bouring present-day buildings look mean and poor. The first floor of this old stone mill is divided into two rooms; one served as the vat-house, the other for the beating of rags. The second floor was used for drying and finishing; the original sliding shutters that had been used to introduce or exclude the air for the drying of paper are still intact and in fairly good working order. By going over this small building it is possible to picture every phase of the old hand process and to determine just how the artisans operated. The limitations of light and space and the crude appliances did not seem to deter the early workers, and not only did the paper they fabricated serve its purpose at the time, but much of it has lasted throughout the years and given to us the records of the past.

It has not been intended to give here complete historical accounts of these few early American mills, since this has been ably done in other volumes, but to set down brief descriptions of them as they now exist, so that a student of the history of papermaking in this country will know what to expect when he visits the

sites of these pioneer paper mills. Papermaking in America grew early into a flourishing industry. At the close of the eighteenth century there were numerous small paper mills, and by the year 1810 there were no fewer than one hundred and eighty-five establishments where paper was made (Figure 209).

Previous to the first World War England had six mills devoted to this craft. Of the 1,043 vats that existed in Germany in 1846, only two or three remained in 1938; while in Holland, a great papermaking country, there were at this same period only three or four vats in operation. In 1938 Italy had a number of handmade-paper mills, and in France at this time two small establishments were still making paper by the old hand methods. In Sweden there was one lone mill (Figure 210).

In Asia the number of small cottage mills where paper is formed by hand is amazing, but these establishments would not be comparable to those of Europe. Between thirteen and fourteen hun-
dried individual handmade-paper mills existed in Japan in 1934, many of them operated within the small homes of the owners as cottage industries (Figure 211). There were a number of large handmade-paper mills in Japan, however, several of them employing hundreds of workers, both men and women (Figure 212). According to the bulletin issued by the Bureau of Trade of the province of Chekiang, China, in 1935, it was estimated that in this one province alone 24,437 individual households were engaged in making paper by hand, employing 120,852 workers. Most of this paper finds use in religious rites and ceremonies. In the whole of China before the Japanese aggression, there were at least 40,000 cottages where paper was made in the traditional manner (Figures 213, 214). In Indo-China perhaps fifty small mills were in daily operation. In Siam only two or three hand mills remained, and in India a census might list two or three hundred individual owners of establishments making paper by hand, each employing from three to a dozen artisans. The paper made in the Netherlands East Indies is of the beaten type and cannot be classed as true paper, made from disintegrated fibre.
most developed trades of these religious bodies. Mr. Bayley says: "... The early papermaking districts were precisely those that were strongholds of the heretical sects known as the Albigenses. The word 'Albigenses' is a term applied loosely to the various pre-Reformation reformers whose strongholds stretched from Northern Spain across the southern provinces of France to Lombardy and Tuscany. In Spain and France they were known as Albigenses from Albi, the name of one of the prominent towns. In the Alpine provinces they were called Waldenses, from Peter Waldo, one of their most conspicuous members. In Italy, history alludes to them under the terms Cathari or Patarini." Mr. Bayley attaches symbolic importance to each of the watermarks used by these mystic people and believes that the papermarks carried with them signals of hidden meaning. This seems really more probable than to try to account for the multitude of watermarked designs as marks of identification for paper sizes or as trade-marks of the makers.

It is not entirely out of the way to suggest that the old watermarks were perhaps nothing more than a mere fancy with the papermakers, who may have formed the designs or emblems to satisfy their own artistic natures. In the entire craft of papermaking there is no part more interesting or fascinating than to couch a sheet of paper upon the felting and watch the impressed mark become clear and distinct as the water slowly evaporates. Another supposition regarding the use of the early papermarks is that since many of the workmen could not read, it was necessary to appeal to them by means of pictures. Simply to have marked a mould with letters or figures would have meant little to the artisans of the fourteenth and fifteenth centuries; it was essential to convey the meaning to them by the aid of illustrations. For the same reason the old signboards of inns and shops were always of a pictorial nature; the mere name of the tavern lettered upon the swinging sign, or of the commodity sold by the tradesmen, would not have been sufficient.

At the present time watermarks are trade-marks of the papermakers, pure and simple, but their ancient significance must remain more or less obscure. It is possible, however, to determine almost exactly the date at which watermarks were first introduced into sheets of paper.

In ancient Oriental papers no watermarks of symbols or devices
are found. The earliest moulds upon which sheets of paper were formed were constructed of bamboo, a material that did not lend itself readily to forming applied designs which would watermark the paper. This fact may be sufficient to account for the absence of such marks in early Oriental papers. In the Paper Museum collection of Chinese papermaking moulds dating from fifty to a hundred years ago there is a mould-cover bearing a watermark (Figure 215). The three characters (Ting Jui Tai) represent the name of the papermakers and are made of ramie (China grass). The lines of these characters are sufficiently flexible to assume any contour taken by the mould-cover during the couching process. In Europe it is likely that iron wires were used in making the first Occidental mould-covers when the art of papermaking was introduced into Spain about the year 1151, yet papermarks did not make their appearance until more than a century later.

The first use of watermarks occurred in Italy about the year 1282, and while they were lacking in complication of design, the forms of the emblems lead us to believe that they may have been employed as signals or symbols for conveying meanings among the workers who made them, or among those who used the paper in which the simple outline designs were impressed. The use of papermarks soon became general and hundreds of different devices were employed in every papermaking country throughout Europe. Watermarks multiplied in number through the centuries, until there were literally thousands upon thousands of different designs depicting almost every phase of nature and every human endeavour. About 1450, when printing from movable types was introduced into Europe, the art of watermarking paper was an accomplishment almost two centuries old. But when we consider nature's use of printing and watermarking from the beginning of time, it is indeed strange that man was so backward in his adoption of the arts of impression. Did not animals, no matter how remote, leave impressions or stamps of their feet in the sands, and vegetation impress itself in the earth and clay? These natural impressions, or indentations, are closely akin to the arts of watermarking and printing.

In examining old books a great profusion of watermarks may be noted in the paper of an individual volume, some fifteenth-century works containing a dozen or more different papermarks in a single book. To account for this variety some writers contend that it was necessary for the early printers to purchase their paper from scattered mills to enable them to procure sufficient material for their use, claiming that the mills were small and could not manufacture paper in sufficient quantities, uniform in size, thickness, and watermark. It is possible that such a course might have been essential in the fifteenth century, but it would not have seemed expedient in the sixteenth; for by the sixteenth century paper manufacture had become an important industry of vigorous growth in most European countries. It is recorded in Thomas Churchyard's poem * that John Spillman, who operated a paper mill in England in 1588, employed as many as six hundred workers, and England was not at that time a great papermaking country. This statement is probably erroneous, for in the half dozen mills of England today there are hardly this number of workers employed in making handmade paper; the methods of work do not differ greatly from those of several centuries ago. In the sixteenth century it is certain that supplies of book

* See page 120.
paper were abundant, yet in individual books printed in this century various papermarks are found.

