

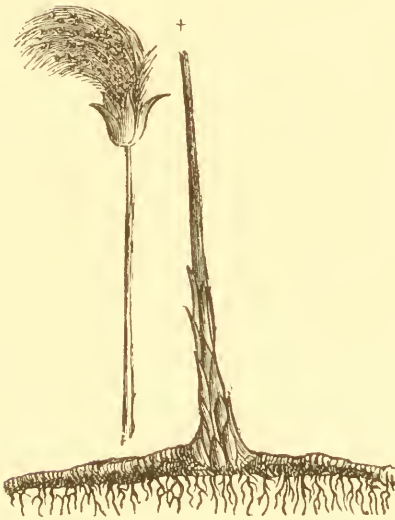
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A
CHRONOLOGY
OF
PAPER AND PAPER-MAKING.



Papyrus.

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P R E F A C E .

The facts embraced in the following pages have been gathered from so many sources, that it would have materially encumbered the work had it been attempted to give authorities in all cases. The work of Matthias Koops, who made extensive experiments in the beginning of the present century, has furnished numerous data. The *Jury Report* of the London Industrial Exhibition, has been used to a considerable extent for more modern statistics of European countries. For the remainder, almost every available work has been consulted, English, French, German, and Nederdutch.

It will be seen by the number of experiments made for the attainment of the same object by the same means, in England and America especially, that paper-makers have but little intercommunication. There is

great want of an American work, practical and experimental, on this most important art. An account of the modes that have been pursued by the experimenters who have so long and arduously sought after a substitute for rags in the manufacture of paper, would of itself form an instructive volume. These experiments began in Europe more than a century ago, and were induced by the same cause which has ever since given rise to efforts in the same direction, the scarcity of rags. They have continually exercised the minds of manufacturers and others in this country during the present century, and the records of the patent office attest the fertility of invention which has been expended in this field of discovery. The following list of substances which have been experimented upon, and of which it is claimed that paper has been produced of fair qualities, will show in a measure the extent of the effort which has been made to procure material to meet the increasing demand for paper fabrics.

Paste board scraps,	Bamboo,	Carduus nutans,
Animal substances,	Mulberry,	Old sacks,
Wheat straw,	Bark,	Floss silk,
Rice straw,	Silk,	Liquorice wood,
Raw cotton,	Flax,	Pine shavings,
Muscovy mats,	Hemp,	Bullen of plants,
Alga marina,	Satin,	Blue grass,

Hornets' nests,	Asbestos,	Ulva marina,
Coton du peuplier,	Leaves,	Decayed wood,
Grape vines,	Tan,	White wood,
Lily of the valley,	Moss,	Banana leaves,
Moth wort,	Beech,	Gutta percha,
Masse d'eau,	Willow,	Mummy cloth,
Cabbage stumps,	Aspen,	Scotch ferns,
Broom corn,	Clematite,	Gnaphalium,
Bavarian peat,	Ropes,	Flag leaves,
Bass wood,	Tow,	Sultana bark,
Couch grass,	Bagging,	Cotton stalks,
Marsh mallow,	Fir,	Dwarf palm,
Spindle tree,	Peat,	Water broom,
Wayfaring tree,	Pine,	Southern cane,
Willow twigs,	Aloes,	Brazilian grass,
Leather cuttings,	Arroche,	Beet root,
Cotton waste,	Thistles,	Swingle tow,
Printed waste,	Conferva,	Corn stalks,
Corn husks,	Linden,	Seratula ervensis,
Plantain,	Erigerone,	Pappus,
Hay,	Oakum,	Wool,
Bracken,	Manures,	Rushes,
Flags,	Hollyhock,	Bran,
Saw dust,	Hop vines,	Sea weed,
Nettles,	Reeds,	Elm,
Lime,	Oak,	Poplar,
Burdock,	Stone,	Spartum,
Asparagus.		

In short, almost *every thing* has undergone a test. Not only have numerous patents been procured for useless modes of producing paper from many of the above articles, but costly machinery has in some cases been erected to assist in bringing them into use, after they had been experimented upon repeatedly and condemned. This will continue to be the case until something is published on the subject in such a shape as to be accessible to the trade. It is hardly necessary to say that this work does not aim to supply the desideratum, yet to a considerable extent it will serve as an index to those experiments. It also indicates what has been done towards bringing machinery to perfection, while those efforts were being made to discover new materials for paper stock. It is in this department that great results have been attained. In a little more than a quarter of a century, the machines have entirely superseded the diminutive hand-mills which sparsely dotted the country, and gigantic establishments have risen up in their places. Paper-mill villages, and banking institutions even, have grown out of this flourishing branch of industrial art, and we behold with satisfaction and amazement, what has been brought about by the aid of a commodity so insignificant in the eyes of the world as linen and cotton rags.

The reader will observe some discrepancies in the following pages; the facts have been given as they were found, it being impossible to reconcile them. The compiler will be obliged by anything that may be sent to

him in regard to this subject, either by way of correction or addition. A few errors of the press occur, which will be so readily observed and understood as to render a particular notice of them unnecessary.

Several specimens intended to accompany this edition came too late for insertion, the work having been promised at a certain time.



SUBSTANCES

USED IN THE

MANUFACTURE OF PAPER.



In early times the materials used for writing upon were chiefly such as required but little mechanical fashioning to fit them for that purpose. Characters were engraved on flat stones made smooth, or were impressed in clay, which was afterwards dried or hardened by sun or fire, as in the Babylonian bricks. Thin boards of wood, covered with wax or a similar composition, and plates of ivory and metal, have been used; but a more convenient material was afforded by the leaves of certain species of trees. The skins and intestines of animals have also been made fit for writing upon; but when the Egyptian papyrus was introduced, all these things fell into disuse, except parchment, which is still preferred for certain purposes.

