically referred to as resins (in solvent-based inks) or binding agents (in water-based inks).

Pigmented inks are advantageous when printing on paper because the pigment stays on the surface of the paper. This is desirable because more ink on the surface of the paper means less ink needs to be used to create the same intensity of color.

Pigments are the main components of ink, containing the different colors. The size of the pigment is very important for the ability of diffuse in the solution inks. Qualities such as hue, saturation, and brightness are inherent in the ink, varying dependent on the source and type of pigment.

Dyes in inks

Dye-based inks are generally much stronger than pigment based inks and can produce more color of a given density per unit of mass. However, because dyes are dissolved in the liquid phase, they have a tendency to soak into paper, thus making the ink less efficient and also potentially allowing for the ink to bleed at the edges, producing poor quality printing.

To circumvent this problem, dye-based inks are made with solvents that dry rapidly or are used with quick-drying methods of printing, such as blowing hot air on the fresh print. Other methods to resolve this include harder paper sizing and more specialized paper coatings. The latter is particularly suited to inks that are used in non-industrial settings (and thus must conform to tighter toxicity and emission controls), such as inkjet printer inks, include coating the paper with a charged coating. If the dye has the opposite charge, then it is attracted to and retained by this coating, while the solvent soaks into the paper. Cellulose, the material that paper is made of, is also naturally charged, and so a compound that complexes with both the dye and the paper surface aids retention at the surface. Such a compound in common use in ink-jet printing inks is polyvinyl pyrrolidone.

An additional advantage of dye-based ink systems is that the dye molecules interact chemically with other ink ingredients. This means that they can benefit more than pigmented ink from optical brighteners and colour-enhancing agents designed to increase the intensity and appearance of dyes. Because dyes get their colour from the interaction of electrons in their molecules, the way in which the electrons can move is determined by the charge and extent of electron delocalization in the other ink ingredients. The colour emerges as a function of the light energy that falls on the dye. Thus, if an optical brightener or colour enhancer absorbs light energy and emits it through or with the dye, the appearance changes, as the spectrum of light re-emitted to the observer changes.

A disadvantage of dye-based inks is that they can be more susceptible to fading, especially when exposed to ultraviolet radiation as in sunlight.

History of ink

Approximately 5000 years ago, the Chinese developed ink for blackening the raised surfaces of pictures and texts carved in stone. This early ink was a mixture of soot from pine smoke, lamp oil, and

gelatin from animal skins and musk. Other early cultures also developed inks (of many colors) from available berries, plants and minerals.

In an article for the Christian Science Monitor, Sharon J. Huntington describes these other historical inks:

About 1,600 years ago, a popular ink recipe was created. The recipe was used for centuries. Iron "salts," such as ferrous sulfate (made by treating iron with sulfuric acid), was mixed with tannin from gallnuts (they grow on trees) and a thickener. When first put to paper, this ink is bluish-black. Over time it fades to a dull brown.

Scribes in medieval Europe (about AD 800 to 1500) wrote on sheepskin parchment. One 12th century ink recipe called for hawthorn branches to be cut in the spring and left to dry. Then the bark was pounded from the branches and soaked in water for eight days. The water was boiled until it thickened and turned black. Wine was added during boiling. The ink was poured into special bags and hung in the sun. Once dried, the mixture was mixed with wine and iron salt over a fire to make the final ink.

In the 15th century, a new type of ink had to be developed in Europe for the printing press by Johannes Gutenberg. Two types of ink were prevalent at the time: the Greek and Roman writing ink (soot, glue, and water) and the 12th century variety composed of ferrous sulfate, nutgall, gum, and water ^[1]. Neither of these handwriting inks could adhere to printing surfaces without creating blurs. Eventually an oily, varnish-like ink made of soot, turpentine, and walnut oil was created specifically for the printing press.

Modern ink applications

Up to a few years ago, consumers had very little interest in ink other than to buy refills for their pens. Fountain pens became a novelty as the disposable ball point pen took over the market. The introduction of home computing led to home printing. Today it is rare to find a residence or a business that does not have a printing capability. As a result, buying "ink" in the form of a cartridge or having that cartridge refilled at an inkjet island in a local mall has once again become a part of the day to day shopping experience in a similar way that buying a bottle of ink was common 50 years ago.

Ink refilling services for printer cartridges are offered by large, official printing companies as well as smaller, "unofficial" refill companies. Customers can often cut printing costs by using refill services from a refill company, or buying the new non-oem brands instead of refilling.