It has been suggested that the different watermarks denoted various sizes of paper. This does not seem reasonable, with every size of paper a special pair of moulds would have been needed and the labour and expense of fashioning these moulds were too great to permit of such a vast variety of dimensions. In later years, to be sure, such marks as foolscap, hand, post, pott, etc., did denote sizes of paper, but these appellations were not used as size names until many years after the establishment of these particular emblems as watermarks; moreover, there were many mills using the same designs on different sizes of sheets. The foolscap mark traces back to 1479, but in England was later replaced by the figure of Britannia, the mark for this size of paper. Watermarks of pots or jugs are seldom found after the seventeenth century, being replaced by the Netherlands or English arms. Watermarks of hands were used extensively by the old papermakers in Germany and the Netherlands, and at times this mark resembled an iron gauntlet or glove, the initials or name of the maker often appearing on the wrist. According to several writers, the posthorn watermark first appeared in the year 1670, at the time the General Post Office was established in England. This is doubtless a mistake, as marks of this type have been found in documents upon paper bearing dates as early as the latter part of the fourteenth century.

The art of forming the actual wire watermark emblems that were applied to the moulds has been modified but little since their origin in the late thirteenth century. In Europe before the eighteenth century all paper was made on "laid" moulds, and the sheets so moulded retained the impressions of the "laid" and "chain" wires used in the construction of the moulds. Any wirework, in the form of objects, added to the top surface of this "laid" and "chain" wire covering (Figure 216) also made impressions in the paper. Why these indentations were called watermarks is not known, as the mark or device in paper is not caused by the use of water to any greater extent than is the sheet itself. In the German language the design impressed in the paper is called Wasserzeichen, which, like the English term "watermark," is confusing. In the French language the appellation is filigrane, and in

![Image](image_url)

**Fig. 216** The actual wires of a watermark laced to the "laid" surface of a mould. The wires in the form of designs cause indentations in the paper. The entire mould on which this watermark appears is shown in Figure 96.
Dutch *papiermerken*. These two names are more suitable. The first use of the term “watermark” in English appeared at the beginning of the eighteenth century, and as the name *Wasserzeichen* was apparently not used by German writers until the first part of the nineteenth century, we are led to believe that the name “watermark,” faulty in its meaning as it is, had its origin in the English language.

The twisted forms used in producing the watermarks, or papermarks, were for centuries held in place on the surface of the moulds by means of thread-like wires *stitched back and forth*, binding the mark to the “laid” and “chain” wires. In much of the old paper it is possible to detect the sewing-on wires around the watermarks when the sheets are held to a bright light. In many of the early papermarks the sewing-on wires are pronounced, owing to wire having been used that was almost as heavy as the wire of the mark itself. At least one writer has stated that the wire designs were fastened to the mould surfaces by the use of soft solder, but this appears to be a mistake, as this method of securing the watermarking wires in place was apparently not used until the first part of the nineteenth century. In watermarks from the thirteenth century the simplicity is striking, as at that time the devices were made of clumsy wire that would not admit of much twisting into complicated shapes. During the fourteenth and fifteenth centuries the wires gradually became finer and the designs more detailed.

The value of watermarks as a means of determining the dates of paper, books, and prints or the locality where the paper was made is to be questioned. Few of the early watermarks bear dates, and even when they do, the date of the mark must not be accepted as the time of the printing on the paper. The sheets might have been dated in the watermark and then remained in the mill a considerable time before the paper was sold, and after being sold the paper might have been held for years in the warehouse of the printer before being used. Paper made from fine material by careful and conscientious workmen should improve with age, seasoning adding to its printing quality. The early printers were doubtless aware of this characteristic. Also a dated mould might have been used for many years with the same date, the papermaker not troubling to change the figures. An example of such a discrepancy in dates in modern times is seen in a letter to me from the late Joseph Willcox, a direct descendant of the founder of Ivy Mills, the third paper mill to be established in Pennsylvania. Joseph Willcox took over the management of the mill in Chester in 1859, and there made the last handmade bank-note paper that was produced in the United States. His letter reads in part: “We had an order for an unusual size of paper and the only moulds we had of the particular size were dated 1810 in the watermarks. I did not like to take off that old date so I made a lot of paper with the mark 1810 in every sheet.” This made a difference of almost fifty years from the date in the paper and the time when the paper was actually made.

It would also be unwise to rely upon a watermark as proof of where the paper was made or at what particular mill. Suppose that an early papermaker established a reputation for a superior quality of paper; there was nothing to prevent a newly set-up mill from using the watermark of the older and more prosperous concern. A striking illustration of this deception in our own time is the imitation of the watermark of the highly esteemed Whatman mill, established by James Whatman in Maidstone, England, in 1731. Certain unscrupulous Continental papermakers have duplicated the Whatman watermark and sold their papers without hesitation, the sheets often being accepted as genuine Whatman papers. It is not unlikely that in the early days of papermaking, moulds were sold by one mill to another without troubling to remove the wire watermarks; or the old worn moulds of a large mill may have fallen into the hands of a less prosperous maker who fabricated an inferior quality of paper. In this way one watermark design could have been used by numerous mills, over periods of many years, for papermaking moulds have always been well and strongly made and they do not easily wear beyond use if treated with any degree of care. From an archaeological and artistic standpoint watermarks are of great interest, but for tracing definitely the dates of paper, or the exact localities of certain mills, the marks should not be relied upon implicitly.

Almost all writers touching upon the subject of ancient paper
and watermarks attach importance to small changes that often appear in watermarks depicting the same subject. This seems to be unwarranted, for the slight variations may be due to very simple causes. The wire forms may have become detached from the moulds and have been replaced by a worker unskilled in wire-working — possibly the vatman or coucher. Every time a wire mark came loose from a mould, it had to be attached again, and in doing some detail naturally was slightly changed from the original outline. This alone would account for the large number of marks, similar in subject, and supposedly from the same mill, but varying to a slight degree. Another simple cause for variance may be suggested: In the first volume of the Mazarin Bible, attributed to Johann Gutenberg, and printed between 1450 and 1455, there may be seen two watermarks of the bull or ox. In these two watermarks there is a striking resemblance; no doubt one was a copy of the other, and the two were supposed to be identical. It is probable that so late as the fifteenth century two moulds were used, as at present, in moulding paper at the vat. Each mould had a wire watermark of a bull, the two possibly formed by different workers, each one trying to rival the other in design, but keeping the two emblems within the same limits of space and general contour.*

The paper that was used in the forty-two-line Bible is of the finest quality and in many ways its excellence has never been surpassed. The watermark of the bunch of grapes (Figure 217) which is found in much of the Gutenberg Bible paper is unusual in its...