The first successful attempt to manufacture an article resembling modern paper, as far as we know, was made in Egypt at a very remote time. An aquatic plant, known to us as *papyrus*, having a soft cellular flower-stem, afforded the material. The stem of the plant grew from ten to twenty feet high, of a triangular shape, from the thin coats or pellicles of which the paper was made. These were separated by means of a pin, or pointed muscle-shells, and spread on a table sprinkled with Nile

water, in such a form as the size of the sheets required, and washed over with the same. On the first layer of these slips, a second was placed cross-wise, so as to form a sheet of convenient thickness, which, after being pressed and dried in the sun, was polished with a shell or other hard and smooth substance. Twenty sheets was the utmost that could be separated from one stalk, and those nearest the pith made the finest paper.

With respect to the time when this paper was invented, there are different opinions. Some authors have attempted to prove its antiquity from the earliest Greek writers; while Varro states that the invention was unknown in the time of Alexander the Great, about four hundred years before the Christian era. But Herodotus, who lived nearly a century earlier than Alexander, testifies that it was an article of commerce and a material for writing long before his time. The Romans at a later day improved upon the papyrus made by the Egyptians; they sized it in a similar manner to that pursued with rag paper, making their size of the finest flour. The paper of the Romans was very white; that of the Egyptians of a yellowish or brown tinge.

The Egyptian paper was manufactured in Alexandria and other cities of Egypt in such large quantities, that one individual boasted that he possessed so much paper that its revenue would maintain a numerous army. Alexandria was for a long time solely in the possession of this manufacture, and acquired immense riches by it. Europe and Asia were supplied therefrom for several centuries. The commerce of Egyptian paper was flourishing in the third century, and continued to the fifth century, when Theodoric abolished the impost upon it in Italy, where it was used occasionally until the eleventh century, at which time the use of parchment and paper made of cotton superseded it.

The art of making paper from fibrous matter reduced to a pulp in water, appears to have been first discovered by the Chinese about eighteen hundred years ago. The Chinese paper is commonly supposed to be made of silk; but this is a mistake. Silk by itself, can not be reduced to a pulp suitable for making paper. Refuse silk is said to be occasionally used with other ingredients, but the greater part of the Chinese paper is made from the inner bark of the bamboo and mulberry tree, called by them the paper tree, hempen rags, &c. The latter are prepared for paper by being cut and well washed in tanks. They are then bleached and dried; in twelve days they are converted into a pulp, which is then made into balls of about four pounds weight. These are afterwards saturated with water, and made into paper on a frame of fine reeds; and are dried by being pressed under large stones. A second drying operation is performed by plastering the sheets on the walls of a room. The sheets are then coated with gum size, and polished with stones.

They also make paper from cotton and linen rags, and a coarse yellow sort from rice straw, which is used for wrapping. They are enabled to make sheets of a large size, the mould on which the pulp is made into paper being sometimes ten or twelve feet long, and very wide, and managed by means of pulleys.

The Japanese prepare paper from the mulberry as follows: in the month of December, the twigs are cut into lengths, not exceeding thirty inches, and put together in bundles. These fagots are then placed upright in a large vessel containing an alkaline ley, and boiled till the bark shrinks so as to allow about a half an inch of the wood to appear free at the top. After they are thus boiled, they are exposed to a cool atmosphere, when the bark is stripped from the wood and

dried, and laid away for future use. When a sufficient quantity has been thus collected, it is soaked in water three or four days, when a blackish skin which covered it is scraped off. At the same time also the stronger bark, which is of a full year's growth, is separated from the thinner, which covered the younger branches, and which yields the best and whitest paper. After it has been sufficiently cleansed out and separated, it must be boiled in clear ley, and if stirred frequently, it soon becomes of a suitable nature. It is then washed, a process requiring much attention and great skill and judgment; for, if it be not washed long enough, the paper, although strong and of good body, will be coarse and of little value; if washed too long, it will afford a white paper, but will be spongy and unfit for writing upon. Having been washed until it becomes a soft and woolly pulp, it is spread upon a table and beat fine with a mallet. It is then put into a tub with an infusion of rice and breni root, when the whole is stirred until the ingredients are thoroughly mixed in a mass of a proper consistence. The moulds on which sheets are formed are made of reeds cut into narrow strips, instead of wire, and the process of dipping is like that of other countries. After being allowed to remain a short time in heaps, under a slight pressure, the sheets are exposed to the sun, by which they are properly dried.

The Arabians in the seventh century, appear to have either discovered, or to have learned from the Chinese, or Hindoos, quite likely from the latter, the art of making paper from cotton; for it is known that a manufactory of such paper was established at Samarcand about the year 706 A. D. The Arabians seem to have carried the art to Spain, and to have there made paper from linen and hemp as well as from cotton.

The art of manufacturing paper from cotton is sup

posed to have found its way into Europe in the eleventh century. The first paper of that kind was made of raw cotton; but its manufacture was by the Arabians extended to old worn-out cotton, and even to the smallest pieces thereof. But as there are cotton-plants of various kinds, it was natural that they should produce papers of different qualities; and it was impossible to unite their woolly particles so firmly as to form a strong, substantial paper, for want of sufficient skill and proper machinery, using, as they did, mortars and rude horse-mills. The Greeks, it is said, made use of cotton paper before the Latins. It came into Germany through Venice, and was called Greek parchment.

The Moors, who were the paper-makers of Spain, having been expelled by the Spaniards, the latter, acquainted with water-mills, improved the manufacture, so as to produce a paper from cotton nearly equal to that made of linen rags.

It is not known when cotton paper was introduced into England, but it appears that its use continued until the latter part of the fourteenth century, when it was gradually supplanted by linen paper, which began to be used in 1342.

Paper manufactures early became very flourishing in France, and the paper-makers in that country soon excelled their neighbors in the art, and were therefore enabled to export considerable quantities, which increased so much yearly, that in 1658 two millions francs in value was exported to Holland alone; and it provided Spain, England, Switzerland, Denmark, Sweden, Russia, but chiefly Holland and the Levant, with paper for printing and writing; and as late as the beginning of the present century twenty-five thousand reams were annually exported to Switzerland and Germany. But at this

time the art of paper-making had arrived at a great degree of perfection in England and Holland, whereby the export from France was so greatly reduced, that, of four hundred paper-mills in two provinces, three hundred were discontinued.