Invisible ink is a substance used for writing, which is either invisible on application, or soon thereafter, and which later on can be made visible by some means. The use of invisible ink is a form of steganography, and has been used in espionage. Other uses may include property marking, hand stamping for readmission, and marking for the purpose of identification in manufacturing.

Soy ink is a kind of ink made from soybeans. As opposed to traditional petroleum-based ink, soy-based ink:

- is more environmentally friendly
- is available in brighter colors
- improves the life span of the printers
- makes it easier to recycle paper
- more economic in the long run

Quink

Also known as **Double Quink** and **Parker 51 Ink**. This ink was developed by The Parker Pen Company and Francisco Quisumbing, A Filipino Chemist. A common misconception about Quink is that it was invented as the ideal ink for the world's most successful fountain pen, the Parker 51. That pen sold for over 400 million dollars in its thirty year history. It was in fact the Parker 51 pen that was developed as the only pen of the time capable of using Quink effectively.

In 1928, under the direction of Kenneth Parker, the Parker company invested three years and \$68,000 into the development of an ink that would eliminate the need for blotting. When used with the Parker 51 pen, this ink was to become a completely new "writing system". Research for the project was headed by the chemist Graham Saylor and took place in a small laboratory at the company's headquarters in Janesville, Wisconsin. The major discovery in the project's development was in creating an ink that dried by absorption, as opposed to evaporation.

Quink was first marketed in 1931. The resulting product was strongly alkaline and contained isopropyl alcohol, a solvent that was not used in

ink until then. At that time, most pen barrels and caps were manufactured using pyralin, and it was often damaged by the alcohol contained in Quink. This problem is what eventually led to the development of the Parker 51 pen. However, the Parker 51 was only made available ten years after Quink, in 1941.

The success of Quink lay in the fact that it had a number of useful features:

- it resisted water,
- it did not clog,
- it had the desired quality of ink flow,
- it resisted moulding,
- it was non-corrosive,
- it did not leave deposits,
- it did not fade

and, most of all, it was quick-drying.

It was manufactured in four colors: India Black, Pan American Green, China Red, and the famous Tunis Blue. It was sold in bottles made by the Armstrong Cork Company, Lancaster, PA. The bottles were designed with a low centre of gravity into order to prevent tipping. The ink was to have several improvements over the years; among them, an even quicker drying product was brought out in 1939 called "Double Quink". With a further refinement in the addition of the chemical SOLV-X which dissolved sediment and cleaned the pen when writing.

In 1941, when the Parker 51 was launched, "Double Quink" was renamed and repackaged as "Parker 51 ink" as a marketing initiative. Parker's ink sales became the key to maintaining the company's profitability. (This is still true today for modern day computer printer companies whose survival often depend on the sales of ink cartridges.) Further enhancements were made to Parker inks with its revolutionary "Super Chrome" ink. This ink was marketed in 1947 after a research period that cost over \$200,000 and lasted 17 years. It claimed to be the "first basic ink improvement in over 250 years." It offered almost instant drying, greater brilliance and a wider selection of colors.

Quink ink is still the world's biggest selling pen ink in this millennium. According to fountain pen enthusiasts Parker Quink is generally considered to be so called "safe fountain pen ink". It means it should not stain or clog fountain pen very easily. Yet, the use of fountain pens gradually fell out of favor over the second half of the 20th century. In

fact, the manufacture of the Parker 51 ink was phased out in the UK in 1972 and the US in 1978. But the legend of the Parker 51 still lives on, with a large worldwide network of collectors and enthusiasts who still use these vintage pens today. In fact, in 2002 Parker introduced a limited edition of Parker 51 revival pens. As part of the revival, Parker emphasised the value of using their own quick drying ink as the perfect partner for the Parker 51, a classic of engineering and design.

An **ink sac** is the anatomical feature, an ink-containing organ of a cephalopod (octopuses, squids and cuttlefish). The ink sac can release an inky fluid from a duct opening at the base of the siphon in order to confuse its enemy or prey, or as cover to escape. A general level of provocation will be necessary to trigger octopuses to release its ink, which is biologically costly to produce. Some species can even use their ink to stun or numb their predators

Stark's ink is one of a number of types of homemade inks whose recipes were widely available in the 19th century. People often made their own ink before commercially available ink was inexpensive and easily obtainable. The origin of the name is unknown.