* In the history of papermaking in our own country this variation of watermarks of the same subject is not unusual. For the past several years I have been making a study of early papermaking in western Pennsylvania, Kentucky, and Ohio, and many of the late eighteenth- and early nineteenth-century watermarks used in these states have been measured and photographed. In practically all of the papers made in the pioneer mills in the "western country" a marked variation in the watermarks is detectable. To cite but one instance: In Ohio the first papermaking establishment was set up in 1807. The watermark was a spread eagle with the word OHIO underneath in outline letters. All of the watermarks from this mill were intended to be identical, but apparently no standard pattern or template was employed in forming or twisting the wires. It is possible, therefore, to determine upon what particular mould a certain sheet of paper was formed. Through an examination of many sheets of paper in early account-books, documents, letters, etc., we have been able to arrive at the actual number of moulds each mill possessed.
brilliance and clearness, although the paper is long-fibred, which, as a rule, does not produce sharp and distinct watermarks. The strength of the paper is usually sacrificed if a well-defined and sharp watermark is desired. While the bunch of grapes as a papermark may be of Swiss origin, it is possible that the paper used in the first printed Bible was fabricated in Gutenberg’s native land. No matter in what locality it was made, or in what particular mill, this paper shows technical skill and workmanship that is seldom encountered in modern times; the texture, strength, and tone have remained unchanged over almost five hundred years. Through the employment of bleach and chemicals, much of the machine-made paper and some of the handmade paper of our own time, even with the nearly five-hundred-year handicap, will no doubt suffer by comparison with that of the Gutenberg Bible in another such period, or about the year 2446.

After watermarking became general, during the fifteenth century, it was seldom that a sheet of paper was made without a distinguishing device of some nature. These emblems were sometimes placed in the centre of the sheets, or where the paper was folded in folio book-printing, but it is more usual to find two symbols or designs each appearing in the middle of the half-sheet of paper. Watermarks, from their origin until the latter part of the eighteenth century, when they began to lose their simplicity, may be consistently divided into four classes: The first of these would embrace the earliest known watermarks, which appeared in the form of crosses, ovals, circles, knots, triangles, three-hill symbols, and devices of the simplest kind that could have been readily twisted in wire. At this period a great many pommée crosses were also used as emblems for watermarking paper. This was a Greek cross with balls or circles placed at each end of the cross-bars. Another similar mark which is found in fourteenth-century Italian paper is a circle surmounted by a patriarchal or papal cross. The watermarks of this first group were in use from the origin of the art, about the year 1292, until the first quarter of the fifteenth century.

The second division of papermarks would include man and the works of man, and in the latter class of this particular group we find the greatest number of subjects, extending into thousands upon thousands of designs. The male figure is met with only in limited numbers and the female figure is rarely found except in

mermaid form, usually holding a mirror. The human head, feet, and hands were also used separately as watermarks by the early workers. The mark of the hand was used by the papermakers of various countries for hundreds of years and was symbolic of both Fidelity and Labour. At times the hand shows two fingers bent downward, a sign of benediction. The hand watermark is also found surmounted by a cross, a star, a rose of bliss, or some like ornament, each of which had its symbolic significance. The size of paper known in later years as “hand” derived its name from the emblem. The watermark of the human foot is exceptional and has been encountered in only a few instances. The works of man would embrace agricultural implements, and small tools such as shears, spades, bellows, swords, scythes, hammers, pruning-hooks, and axes; with the works of man would also be included such watermarked objects as ships, anchors, anvils, bagpipes, keys, horns, scales, bishops’ and cardinals’ hats and staves, curry-combs, weapons of all kinds, hawks’ bells, as well as architectural ornaments, lettering, and escutcheons.

The earliest watermark of the human head was a portrait of Jesus Christ, and was of French origin, from about the year 1359. This device represents the Vera Icon, or True Image. The legend runs that the Saviour on the way to Calvary was encountered by the woman Berenice. Filled with compassion she wiped His face with her handkerchief, which miraculously retained an imprint of the divine features, whereupon Berenice was sainted and rechristened Veronica, an anagram of Vera Icon. It is no doubt the kerchief with the impress of this head that is reproduced in the late fourteenth-century watermark.

Watermarks of Jesus in profile appeared in limited numbers during the fourteenth, fifteenth, and sixteenth centuries. In these marks the head is usually represented with three locks or strands of hair, evidently meant to symbolize Christ’s oneness with the Trinity. In most of these marks the mouth is open, intended to denote Jesus teaching. Another profile watermark used in the fifteenth century was that of a Negro slave. In some instances this head appears with a bandage raised from the eyes, symbolizing freedom.

Most of the early watermarks portraying the human figure and head were ecclesiastical in nature, as was natural since the church
penetrated the workshops of the ancient craftsmen in a manner that cannot be conceived today. Nothing really artistic in the watermarking of portraits was accomplished until the middle of the eighteenth century, when we find the French and German papermakers making simple outline portraits of prominent personages.

In arranging papermarks in classes according to their subjects, the third group or division would embrace such marks as flowers, trees, leaves, vegetables, grain, plants, and fruits. In a number of the old emblems there are also combinations of vegetation and the works of man, such as a bunch of grapes with a bell or crown, or a pot or jug holding flowers or leaves.

The fourth and probably the most interesting group of watermarks would include wild, domesticated, and legendary animals, as well as snakes, fish, snails, turtles, crabs, scorpions, and all varieties of insects. It was the forms of animals that required most dexterity to twist in wire and gave the early artisans the greatest outlet for their skill. The bull's head, one of the earliest animal papermarks, made its appearance in 1310 and was a favourite emblem with papermakers for over two hundred years. The head of the bull was sometimes used without appurtenances, but more often it is found surmounted by a Latin cross, rose of bliss, half-moon, crown, flails, or like symbols. We find also a curled snake on the staff of a cross projecting from the bull's-head device, resembling a caduceus. Watermarks of the head of the bull, surmounted by both a snake and cross and the rose of bliss are found in some of the sheets of paper that were used in Miles Coverdale's translation of the Bible in 1536 — the first Bible printed in English. The bull's-head mark (Figure 218) in various forms also appears in paper that was used by William Caxton, Colard Mansion, Gerhard Leeu, and other noted printers who procured their paper from the Low Countries. This illustration shows the actual wires on the surface of the mould (sixteenth century).

Fig. 218  The bull's-head watermark in various forms appears in the paper used by William Caxton, Colard Mansion, Gerhard Leeu, and other noted printers who procured their paper from the Low Countries. This illustration shows the actual wires on the surface of the mould (sixteenth century).

The sake of Christ, and of all who patiently bear the yoke and labour in silence for the good of others.

The unicorn, like the bull, is found as a watermark in the paper used by Caxton, and holds a prominent place in papermarks from the fifteenth to the seventeenth century. M. Briquet has recorded over eleven hundred different renderings of this animal used as a device for marking paper. The unicorn was symbolic of purity and innocence, and it was believed that the horn of this mythical animal was a panacea for all illness and an antidote for poisons.
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The ancients believed the horn of the unicorn so sensitive that if a cup of poison was brought near it, a thick moisture would be expelled from the surface of the liquid, and if a piece of horn was thrown into the poison, the poison would bubble and in time boil over. It was also thought by the ancients that the horn was removable at will, like a kind of sword. Both the whole body and the head of the unicorn were used as watermarks by the old papermakers. They are seldom found as papermarks with any other symbol incorporated with them, but in a few instances a sword or cross protruding from the animal’s back has been noted.