Peter the Great, of Russia, visited the paper-mill at Dresden, in 1712, and was so much pleased with the art, that he immediately engaged paper-makers, whom he sent to Moscow, to establish a paper-mill at his own expense.

In the manufacture of paper, any fibrous vegetable substance may be used. Bark and straw are much employed, but the process of manufacture has hitherto been found too expensive. A French paper-maker claims to have obviated, by the aid of chemistry, all difficulties in the use of straw, and the experiments of Mr. Beardslee of Albany, were so far successful as to lead many to hope for an economical mode of converting the forests into paper to supply the all-devouring maw of the press. Yet it is still thought that we shall never find anything to answer the purpose so well as linen and cotton rags. The Chinese employ a vast number of fibrous substances for this manufacture, and apply paper to a variety of uses little thought of in other countries.

In all kinds of paper-making, whether from the bark of trees or other fibrous matter, or from rags, the general process is the same. The fibrous material is cut and bruised in water till it is separated into fine and short filaments, and becomes a sort of pulp. This pulp is taken up in a thin and even layer upon a mould of wire-cloth, or something similar, which allows the water to drain off, but retains the fibrous matter, the filaments of which are, by the process of reduction to

pulp, and subsequent drying and pressing, so interwoven and fitted together, that they can not be separated without tearing, and thus form paper.

But the manufacture of paper, though an interesting process to witness, is difficult to describe intelligibly. Like the art of printing, it has undergone a wonderful change within a quarter of a century, calling into use immense steam and water power, and ponderous machinery, that consume the cast-off habiliments of the population of the whole world, and now require other material for consumption, to keep pace with the demand for their fabrics.

CHRONOLOGY OF PAPER.

670 B. C. Numa, who lived three hundred years before Alexander, left several works written upon papyrus, which were still found at Rome a long time after his death. This is perhaps the earliest authenticated use of papyrus.

600 B. C. Manufactories of Egyptian paper from papyrus, are supposed to have existed at Memphis. But papyrus manuscripts are found in the Catacombs, apparently several thousand years old.

440 B. C. Herodotus alludes to the general use of parchment among the Ionians at this time, under the term of sheep and goat skins.

300 B. C. For at least three hundred years before Christ papyrus was exported in large quantities from Egypt.

270 B. C. The Jewish elders, by order of the high priest, carried a copy of the law to Ptolemy Philadelphus in letters of gold upon skins, the pieces of which were so artfully put together that the joinings did not appear.

200 B. C. A better method of dressing parchment was found at Pergamus about this time, which led to the supposition that parchment was invented there, and hence derived its name.

15 A. D. About this time, during the reign of Tiberius, a popular commotion arose in consequence of the scarcity of papyrus; the commerce in which had flourished a long time, but the supply seems to have been always less than the demand.

79. Herculaneum was overwhelmed, a city so obscure that very little account has been given of it by ancient writers; yet eighteen hundred manuscripts on papyrus have been taken from its ruins.

95. Du Halde says it was in this year that a mandarin of the palace manufactured paper of the bark of different trees, old rags of silk and hemp.

290. About this time the value of papyrus was so great, that when Firmus, a rich and ambitious merchant, striving at empire, conquered for a brief period the city of Alexandria, he boasted that he had seized as much paper and size as would support his whole army.

500. About this time Theodoric abolished the duty on papyrus, which contributed to the revenue of the Roman empire, and fresh imposts had been laid upon it by successive rulers, until they became oppressive. Cassiodorus congratulates "the whole world on the repeal of the impost on an article so essentially necessary to the human race," the general use of which, as Pliny says, "polishes and immortalizes man."

572. There is a manuscript in the British Museum, which appears to have been written at this time, upon a roll of papyrus eight feet and a half long, and twelve inches wide. The longest specimen of papyrus known is the one at Paris, measuring thirty feet.

600. About this time paper made of bark was used by the Longobards, for the imperial protocols, in order to render the forging of diplomas more difficult.

648. There was a manufactory of paper at Samarcand, similar to that which had long been made by the Chinese.

650. The Saracens having become masters of Egypt, the intercourse between that country and Rome was so much interrupted that the supply of papyrus became scanty and precarious. Previously to that event, all public records had been executed on papyrus, while it is found that at a date immediately subsequent parchment was substituted.

704. The Arabians are supposed to have acquired the knowledge of making paper of cotton, by their conquests in Tartary.

706. Casiri, a Spanish author, attributes the invention of cotton paper to Joseph Amru, in this year, at Mecca; but it is well known that the Chinese and Persians were acquainted with its manufacture before this period.

900. The bulls of the popes in the eighth and ninth centuries were written upon cotton paper.

900. Montfaucon, who on account of his diligence and the extent of his researches is great authority, wrote a dissertation to prove that *charta bombycine*, cotton paper, was discovered in the empire of the east toward the end of the ninth or beginning of the tenth century. But see 706.

1007. The plenarium, or inventory, of the treasure of the church of Sandersheim, is written upon paper of cotton, bearing this date.

1049. The oldest manuscript in England written upon cotton paper, is in the Bodleian collection of the British Museum, having this date.

1050. The most ancient manuscript on cotton paper that has been discovered in the Royal Library at Paris, having a date, bears record of this year.

1085. The Christian disciples of Moorish paper-makers at Toledo in Spain, worked the paper-mills to better advantage than their predecessors. Instead of manu-

facturing paper of raw cotton, which is easily recognized by its yellowness and brittleness, they made it of rags, in moulds through which the water ran off; for this reason it was called *parchment cloth*.

1100. The *Aphorisms of Hippocrates*, in Arabic, the manuscript of which bears this date, has been pronounced the oldest specimen of linen paper that has come to light.