Another favourite animal watermark was the form of the dog, and numerous specimens are found extending over a period of about two hundred years. Like the bull and the unicorn, the dog device was used as a symbolic emblem by the ancients, and centuries later, along with other symbols, was adopted by papermakers for watermarking. Certain species of the canine were considered sacred by the ancient Egyptians and there are instances where sacred dogs were mummified by them. Early watermarks of the dog usually represent the greyhound, and a great many of them are drawn with considerable motion and vigour, a merit not often found in old papermarks.

The camel is prominent in the watermarks of the fifteenth century and is usually of crude workmanship and seen in a rather grotesque attitude. The camel mark here illustrated (Figure 219) shows the actual wire form on the surface of the mould. It was constructed of two wires, one starting at the ears and continuing around, shaping the tail and legs and terminating at the neck; the other wire completed the head, the eye being shaped by a crook in the second wire. This camel papermark is French, from about 1379.

Elephants, leopards, goats, lambs, dragons, cats, horses, and deer are found in abundance in watermarks from the middle of the fourteenth century onward. The cock is not a common mark in old paper, but a variety of specimens, mostly of French origin, have been discovered in the pages of antique books and manuscripts. Many of the chanticleer marks display ability in design as well as fashioning in wire. It is noticeable that the cock was generally formed with open bill, which, according to the authorities on symbolism, denotes the dawn of light. Birds of many kinds and

Fig. 220 An American-made papermaking mould used in a Massachusetts mill during the latter part of the eighteenth century. The watermarks read “Massachusetts Bank” in eight places, with the numbers 5, 10, 15, 20, etc. The short, irregularly twisted wires throughout the mould were placed there to detect counterfeiting of the paper.

sizes furnished a multitude of devices for the old papermakers in the marking of their papers. We find also in unlimited numbers representations of fish, as well as many examples of crustacean life of the sea.

During the first fifty years of papermaking in the American colonies there still existed among craftsmen a love for symbolic design, which was manifest in the watermarks of the period. But by the middle of the eighteenth century superstition and symbolism began to lose hold upon the artisans, and from that time, in the colonies as in Europe, symbolic watermarks and printers’ marks began to fall into disuse. Watermarks with an emblematic significance were not uncommon in the early papermaking history of Pennsylvania, and the pioneer workers of this region were responsible for the most unusual specimens. New England, which con-
tributed so much to the history of the applied arts in other fields, added little of an artistic or interesting nature to the watermark annals of America. The few marks that are recorded from this locality consist chiefly of names and initials of the papermakers, which have no special appeal to the imagination (Figure 220).

The first paper mill in the colonies, as has been said, was established in Pennsylvania by William Rittenhouse, a native of Germany, who was assisted in his undertaking by William Bradford, the first printer in Pennsylvania and New York, and two other worthy gentlemen. In all probability the papermaking moulds used by this mill had been brought from the chief founder's native land and were no doubt plain moulds, without watermarks. The first watermark used in Rittenhouse paper was the single word "Company," designating the original partnership. Judging from its crudity, it was fashioned by untrained and unskilled hands, probably by one of the mill workmen unaccustomed to forming objects in wire. This mark was used from about 1690, when the mill was established, until some time during the year 1704, when Bradford was induced to part with his share in the paper mill. In 1706 the property was in the full possession of Rittenhouse. The second watermark to be adopted by this pioneer mill was the monogram WR, the initials of the principal founder, on one half of the sheet of paper, while on the other half appeared a clover leaf inside a shield surmounted by a crown. Underneath the shield, in outline letters, was the word "Pennsylvania." The shield-and-crown device displays a great deal of Dutch and French influence, as watermarks of this style had been used by early papermakers in Holland, adopted by them from France, where the device had been used as a watermark as early as 1460. This emblem was an evolution of the bull's-head watermark. The crown and shield with three fleurs-de-lis constituted the arms of France, and this device was frequently used as a watermark by the papermakers of the Low Countries, probably in reference to the direct descent of the House of Burgundy from the kings of France. Watermarks of this character may be found in the paper used by William Caxton, the first printer in England, whose paper was procured from the Low Countries. No paper was produced in England until the establishment of the John Tate mill in Hertford about 1496. The clover leaf, trefoil, or "klee-blatt," which Rittenhouse substituted for the fleur-de-lis, was adapted from the townmark or seal of the village of Germantown, a settlement not far distant from the location of the paper mill. This seal or emblem had been in use by the community only a short time before Rittenhouse put it to use as a watermark.

The next papermark to be adopted by this mill consisted simply of the letters KR, the initials of Claus Rittenhouse, the son of the founder, the name in Dutch being Klaas. With the use of this initial mark on the left half, the clover leaf was sometimes introduced on the right half of the paper. The only other watermark known to have been used by this family of papermakers was the letters IR, the initials of Jacob Rittenhouse, a great-grandson of the founder of the mill.

In 1710 William De Wees established the second paper mill in the colonies. This mill was really an outgrowth of the original Rittenhouse establishment. Apparently the De Wees owners did not make use of watermarks. It is recorded, however, that this mill manufactured "an imitation of asses-skin paper which was well executed."

In the year 1729 Thomas Wilcox set up the third paper mill in the colony of Pennsylvania. This establishment used as a standard watermark a dove and olive-branch design with the initials of the papermaker—first TMW for the founder, and in later years MW, the initials of Mark Wilcox, the son, who was operating the mill in 1767. In 1827 an ivy leaf was adopted as a watermark, the mill being known as Ivy Mills on account of the English ivy that covered the stone buildings. The original vine was brought from England by Thomas Wilcox to Pennsylvania in 1735, from near the Old Ivy Bridge in Devonshire. This mill also used the familiar post-horn device as a watermark previous to 1787. The many bank-note papers executed at Ivy Mills were mostly watermarked with the names and marks of states and banks. One of the earliest of these papermarks was made for Pennsylvania in the year 1777. A letter of Revolutionary interest (dated March 11, 1778) concerning this
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watermark was written to Colonel Andrew Boyd, Sub-Lieutenant of Chester County, Pennsylvania, where the Willcox paper mill was located. This letter reads in part: "Mr. Willcox has in his possession a mould for making paper belonging to this state, which you are requested to bring away, it is marked with the word 'Pennsylvania' in twenty-four places, he did promise if the enemy came that way he would throw it into the mill dam."

The Gilpin mill, also in Pennsylvania, used the dove and branch watermark certainly as early as 1789, possibly from the establishment of this mill two years earlier. This mill in 1793 was using the word "Brandywine" as a watermark, as the Gilpin mill was situated on the Brandywine River. The dove and branch were a favourite watermark with American papermakers, for we find it used again in 1805 by Thomas Amies, the third mill to adopt this design as a trademark. The dove sometimes lacks the branch and is at times quite poorly drawn, but the identifying name is usually present, variously given as Amies, Amies Phila, etc. Amies was at one time superintendent of the Willcox mill at Chester, and after setting up his own establishment he adopted the dove and branch of Willcox origin as a watermark. A direct descendant of Thomas Willcox living in the old family home near Chester in 1925 had in his possession a pair of moulds that had been used in the old Ivy Mills, which bore the dove and branch watermarks. In the "western country" the dove and branch watermark was used by Jackson and Sharpless as early as 1809. This mill was located on Redstone Creek, Fayette County, Pennsylvania, and was the earliest papermaking establishment in western Pennsylvania.