1100. Arabic manuscripts were at this time written on satin paper, and embellished with a quantity of ornamental work, painted in such gay and resplendent colors that the reader might behold his face reflected as if from a mirror.

1100. There was a diploma of Roger, king of Sicily, dated 1145, in which he says that he had renewed on parchment a charter which had been written on cotton paper in 1100.

1102. The king of Sicily appears to have accorded a diploma to an ancient family of paper-makers who had established a manufactory in that island, where cotton was indigenous, and this has been thought to point to the origin of cotton paper.

1120. Peter the Venerable, abbot of Clum, who flourished about this time, declared that paper from linen rags was in use in his day.

1150. Edrisi, who wrote at this time, tells us that the paper made at Xativa, an ancient city of Valencia, was excellent, and was exported to the east and west.

1151. An Arabian author certifies that very fine white cotton paper was manufactured in Spain, and Cassim aben Hegi assures us that the best was made at Xativa. The Spaniards being acquainted with water-mills, improved upon the Moorish method of grinding the raw cotton and rags; and by stamping the latter in the mill,

they produced a better pulp than from the raw cotton, from which various sorts of paper were manufactured, nearly equal to those made from linen rags.

1153. Petrus Mauritius, who died in this year, has the following passage on paper in his *Treatise against the Jews*: "The books we read every day are made of sheep, goat, or calf skin; or of oriental plants, that is, the papyrus of Egypt; or of rags, *ex rasauris veterum pannorum*;" supposed to allude to modern paper.

1170. The time when papyrus wholly ceased to be used is not certainly known; but Eustathius, the scholiast on Homer, says it was disused before this time.

1178. A treaty of peace between the kings of Arragon and Castile, is the oldest specimen of linen paper used in Spain with a date. It is supposed that the Moors, on their settlement in Spain, where cotton was scarce, made paper of hemp and flax. The inventor of linen rag paper, whoever he was, is entitled to the gratitude of posterity.

1200. Casiri positively affirms that there are manuscripts in the Escorial palace near Madrid, upon both cotton and hemp paper, written prior to this time.

1221. Frederic II of Germany, in consideration of the bad quality of paper made of cotton, its subjection to humidity, to alteration, and other defects, issued an order, nullifying all public acts which should be upon cotton paper, allowing two years to transcribe upon parchment all such as then existed.

1239. One of the earliest specimens of paper from linen rags, which has yet been discovered, is a document, with the seals preserved, with this date and signed by Adolphus, count of Schaumburg. It is preserved in the University of Rinteln in Germany, and establishes the fact beyond dispute that linen paper was already in use in Germany.

1270. By far the oldest manuscript written in France upon modern paper, is a letter from Joinville to St. Louis, which bears date a short time before the death of that monarch in 1270.

1270. Notwithstanding the most diligent search of the learned antiquary Montfaucon, both in France and Italy, he could find no book nor leaf of paper made of linen rags, before this year; whence it was concluded that there was no hope of finding an exact date to the invention.

1280. At this time very little use was made of Egyptian paper for diplomas, in England and Germany, but parchment was the universal substitute; and yet no map of parchment made before the sixth century is known to have been discovered.

1308. Meerman satisfied himself that linen paper was used in Germany at this time, but was not able to decide in what country its invention originated.

1311. No other than Egyptian papyrus and cotton paper, it is asserted, was known in France before this time; although a letter is produced which is claimed to be linen paper, written before 1270. (See 1270.)

1314. The earliest undisputed French manuscript on linen paper is of this date, but it is not conclusive that it was fabricated in France.

1318. In Deutschland kommt leinenes Papier vor 1813 schwerlich vor; von diesem Jahre aber hat das Archiv des Hospitals Kauf beuern Urkunden auf leinemem Papier aufzuzeigen—*Conversations-Lexikon*.

1319. Linen paper is said to have been found at Nuremberg by Von Murr of this date. (See 1342.)

1320. The earliest English manuscript on linen paper with a date that has been discovered is of the fourteenth year of Edward III.

1338. Peter II of Valencia issued a command to the

paper-makers at Valencia and Xativa, under pain of punishment, to manufacture better paper, which was to be equal to that formerly made ; showing that the manufacture had degenerated.

1339. From a piece of very coarse cotton paper, bearing this date, in the possession of Meerman, who wrote about 1760, he argues that the art of paper-making was neglected by the Spaniards, and that prior to the middle of the fourteenth century no linen paper had been manufactured in that country, yet the scientific men of Spain persist in its being linen paper.

1340. Tiraboschi, in his history of Italian literature, places the establishment of paper-making at Padua in this year, deriving his authority from a passage of the ancient history of that city by Cortusius.

1340. Peignot says it was about this time that the manufacture of paper was established in France, in the neighborhood of Troyes and Essonne. Lombardy furnished paper to the French before this time.

1342. It has been claimed that the earliest manuscript in England on linen paper has the above date (see 1320). In the Cottonian Library of the British Museum, it is said there are several writings on this kind of paper, as early as the year 1335. Linen paper gradually supplanted that made of cotton.

1342. The Royal Society of Gottingen adjudged to John Daniel Fladd a prize medal of twenty-five ducats for the discovery of the most ancient linen paper, which bears this date. It is claimed that earlier specimens have been found. (See 1319.)

1350. There was a large paper manufactory at Fabriano in Italy, which, according to the description of Bartolus, had been long established, and enlarged from time to time, till it consisted of several mills belonging

to different persons, although the whole formed only one manufactory of cotton paper.

1350. Although cotton paper was early introduced into Germany, and at the commencement of the ninth century was known under the name of Greek parchment, and although cotton and flax were spun and wove in that country in the tenth century, the manufacture of paper can not be traced beyond the middle of the fourteenth century, when it was made by stamping mills.