The watermarks used by the New England paper mills during their pioneer history have never been systematically recorded and it is doubtful if the emblems employed by these early establishments could be gathered together with any degree of accuracy. The several watermarks used by the William Parks paper mill established at Williamsburg, Virginia, in the eighteenth century have been well described and pictured in a pamphlet issued by the corporation.

The fourth paper mill in Pennsylvania, established forty-six years after the original Rittenhouse project, was *Die Papier Mühle der Bruderschaft zu Ephrata*, already mentioned. Ephrata was a

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communistic settlement made by a branch of the Pietists of Germany who emigrated to Pennsylvania in the early eighteenth century. The members of the community lived in a cloister or convent under monastic rules of celibacy and austerity. The community was self-sustaining, not only fabricating its own paper, but engaging in printing and bookbinding, as well as in a number of less pretentious crafts. Several of the buildings of the old cloisters are still standing and form one of the most interesting groups of early eighteenth-century construction in this country. The paper mill of the community at Ephrata was under the direction of the Funk Brothers, Samuel and Jacob, both experienced in the art of paper-making, having acquired the trade in Germany. The principal product of the mill was a coarse brown paper that they called "macalatu." This paper was never watermarked, but the finer grades of printing and writing papers bore marks of identification. One of the Ephrata watermarks was a large figure four, the perfect number, below which were the initials RF, a private mark of the Funk family. The letters FB for Funk Brüder also appear, without the figure four, in some of the Ephrata publications. This mark may be studied in the paper used in the edition of *Theosophische Lectionen*, printed in 1745. The most emblematic watermark of this idealistic community appears in the paper used in mystic books that they printed. This highly symbolic device consists of a Latin cross surmounted by a scroll with the word "Zion," two keys forming triangles with the uprights and arms of a cross, which rested upon a narrow panel bearing the name "Ephrata." The keys had reference to the *Clavicula Solomonis, or Keys of Solomon*, a mystic book of the seventeenth century which was highly regarded by the brotherhood. The entire emblem was capped by a flagpole, not unlike the upper part of the second Rittenhouse watermark. The cross-and-keys device may be found in books printed at Ephrata before 1745.

Several other watermarks that were used by this mill were the crown, the post-horn, and perhaps a three-circle device which again shows the perfect figure four, so much favoured by the Brotherhood. In going through one of the dilapidated buildings at Ephrata many years ago, I found an old chest that had been
hidden under a heap of discarded lumber. When this chest was opened, it was found to contain about seventy sheets of paper, each sheet having eight pages of German text printed upon it; the paper was unfolded, just as it had come from the press in the eighteenth century. It is believed that this paper is of European make, but it is possible that it was made at the Ephrata mill upon moulds brought from Germany. In this paper the three-circle and figure-four device appears, but it is not possible to identify it definitely as an Ephrata watermark. The printing, however, is authentically American. In the paper upon which early American books and newspapers were printed we find numerous watermarks, but it is an almost hopeless task to classify the marks and state precisely what mills produced them. Papermaking moulds were brought to this country from all parts of Europe and it is probable that many of them had watermarking wires already attached. In this way foreign marks were introduced into American-made sheets of paper.

As an example of the prejudice of the American public in the early nineteenth century regarding American-made paper the following amusing article is taken from Niles' Weekly Register, February 22, 1812: “About seven years ago I witnessed a circumstance which afforded me a high gratification. I was in a book-store when a person came in and asked for a reprint of letter paper. The bookseller shewed some of an excellent quality, with which the customer was fully satisfied, — but asking the price, was led to suppose, from its cheapness, that it was American, and demanded if it was so? On receiving an answer in the affirmative, he said it would not do — he wanted ‘English,’ ‘I have other paper,’ said the bookseller, ‘for which I must have such and such a price, will you look at it, sir?’ The price being high enough, the gentleman after much examination and comparison made his purchase, paid his money cheerfully, and carried his paper away. The two reams exhibited came from the same mill, and were taken out of the same bundle! Large quantities of paper are made in the United States with British watermarks, and, if not openly offered as British, at least insinuated to be so and sold as such. I can see no harm in it, — the quality is as good, and if the people will have preju-
silks that otherwise might not have been recorded. Present-day workers in the paper industry may well be proud of the history and traditions of their trade, for no other craft of Europe can display such an endless array of designs extending over a period of almost seven hundred years.

Latter-Day Watermarks

THE NINETEENTH-CENTURY DEVELOPMENT OF WATERMARKS INTO AN ARTISTIC AND TECHNICAL ACHIEVEMENT

The Bank of England was established in 1694, but it was not until sixty-four years later, in 1758, that its bank-notes were first forged. This original attempt at deception was in no way a skilled achievement where the perpetrator was versed in papermaking, watermarking, and engraving, but was the crude attempt of a Stafford linen draper, Richard William Vaughan, to change the figures of a note to a higher denomination. Vaughan was found guilty of the crime and was executed at Tyburn on the 11th of May 1758.

There were few who wished to emulate Vaughan, so for the following twenty years the counterfeiting of bank-notes was exceedingly rare. The next case of counterfeiting bank paper in England occurred in 1778 when John Mathieson, a native of Scotland, tried to manufacture spurious money duplicating that used by the Darlington Bank. Mathieson's methods were far more skilful and ingenious than the rough and clumsy attempts of Vaughan. Mathieson was versed in engraving, and while he did not actually make his own paper, he devised imitation watermarks in plain paper which went undetected for a considerable time, as this mode of issuing fraudulent bank-notes was entirely new to the authorities and they could not conceive how their notes could possibly be imitated. In Mathieson's clever work the engraving was finely executed and the watermark, which the bankers had considered an infallible criterion, tallied so precisely with the original that no discrepancies could be detected. Several paper-makers were of the opinion that the devices were genuine water-
THE ARTISTIC DEVELOPMENT OF WATERMARKS

marks and had been placed in the paper in the usual manner during the process of forming the sheets, but Mathieson declared that this was not the case and claimed the marks were the result of a particular process known only to himself. After his apprehension he offered to explain the secret of his discovery provided the corporation would spare his life, but his proposal was rejected and his "secret" died with him.¹

A watermark may be imitated by copying the design with a pointed stick dipped in the following preparations: spermaceti and linseed oil, equal parts, melted together in a water bath and then stirred until cold; or equal quantities of turpentine and Canada balsam, well shaken together until dissolved; or the meaglp used by artists.² If the required designs or symbols be well drawn they will have some resemblance to a genuine watermark, as the liquids, when dry, render the paper somewhat transparent. It is needless to say, of course, that all these manoeuvres are very easy to detect, since a false mark produced in this manner will fade completely when the paper is dipped in water, while an actual watermark when wet will become more brilliant and more discernible. Mathieson, the forger, no doubt resorted to an elementary process of this kind in his work and it is surprising that this simple method of creating artificial watermarks baffled the officials.

In 1773 an act was passed making the penalty death for copying the watermark in English bank-note paper; and to prevent imitation, it was enacted that no person should prepare any engraved bill or promissory note containing the words "Bank of England," or "Bank post bill," or expressing any sum in white letters on black ground in resemblance of "Bank paper," under the penalty of imprisonment for six months.³

Notwithstanding all the precautions taken and the penalties enacted by the British Government after their first experiences with counterfeitors, there was much deceit practised.

The next forger in the annals of the Bank of England was a man of rare skill as a designer, engraver, papermaker, and printer, and while his work was eventually detected, he evaded the authorities on every side. Charles Price, or "Old Patch," as he was called on account of a black cloth over one eye which he wore as a disguise, was one of those men whose whole abilities were employed in defrauding. His first efforts in counterfeiting were practised about the year 1780 and his false bank-notes were so skilfully engraved and the watermarks so perfectly executed that the Bank of England accepted his bank-notes without question, and they were discovered to be forgeries only after they had reached a particular department. Price carried on his unlawful work in Titchfield Street, London, and there had set up a small paper mill where he formed the sheets of paper with the forged watermarks. He was finally taken into custody, and his end was worthy of his life: he employed his son to procure the necessary implements of destruction and was found hanging in his cell in Bridewell Prison.⁴

In September 1801 the following advertisement appeared: "All the one and two pound notes issued by the Bank of England, on and after the first of August will, to prevent forgeries, be printed on a peculiar and purposely constructed paper; consequently those dated 31st July, or any subsequent day, will be impressed upon paper manufactured with waved or curved lines."

In the twenty years prior to 1817 there were no fewer than 870 prosecutions connected with bank-note forgery in Britain, three hundred persons being executed. In the Bank of England alone there were seventy clerks employed in detecting forged notes. The year 1818 was the culminating point of the crimes; in the first three months of that year there were 128 prosecutions by the bank, and by the end of the year thirty-two individuals had been hanged for note forgery. From January 1, 1812 to April 10, 1818 there were circulated 131,331 pieces of forged bank paper.⁵

By 1818 there was great consternation among the Bank of England officials, as well as among merchants and tradesmen, at the extent to which forgers had carried their skill. The engraving and printing did not hinder the efforts of a man who wished to turn his ingenuity to such a purpose; neither did the complications of papermaking and watermarking. The leading typographers and engravers of the day were engaged in trying to produce bank-notes that would not easily lend themselves to being imitated, and interest was aroused to such an extent that the Society of Arts attempted to supply remedies to counteract the spread of counterfeiting and published a report in 1819.⁶

No artisan laboured more diligently or more conscientiously than Sir William Congreve to arrive at some peculiar or technical
complication in engraving or papermaking that would be a stumbling-block to even the most talented of forgers. While his plans were never adopted by the bank in their entirety, they were, nevertheless, of great importance and it was through his knowledge, patience, and skill that coloured watermarks were invented and brought into existence as so early a date, for at the beginning of the nineteenth century watermarking in England had not reached any great degree of perfection.

Sir William Congreve was born in Staffordshire in 1772. He was a General of artillery in the English Army and was attached to the Royal Laboratory at Woolwich. Sir William was a man of remarkable inventive genius and is now best known for his development of the rocket as a military weapon and for his writings relative to warfare. He died in France in 1828.

Congreve’s first method of making coloured watermarks consisted in couching a thin layer of white paper and then laying another tinted sheet in the form of a design on the first wet sheet; then another white sheet was couched over this, which made a triple sheet. After pressing and drying, these layers became a homogeneous piece of paper, and the middle coloured layer could only be perceived when the sheet was held to the light. The lettering or device in the second, or coloured, sheet was made by the use of a stencil placed over the mould, cut in the form of the required design. As many colours as desired were inserted between the two outside layers of moist paper, each colour being formed separately (Figures 221, 222, 223, 224).

In 1818, the year in which counterfeiting had reached its height, Sir William endeavoured to have his triple paper adopted by the bank of England for their bank-notes. All of the experimental sheets of paper which he made to show the directors of the Bank, as well as his appeal to that institution to adopt his plan, were set down in a folio volume, the manuscript being in his own hand. This unique book* has been in my possession for a number of

* The volume measures 8½ by 13 inches and contains 62 pages with 12 solid pages of manuscript in Sir William Congreve’s hand. Thirty-six specimens of watermarked bank-note paper made for or by Congreve are tipped in the book, each example having a description by the inventor. The paper used throughout the book for text pages is watermarked 1818 and bears the name J. Rump. There is, of course, only the one copy of this volume and it forms a unique document in the evolution of papermaking and watermarking.
years, and owing to its interesting nature the text is here reproduced verbatim:

Account of the Origin and Experiments of the Triple Paper invented by Sir William Congreve and proposed for the new Bank-Note.

The first suggestion of this paper was given by me to the Commission in a Memoir read to them on the 30th October 1818. In a subsequent memoir dated the 11th December I stated some further particulars respecting this Paper and proposed extracting the colour partially in the interior layer of the Paper by means of acids. Experiments to this effect will be found in the annexed collection. On the 29th December I procured a quantity of Adrianople red cloth, which I was induced to consider the best colour for reasons that will be found to be stated at full length in the following Memoir addressed to the Bank and sent this cloth to Mr. Harman with directions to Mr. Brewer. Mr. Brewer proceeded immediately to Freefolk and made his first report to me on the 7th February 1819, after which a series of letters passed between us containing directions from me to him from time to time, and his observations on sending me back the results as per copies dated February 8th, 10th, 12th, 15th, 16th, 19th, and March 19th.

With this cloth Mr. Brewer went through a regular series of experiments under my direction. Specimens of which are here annexed with proper explanations. These experiments were at first all carried on by making the triple Paper of three separate layers and three couplings. On the 12th of February I desired to have some with two layers only to be sent up that they might be printed on the interior layer and returned for another white layer, so that the printing would be in the heart of every sheet of paper.

On the 19th of February it occurred to me that a good effect might be produced by leaving part of the interior bare so as to produce a coloured border round the edge. This border helps to complete the genuineness of the triple Paper with the colour in the interior as is seen in the Memoir to the Bank. In these experiments with the red pulp a very curious effect was accidentally discovered by which the interior coloured layer is mottled.

In the middle of April Mr. Portal endeavoured to produce an imitation of the triple Paper made on a small scale. A specimen is annexed and it will be seen how unsuccessful an attempt it was. He did not pretend that he was not obliged to go through all the process used by us in making regular triple Paper, or that it did not require Papermakers to fabricate it, for in fact he employed the same men that had carried on my experiments, the only difference was that it was done in smaller quantities and in truth that the effect in making it in smaller quantities
is visible enough in the specimen of his imitation. (Messrs. Portal have manufactured the bank-note paper for the Bank of England since 1725.)

This imitation, however, became the subject of discussion at the Commission whose faith in the security derivable from the triple Paper except by the regular process of Papermaking, was rather confirmed than shaken by this attempt of Mr. Portal, and it was subsequent to this that they recommended the adoption of this triple Paper to the Bank.

But to proceed in detailing the course of the experiments,—all the specimens hitherto produced were either without watermark, or with common wire watermark. I now conceived that a very superior watermark might be produced by a filigree pattern cut out in metal, and accordingly on this principle an oval watermark in silver was prepared by Mr. Brantston. The great security of this description of watermark is that the lines of the pattern may cross in the most complicated scroll or cheque work which involves a difficulty in the imitation either by varnish or by cutting out the middle leaf.