1360. Ulman Stromer began to write at Nuremberg the first work ever published on paper-making.

1366. The senate of Venice granted an exclusive privilege to the paper-mill at Treviso, that no linen-paper shavings or offal should be exported from Venice than for the use of that mill. This would seem to show that linen paper was already in use there.

1367. It is thought that there was no linen paper used in Italy before this time. The knowledge of cotton paper came by means of the Greeks to Italy; and the art of making it in Sicily, through the invasion of the Saracens.

1367. A document of a notary of this date proves the use of linen paper in Italy; and Maffei states that he possessed a family manuscript of linen paper of the same date, and he therefore attempts to appropriate the invention of linen paper to Italy.

1376. Du Cange cites the following lines from a French metrical romance written about this time, to show that waxen tablets continued to be occasionally used till a late period:

Some with antiquated style
 In waxen tablets promptly write;
 Others with finer pen, the while
 Form letters lovelier to the sight.

There are many ample and authentic records of the

royal household of France, of the thirteenth and fourteenth centuries, still preserved, written upon waxen tablets.

1377. A charter of this date, given at Fabriano in Italy, relates to the lease of a mill with a waterfall, *ad faciendas cartas*. It was from the mills of this place that Bodoni, at the commencement of the present century, obtained the paper for his beautiful editions.

1390. Ulman Stromer established a large paper-mill at Nuremberg, where were many Italian workmen. He employed *two rollers*, which set eighteen stampers in motion; but when he would add another roller, he was opposed by the Italians whom he employed, who would not consent to the enlarging of his manufacture; but they were imprisoned by the magistrates, and then they submitted by renewing their oaths. He died in 1407. This is the first mill known to have been erected in Germany, which is said to have manufactured the first paper from rags in Europe. But see 1350, 1366, etc.

1400. There were paper-mills at Colle in Tuscany, which were moved by water power.

1450. It is said that copies of the Bible printed upon parchment, by Gutenberg, of this date, are found at Berlin, Brunswick, St. Blaise Monastery and Paris, in three volumes, folio. But it is presumed to be a mistake.

1453. After the fall of Constantinople some Greeks established the manufacture of paper at Basle, in Switzerland.

1468. An edict of Charles VIII attests that there were paper manufactories at Troyes, Corbeil and Essonne.

1471. Sweynheim and Pannartz, in a petition to the pope for assistance, inform him that the number of books they had printed and which remained on their hands was so great that he would admire how and where they could have procured a sufficient quantity of paper, or

even rags, for such a number of volumes, which amounted to 12,475. This would probably have required about 1250 reams.

1498. An entry has been found in the privy purse expenses of Henry VII, as follows: "For a rewarde yeven at the paper mylne, 16s. 8d.," which establishes the fact that a paper-mill preceded that of Spilman nearly a century, and was probably the mill mentioned below.

1498. In Wynken de Worde's edition of *De Proprietatibus Rerum*, it is stated that the paper was made by John Tate the younger, in these quaint lines:

"And John Tate the yonger Joye mote he broke
Whiche late hathe in Englund doo make this paper thynne,
That now in our englyssh this book is prynted Inne."

This mill was at Hartford. The water-mark he used was an eight-pointed star within a double circle. A print of it is given in *Herbert's Typ. Antiquities*, i, 200.

1500. Paintings of this date by Julio Clavio, on parchment, are preserved in the Vatican. The art of painting on parchment was common before the art of painting with oil colors was discovered.

1514. John Tate died, who is supposed to have erected the first paper-mill in England, about 1498.

1539. An ancient *water-mark* (erroneously so termed) of this era, consisted of a hand with a star at the fingers' ends, and is supposed to have given the name to what is still termed *hand paper*.

1539. A favorite paper-mark of this time was the jug or pot, and is supposed to have originated the term *pot paper*, for a peculiar size. The *fool's cap* was of a later date, and has given place in England to the figure of Britannia.

1540. About this time Henry VIII of England, in the wildness of his hatred of the pope, used for his corre-

spondence a paper of which the water-mark was a hog with a mitre.

1558. Churchyard's *Spark of Friendship* was first printed this year, and mentions the paper-mill of Spilman, which is often quoted as the first paper-mill in England under the date of 1588, q. v. (See also 1498.)

1562. A work printed in this year mentions a paper-mill at Fen Ditton, near Cambridge, England.

1564. Charles IX of France having put an impost upon paper, the university brought the subject before the parliament, when Montholon and De Thou advocated the abolition of the tax, and the university gained its cause.

1565. Charles IX of France, at the remonstrance of the university and the decision of the parliament, abolished the duty which he had laid upon paper.

1588. Nicholls, in his *Progresses of Queen Elizabeth*, gives a poem with the following title: *A description and Playne Discourse of Paper, and the whole benefitts that Paper brings, with Rehearsall, and setting foorth in Verse a Papermyll built near Dartzforth. by a high Germaine, called Master Spilman, Jeweller to the Queene's Majestie.* This is supposed to have been the second paper-mill in England, and is often mentioned as the first. It was erected by a German named Spielman, or Spilman, in reward of which he received from Elizabeth the honor of knighthood. (See 1558.)

1635. Under the reign of Louis XIII of France, an impost upon paper was established, but with the condition that the *fermier* should pay each year the sum of ten thousand livres to the royal printing office and the university of Paris.

1640. The manufacture of wall paper was begun about this time; as a substitute for the ancient *hangings* of

tapestry, or cloth, they reached a high state of beauty and perfection.

1646. Athanasius Kircher, a Jesuit of the seventeenth century, boasted of having paper, among other things made of asbestos.

1652. Christina of Sweden having invited one of the Jansens from Holland as a printer, granted him the valuable privilege of importing all his paper duty free.

1654. Under Louis XIV, the indemnity established by his predecessor for the tax upon paper was changed to an exemption from duty of thirty thousand reams of paper, of all qualities and fabrics, of which the distribution was left to the superior of the university.