The next improvement which I suggested by letter to Mr. Portal of the 15th June was to attempt to make the triple Paper by three dippings and only one couching which I conceived would not only improve the brilliancy of the watermark, but would also save labour and expense in making the Paper by saving the operation of two couchings out of three in each sheet, and I accordingly prepared another watermark for the experiment. The result of this experiment fully justified my supposition and some specimens are attached in which I think the art of Papermaking for Bank-Notes is brought to the highest state of perfection.

I caused another watermark also to be made which was used quite on a different principle to any hitherto adopted, it was not attached to the mould, but to the deckle and lifted off with it, so as to carry away with it all the pulp where the watermark is intended to appear.

There are thirty-six specimens of paper affixed in the back of Congreve's manuscript volume. The first twenty-four examples were fabricated by the original method of three dippings and three couchings. These are the identical sheets which were fashioned by Mr. Brewer for Sir William, and were made, as Congreve states in his explanation, "with common dye; the paper thick and clumsy." Other specimens shown were produced "with the interior pulp made from Adrianople red cloth and the paper much finer." There are also sheets of two colour combinations, made with white and yellow, and white and red pulp. Congreve shows one sheet in four colours, red, yellow, blue, and white. This particular sheet of bank-note paper was the most complex ever attempted up to that time, and although Sir William stated that "it is crude and rough," the specimen has many good qualities; and when it is considered that this sheet of paper was made in the infancy of coloured watermarking, it must be regarded as a remarkable specimen. Congreve also gives specimens of paper with printing on the interior of the sheet, giving the appearance of a watermark in black. This was accomplished by printing with common printers' ink upon one leaf and then couching another leaf over the printed one. He also extracted the colour from the ink, leaving the lettering in white, resembling a genuine watermark made with wire. Of the attempt by Mr. Portal to imitate the Congreve triple paper, the inventor has this to say: "Mr. Portal's imitation of the Adrianople red triple paper, the badness of which imitation will be evident by comparing it with one of the genuine Adrianople notes below it." While Sir William's specimen is a little more brilliant in colour than that of Mr. Portal, it would be unfair to suggest that the "imitation" was nearly so bad as Sir William would lead us to believe.

In advocating the use of his triple paper in the making of bank-notes, Sir William Congreve directed this letter to the officials of the Bank of England:

TO THE GOVERNOR AND DIRECTORS OF THE BANK OF ENGLAND:—As the triple Paper which I have had the honour to propose and superintend for the new Bank-note seems now to be brought very nearly to perfection, I think it is desirable that I should give as concise and summary a view as I can of the principal points of security which I have had in view, in proposing this plan, and as all the points now left for decision rest entirely with the Governor and Directors of the Bank, I have thought it right to address this paper in particular to them.

First then, as to the security arising from the mode of fabricating this paper. I feel confident that no imitation of this paper with the layer of coloured pulp thrown into the interior, can be made without going through the process of papermaking, and indeed this has never been denied. The imitations that were attempted were made as paper and by papermakers, and no man has ever been bold enough to say he can
produce the effects here produced by any process subsequent to the original formation of the paper.

This fact alone therefore, amounts to no ordinary security for most assuredly the forger cannot as at present by various simple means take a piece of common paper and produce the appearance of a watermark upon it. He must, as I have already observed, absolutely go through the process of papermaking, and moreover to produce the extraordinary clear watermark thus given he must discover and pursue a process quite new and little likely to be suspected even by an expert papermaker, of dipping the three layers of pulp, one upon the other, without couching, and still further of making the coloured layer in clear water. I say, therefore, that as this new and extraordinary system of manipulation has been found essential to the production of the new watermark so peculiarly clear and transparent, there is no probability, for the present at all events, of its being imitated even by a papermaker.

In the second place, as to the security arising from the introduction of colour. It is evident that the tint in the interior of the paper gives a brilliancy to the watermark which cannot be obliterated by the wearing of the note, or by its being soiled, whereas in the present white note, after being considerably rubbed and soiled, it is extremely difficult to distinguish the watermark. Another very important advantage in the introduction of colour in the interior of the note is that it is a much greater security than the thinness of the present paper against attempting any alteration in the value of a note, such as the making a ten pound out of a one or two pound note by erasure. This is a mode of forgery that has been practiced with the present paper, but with the coloured paper any erasure which would not show on colourless paper would produce a greater strength of colour by laying bare the interior.

With regard to the particular colour, the pale blue as far as appearance goes seems to be the most preferred, there are, however, reasons which induce me to prefer the pink produced by the Adrianople red dye, and which I shall here state as this is a point resting with the Bank, and one which I think well worthy their mature consideration as independent of the general security attached to the introduction of colour, much of the security depends upon the use of this particular dye. The fact is that the pink pulp with which the first specimens were produced was of a very peculiar and remarkable tint that can only be obtained from the Adrianople red and is moreover a colour that cannot by any possibility be applied to the pulp after it is made, but must actually have been given to the cloth previous to its being made into pulp. The least quantity of pulp that can be made at one time is one hundred weight.

As therefore to obtain pulp of this colour so large a quantity must be made at once, it is evident that the true Adrianople pink pulp, which can always be distinguished from any other tint, can only be made in a regular paper mill on the largest scale. The Adrianople red cloth from which this pulp must be obtained is not produced in more than two or three principal manufactories in this country, as the process of dyeing it is a most laborious, troublesome, and uncertain operation consisting of nine or ten different manipulations. By adding this dye, therefore, the security arising from the paper appears to be completed, for the forger would not only then be obliged to make the paper, but to make it in large quantities. I must confess therefore, that I am of opinion that although there seems a predilection for the blue tint, that this is a point which should be reconsidered and especially as the tint may be given in as light a shade as the blue, and as little detrimental to the effect of the printing.

Test of the genuineness of this Paper: — The most simple rule may be laid down for the test of the genuineness of the triple paper, namely that when held up to the light and looked through the colours will look much stronger than when looked at. Now, if the colour were not in the interior, which we have seen is a process too difficult for the ordinary forger to attempt in his paper, the very reverse would be the effect, that is, if the colour were stained on the surface which seems to be the only mode of imitation open to the forger, then would the colour look paler when looked through than when looked at, instead of looking stronger as in the genuine note. And to prove this difference to the Public on the note itself, a narrow border of the interior coloured pulp is left bare all round the note, in this border, therefore, the colour is superficial and accordingly when the note is held up to the light the border where the colour is superficial and which is the strongest tint when looked at, appears the palest when looked through, and vice versa, the remainder of the note, where the colour is in the interior and which appears the palest when looked at, is much the strongest tint when looked through. Thus the truth and value of this simple test are at once established on a first inspection.

Of the expense: — Mr. Brewer has informed me that it has been ascertained by experiments in the presence of Mr. Portal, that one man could on the last new plan of three dippings with only one couching make eight sheets of this new paper in ten minutes without any succession of moulds. The following is the calculation he founds upon this fact: 8 sheets in 10 minutes by one man; 48 sheets in one hour; 480 sheets in one day of ten hours. If there be eight notes on a sheet, 3840
notes may be made in one day by one man and if 20 men are employed
they would make 76,800 notes in a day, which is, I believe, consider-
ably more than required.

The Governor and Directors seriously considered the use of Sir
William Congreve’s invention for their bank-notes and conducted
a number of experiments regarding its probable use. It appears
that Mr. Portal, whose firm had long since made all of the Bank
of England paper, did not take kindly to Sir William’s new triple
paper and dissuaded the bank officials from its adoption. Produce-
ing the triple paper would have involved great difficulties, and
had the bank authorities and Mr. Portal seen fit to decide upon
the new paper, its fabrication on so large a scale would have been
a perplexing task for even the most adept of papermakers.

Sir William Congreve was naturally disappointed when the
bank officials finally refused to make use of his paper for bank-
notes, and in a communication addressed to the commission, dated
September 11, 1819, he writes:

The main points as to the fabric of triple paper having been suc-
cessfully accomplished, that is to say the cleanness and brilliancy of
the watermark and the fitness of its texture for a bank-note having
been brought to perfection, its adoption for that purpose having also
been decided upon by the Commission, it was natural to suppose that
time would have been given to realize the necessary arrangements for
making it in sufficient quantity for the supply of the Bank. No prepa-
trations, therefore, or experiments were made for this object which was
considered as the minor point until about a fortnight since, nor indeed
was any opposition anticipated on this ground since the first objections
stated were that the paper was too easily made, and not that it was too
difficult. The event, however, has proved there was a want of due pre-
caution and foresight in this want of preparation, for seeing the deter-
mined opposition that is made to it in every stage, arrangements for
producing the supply ought certainly to have been made and proceeded
hand in hand with the main operation of perfecting the paper.

As the matter now stands this paper has only been produced in a per-
fect state with the two note moulds. This much, however, has been
ascertained from the experiments that have been tried with the eight
note mould, that it is the breadth of these moulds and not their length
that prevents the man from throwing off the water as well from an eight
note, as from a two note mould. Now, if the notes of the eight note

THE ARTISTIC DEVELOPMENT OF WATERMARKS

mould were put crossways instead of lengthways, the eight note mould
might be made a little broader than the two note mould, and might
therefore be used equally well in the production of the triple paper.

I am, therefore, still convinced that the necessary quantity may thus
be made with very little increase of means at Freefolk. I have no wish,
however, to press the matter further on the Bank and Mr. Portal in de-
fiance of such determined opposition on his part, if the Commission
think fit to rescind their decision for its adoption. I have only to say
that if such be the result I shall find other means of ascertaining for
my own satisfaction after having taken so much trouble how far the
fabrication of this paper can be realized on the great scale and at what
expense.

[Signed] Wiliam Congreve

As Mr. John Portal figured so prominently in the controversy
between the Bank of England officials and Sir William Congreve
regarding the triple paper, it may be interesting to trace the his-
tory of his family and his record and experience as a papermaker.

The Portals were a Huguenot family of Albignesian descent,
their house, both ancient and noble, having long been associated
with Toulouse. During the trouble under Louis XIV, Louis de
Portal, then head of the family, attempted to escape, but he and
his wife and one child were killed, and only the four other chil-
dren managed to flee to Holland. One of these, Henri, attached
himself to the court of William of Orange, and when the latter
came over to England to supplant James II, he followed after a
lapse of several years. Henri landed in Southampton in 1706 and
found employment in the paper mill at South Stoneham, which
belonged to the Governor and Company of White Papermakers in
England. Here Henri de Portal mastered the many branches of
papermaking. In 1711, when he attained his majority, Henri de
Portal was naturalized and became Henry Portal. When he started
out for himself, Henry first had the Bare mill, near Whitechurch,
but in 1718 he took over the neighbouring Laverstoke mill, which
the family has held ever since. The original tenure was a ninety-
nine-year lease at five pounds and “one Ream of Fools-cap paper,
neatly cut,” per annum. Under the lease he was required to rebuild
the mill, which he did in 1719. In 1725 Henry Portal secured the

The bank-notes that were manufactured in England previous to
THE ARTISTIC DEVELOPMENT OF WATERMARKS

Henry Portal’s contract were of plain paper, without watermarking. Those from the Laverstoke mill had a watermark border of a loop pattern running around the edges of the sheets, and ever since 1725 the Bank of England notes have been watermarked.

Henry Portal died at Freefolk Pryors, adjoining Laverstoke mill, in 1747. He was succeeded by his son, Joseph Portal, who operated the mill until his death in 1793. His son John Portal, continued the fabrication of the Bank of England notes for a period of fifty-three years, until his death in 1848. The paper mill is still continued by the Portals — a record of over two hundred years in the same family. It will be seen that John Portal, Sir William Congreve’s adversary, had come from a family of papermakers and that his own long experience qualified him to advise the Bank of England authorities regarding the adoption of Congreve’s triple paper.

Sir William Congreve was forty-six years of age when he discovered that three separate sheets of paper could be formed and couched as one sheet, thus introducing colour into the interior of the paper. There is no record of his having made any other triple paper than that shown to the Governor and Directors of the Bank of England in 1818, all of which is in the Paper Museum of the Massachusetts Institute of Technology. Congreve patented his invention on December 4, 1819.

There was but little accomplished in the art of coloured watermarking from the time of Congreve until about 1885 when Mr. Lee of Wookey Hole, near Wells, Somerset, England, undertook to revive and improve the art. Clayton Beadle in his article on watermarking gives Lee the credit of being the pioneer in England in the making of coloured watermarks, but this is obviously a mistake. Mr. Beadle also states that Lee patented his invention in 1886, but a search through the British Patent Office records does not reveal a coloured-watermark patent under his name.

As late as 1900 W. Fairweather and A. and G. B. Fornari were granted a patent in England which reads in part: “A sheet of white or coloured pulp, having any design suitable for a watermark, is inserted between two plain sheets of pulp, and the three layers are pressed together to form a single sheet of paper. The mould consists of a base over which is stretched the sieve, the latter being covered with a plain plate having the required design cut in it. The watermark can only be seen by transmitted light.”

From the advent of papermaking in the thirteenth century until Congreve’s invention there was practically no change in the method of impressing designs in paper during the process of fabrication. After the experiments undertaken by Congreve it became apparent to European papermakers that the art of watermarking need not be limited to line lettering and simple devices and emblems twisted in wire and applied to the surface of the moulds. Contemporary with Congreve working in England was Johannot carrying on the art of watermarking in France. This French papermaking firm did excellent work and today specimens of their papers are accepted as superior watermarking. With the Johannot watermarks the woven wire was pressed so the stock, or pulp, was held in two degrees of density or thickness, which formed backgrounds for the outline single wire portraits or emblems. This was the first instance of simple light-and-shade watermarking; the Johannot mill was executing work of this kind as early as 1812. Figures 225 and 226 are representative of early nineteenth-century watermarks from the Johannot establishment, whose origin dates at Ambert from the first part of the seven-