1658. The French paper-makers produced fabrics so much superior to those of their neighbors, and their export trade had become so flourishing in consequence, that paper to the value of two millions of livres was this year sent to Holland; and they provided Spain, England, Switzerland, Denmark, Sweden, Russia, but chiefly Holland and the Levant, with paper for printing and writing.

1661. Fuller, writing of the paper of his time, says that it partook in some sort of the characters of the countries which made it; the Venetian being neat, subtil and court-like; the French light, slight and slender; and the Dutch thick, corpulent and gross, sucking up the ink with the sponginess thereof. He complains that the English manufactories were not sufficiently encouraged, considering the vast sums of money expended for paper out of Italy, France and Germany.

1663. England imported from Holland alone paper to the amount of £100,000.

1670. Post paper seems to have derived its name from the post horn, which at one time was its distin-

guishing mark. It does not appear to have been used prior to the establishment of the general post office, here given, when it became the custom to blow a horn, to which circumstance no doubt we may attribute its introduction.

1670. The manufacture of paper was still carried on with so little success in England, that the deficiency of that indispensable fabric was imported from the continent, and principally from France.

1678. At the end of a book with this date is the following singular advertisement: "To the King's most excellent majesty, this book is humbly presented, being printed upon English paper, and made within five miles of Windsor, by Eustace Burneby, Esquire, who was the first Englishman that brought it into England; attested by Henry Million, who was overseer in the making of this royal manufacture." (See 1498, 1558, 1588.)

1685. Among the French refugees who went over to England, were a number of paper-makers, who are supposed to have greatly improved the manufacture in the latter country.

1688. It is stated in the *British Merchant*, that hardly any sort of paper except brown, was made in England previous to the revolution.

1689. Edmund Bohun says in his *Autobiography*, that "paper became so dear, that all printing stopped, almost, and the stationers did not care to undertake anything."

1690. Anderson states in his *History of Commerce* that it was in this year paper was first manufactured in England (see 1588); and that up to this time England imported paper from France to the amount of £100,000 yearly; but as the war with France occasioned very high duties to be laid on foreign productions, some French protestant refugees settled in England, and introduced the manufacture of white writing paper.

1695. A company was formed in Scotland "for making white writing and printing paper," the articles of which are preserved in the library of the British Museum.

1696. It appears by a document in the British Museum entitled the *Case of the Paper Traders*, that a bill was now pending for levying 20 per cent upon foreign paper, parchment, vellum, and pasteboard, and 20 per cent upon English paper, &c. It is also stated that there were not at this time one hundred paper-mills in all England, and that the value of paper annually made was only about £28,000. It is further said that the paper-makers were generally very poor and could scarce maintain their families.

1700. Though several unsuccessful attempts had been made to introduce the manufacture of paper into Belgium, it was not until about this time that it became regularly established, by the aid of government; nor was its progress rapid during the eighteenth century.

1700. There were four hundred paper-mills in the provinces of Perigord and Angoumois, in France; but the art of paper-making had now arrived to such a degree of perfection in England and Holland, that the trade of these mills began to decline, and finally three-fourths of them were shut up.

1701. An effort was made in parliament to affix a tax to cheap publications which had just come into vogue, yet the quantity of paper consumed by them was estimated at 20,000 reams a year.

1711. The excise duty on paper was first imposed in England during the reign of Queen Anne, occasioned by "the necessity of raising large supplies of money to carry on the present war." The necessity seems not to have ceased since.

1712. Peter the Great of Russia visited Dresden and witnessed the operation of paper-making, with which

he was so much pleased that he immediately engaged workmen to be sent to Moscow, where a mill was erected with great privileges.

1713. Thomas Watkin, a London stationer, revived the art of paper-making in England, which had gone to decay; he brought it to great repute and perfection in a short time.

1714. A paper-mill was erected upon Chester creek, Delaware, which is still in operation. The owner is a Mr. Wilcox, whose father made paper that was used in Franklin's printing-office. Paper is still made there by hand, by the same process as was in use a century ago.

1716. John Bagford, the most extraordinary connoisseur of paper ever known, died in England. His skill was so great that it is said he could at first sight tell the place where and the time when, any paper was made, though at never so many years' distance. He prepared materials for a history of paper-making, which are now in the British Museum, numbered 5891 to 5988.

1719. Reaumur, in an essay published at this time, seems to have been the first author who perceived that paper might be produced from wood. Observing that the fabric of wasps' nests was procured from wood, he took the hint, and explaining his own conceptions on the subject, desired that some one of those who had an opportunity should make the experiment.

1720. The kings of Spain having granted monopolizing privileges to many convents for the manufacture of paper, and when it came again into private hands, fixed such a low price upon printed books, that the trade went to decay. The Genoese availing themselves of the opportunity, and procuring considerable quantities of rags from Andalusia, in this year sent back paper to Spain to the amount of 500,000 piasters.

1721. The quantity of paper manufactured in Great Britain annually was estimated at three hundred thousand reams, which was equal to about two-thirds of the whole consumption.

1723. There were but few paper-mills in Holland; the Dutch importing great quantities of paper from France.

1723. The value of the paper annually made in Great Britain was estimated at £780,000.

1728. William Bradford owned a paper-mill at Elizabethtown, N. J., which Thomas think was the first in that state, and that it may have been the first in British America.

1728. A patent was granted by the general court of Massachusetts to a company for the sole purpose of manufacturing paper, for a term of ten years, on condition that in the first fifteen months they should make 115 reams of brown paper and 60 reams of printing paper; the second year 50 reams of writing paper in addition to the above; and the third year and afterwards yearly, 25 reams of a superior quality of writing paper in addition to the foregoing; and that the total annual produce of the various qualities should be less than 500 reams a year.

1730. The first paper-mill in New England went into operation in Milton, Mass., under a patent granted two years before. It was carried on several years, and is supposed to have been discontinued for want of a workman. This was probably the paper-mill of Daniel Henchman, an enterprising bookseller of Boston, who is said to have petitioned for and received some aid from the legislature of Massachusetts, and erected the first paper-mill in that colony.

1731. Daniel Henchman, who with legislative aid erected the first paper-mill in Massachusetts, produced a sample of his paper before the general court.

1732. Richard Fry, stationer, bookseller, paper-maker and rag-merchant, in Cornhill, Boston, returned the public thanks for following the directions of his former advertisement encouraging the gathering of rags, and hoped they would continue the like method, having received upwards of seven thousand weight already.

1734. Seba, a Flemish writer on natural history, whose first volume was published this year, called attention to the fact that his country "does not seem to want trees fit for making paper, if people would give themselves the necessary trouble and expense. *Alga marina*, for example, which is composed of long, strong, viscous filaments, might it not be proper for this purpose, as well as the mats of Muscovy, if they were prepared as the Japanese make their timber?"

1746. The English had manufactures of *papiers peints* about this time, and more recently the Messrs. Potter erected at Manchester a colossal establishment, which by an ingenious machine printed four colors at a time, and which, by the aid of eight machines, produced in a single day from 8 to 10,000 rolls, which was more than all the London manufactories together.

1748. The decrease of exports of French paper from Rouen was so great that many of the mills were converted to other uses, principally to fulling-mills.

1750. About this time the cylinder or engine mode of comminuting rags into paper pulp appears to have been invented in Holland, but received very little attention abroad for several years after.

1750. It was in this year that Baskerville, to obviate the roughness of the laid paper of that time, had it made on wove moulds; his beautiful edition of Virgil (see 1757) was chiefly printed on this wove paper.

1751. Many suitable vegetables had been discovered, and schemes proposed for converting them into paper,

as a substitute for rags, but none were carried into effect until now, when M. Guettard in France published his experiments and communicated new specimens of paper made from the bark, leaves, wood, &c., of different plants, shrubs and trees.

1755. The Royal Society of Sciences at Gottingen offered a premium to trace the exact time of the discovery of the manufacture of paper from linen. (See 1763.)

1756. William Hutton opened the first paper warehouse in Manchester, England.

1756. The first attempt to manufacture paper of straw was now made in Germany, and was induced by the scarcity of rags. A treatise was printed on the subject, giving a plan for reducing all vegetables into pulp, and bleaching the same.

1757. An edition of Virgil was printed by Baskerville in England, principally upon what the French term *papier velin*. It was an English invention, and this was the first work printed upon it.

1759. Until this period rags were reduced to pulp by means of stampers, a slow process, requiring considerable motive power; to remedy this, cylinders with sharp steel blades for tearing the rags (invented in Holland, where the wind-mills, then used for propelling machinery, were found inadequate to put these stampers in regular and constant motion), began to be used in other countries.

1760. The first paper-mill in New England, which is supposed to have been stopped for want of a workman to carry it on, was revived by a citizen of Boston, who obtained a furlough for a British soldier, stationed there, long enough to put the mill in operation.

1760. The making of paper in England had scarcely reached any high degree of perfection until this time

when the celebrated James Whatman established his reputation at Maidstone. He had visited the most celebrated paper-mills in Europe, which enabled him to acquire a great celebrity in his profession, and his successors have maintained the reputation of the establishment to the present time; a medal having been awarded them at the World's fair in 1851.

1762. Gerardus Meerman, a Hollander, who wrote upon the origin of printing, offered a premium of twenty-five ducats to discover the time of the first manufacture of linen paper. Specimens were sent to him from different countries, which were claimed to be linen; but all his researches were lost and reduced to an uncertainty, through the existing remnants of cotton paper, which was in use some centuries before linen, because the two are in many respects similar, and cotton and linen rags may have been at first mixed; it was therefore rendered more difficult to ascertain when the first paper was made from linen rags alone.

1763. The Royal Society of Sciences at Gottingen renewed their premiums of 1755 for the discovery of the period of the introduction of paper.

1765. Jacob Christian Schaffers, of Ratisbon, published a work in octavo, upon the different sorts of paper which he could make without the use of rags, giving specimens, among which were the cotton du peuplier, hornets' nests, saw dust, moss, beech, willow, aspen, mulberry, clematite, and pine; with hop vines, the peelings of grape vines, hemp, the leaves of aloes, and lily of the valley; with arroche, moth-wort, masse d'eau, barley straw, cabbage stumps, thistle stalks, burdock, conferva, wheat straw, broom corn, and Bavarian peat. (See 1772.)

1768. Christopher Leflingwell began to make paper at Norwich, Connecticut, about this time, and was encouraged by the legislature with the promise of a bounty.

1768. Such was the reputation of the paper fabricated in Holland, that the French Academy of Sciences at Paris, sent Demarets to that country for the purpose of visiting the mills and studying the process.

1769. It was announced in the *Boston News Letter* that "the bellcart will go through Boston before the end of next month, to collect rags for the paper-mill at Milton, when all people that will encourage the paper manufactory may dispose of them."

"Rags are as beauties, which concealed lie,
But when in paper how it charms the eye;
Pray save your rags, new beauties it discover,
For paper truly, every one's a lover:
By the pen and press such knowledge is displayed,
As wouldn't exist, if paper was not made.
Wisdom of things, mysterious, divine,
Illustriously doth on paper shine."

1770. Christopher Leffingwell, who was manufacturing paper at Norwich, Ct., under the official encouragement of 2*d* a quire on all good writing paper, and 1*d* a quire on all printing and common paper (see 1768), now received a bounty on 4,020 quires of writing paper, and 10,600 quires of printing paper, after which the government patronage was withdrawn.

1770. There were eleven large paper-mills in Holland in which wind-mills were used to drive the cutting and grinding engines, which performed more labor in an hour than the German water-mills with the stampers would do in six hours. In Saardam 1000 persons were employed in paper-making. They imported nine-tenths of their stock; but exported great quantities of paper.*

1770. In the states of Pennsylvania, New Jersey and Delaware there were forty paper-mills, which were supposed to make £100,000 worth of paper annually.

1772. A book was printed in Germany, containing upwards of sixty specimens of paper, made of different

materials, the result of one man's experiments alone. The author was Jacob Christian Schaffers,* and a copy is in the Smithsonian Institution Library.

1774. Scheele discovered a gas now known as chlorine, which, in combination with lime, came to be employed in bleaching paper to a very great extent.

1775. There were, at the breaking out of the revolution, three small paper-mills in Massachusetts; in New Hampshire none; and one in Rhode Island out of repair. The paper which these mills could make fell far short of the necessary supply. Paper, of course, was very scarce, and what could be procured was badly manufactured, not having more than half the requisite labor bestowed upon it. It was often taken from the mill wet and unsized. The people had not acquired the habit of saving rags, and stock for the manufacture of paper was obtained with great difficulty. Everything like rags was ground up together to make paper, which accounts for the peculiar colors often observed in the paper of this time.

1776. A volume was printed in France upon white looking paper, made from the bark of the linden (basswood), at the end of which were some twenty specimens of paper, made from as many different kinds of vegetables. But the poor quality of the fabrics and the cost of producing them seem to have discouraged the inventors.

1776. Watson & Ledyard, having a paper-mill at East Hartford, Ct., wholly supplied the press at Hartford, which published about 8000 papers weekly, as well as the greater part of the writing paper used in Connecticut, and much of that used by the continental army.

* This work of Schaffers, *prediger zu Regensburg*, is entitled *Sammtliche Papierversuche*. It seems to have been the second work by this author on the subject (see 1765). Ratisbon is the more common name for the ancient city of Regensburg.

1777. The French Academy of Sciences sent a second deputation to Holland to visit the paper-mills and learn the process by which their fine papers were produced.

1779. M. Didot, the noted Parisian printer, having analyzed the vellum paper of the English, addressed a letter to M. Johannot d'Annonay, a French paper-maker, inviting him to attempt a similar fabrication, which was successfully made by him. (See 1781.)

1779. There were ten paper-mills in the neighborhood of Edinburgh.

1781. M. Didot, of Paris, having in 1779 encouraged M. Johannot d'Annonay to attempt an imitation of the English vellum paper, received from that manufacturer a quantity of the desired fabric, which procured for the latter a gold medal from the king, Louis XVI. It is known among the trade as *papier velin*.

1781. The scarcity of paper in New York at this time was so great that the journal of the second session of the assembly was not printed, the printer being unable to procure the necessary paper.

1781. Stockholm imported 18,579 reams of paper. The kingdom of Sweden had no more than twenty-four paper-mills at a period about twenty years later.

1782. Hamburgh imported 80,000 reams of paper. The city had but two paper-mills of two vats each, which consumed about 60,000 pounds of rags in making a dark purple paper for sugar bakers.

1784. The value of the paper manufactured in England was reported at £800,000, the excise on which was nearly £46,868.

1784. It was advertised in Albany that rags were wanted at the printing-office and paper-mill at Bennington.

1785. According to Count Ewald von Hartzberg there

were in the Russian dominions 800 (?) paper manufactories, the revenue from which was \$200,000 annually.

1785. The legislature of Massachusetts passed an "Act imposing duties on licensed vellum, parchment and paper." This was so unpopular that the same body found it necessary to repeal it.

1785. A gentleman who had directed his researches to national industry stated that there were 400 paper-mills in Germany, which furnished 20,000 bales, of ten reams each, per annum.

1786. The Society of Sciences at Philadelphia offered a premium for the best remedy to protect paper against insects, and another for the best method of making paper for St. Domingo which would resist insects. Several answers and samples were received, all recommending to mix the size with sharp and bitter or other ingredients which might kill the insects. But they were all rejected.

1786. The works of the Marquis de Villette were printed in London in 24mo, on paper made of marsh mallow; and at the end are specimens in single leaves of paper made of the nettle, hops, moss, reed, three species of conferva, couch grass, spindle trees, wayfaring tree, elm, lime, yellow willow, sallow willow, poplar, oak, burdock, coltsfoot, and thistle. These experiments were made at the manufactory of M. Leorier, at Bruges, and served to show that paper could be made of a multitude of articles; but they did not overcome the difficulty which existed, and which still exists, of disclosing a substance which should be more economical than linen and cotton rags.

1787. The consumption of French paper-hangings in the United States was so great, that the French government took off the export duty.

1787. A patent was granted to one Hooper, of London, for a new method of manufacturing printing paper, particularly designed for copperplate printing.

1788. Mr. Greaves, of Warrington, England, made paper from the bark and leaves of willow twigs.

1788. The Society for the Encouragement of Arts conferred a silver medal on a French manufacturer, for the production of forty-four quires of paper from the bark of the sallow tree. About 600 pounds of the raw material were used in the production of that quantity.

1789. The paper-mill nearest to Albany was at Bennington, Vt., which depended for stock upon the cast-off rags of the children of the wilderness. The paper was frequently brought from the mill on horseback, and coarse and unbleached as it appears beside the poorest paper of our day, was of such value that it was customary to repair with paste the broken quires which always came with hand-made paper, so that no sheets were lost. There are several copies of the *Albany Register* preserved in a volume in the Albany Institute, which have undergone this process, and are so ingeniously done as not to be detected unless held up to the light.

1789. Homer, in his *Bibliotheca Americana*, informs us that at this time the people of North America manufactured their own paper, and in sufficient quantities for home consumption; but that the price of labor was so high as to discourage publishing beyond their own laws, pamphlets and newspapers.

1789. Neuerdings versuchte Gutermann im *Serapeum* der Stadt Ravensburg in Wurtemberg, die Ehre der Erfindung des Leinenpapiers zuzuwenden.

1789. The celebrated *munitionnaire* Ouvrard, son of a paper-dealer in France, perceiving that the revolution would give birth to a multitude of publications, contracted for all the paper which the manufactories at

Poitou and Angoumois could produce in two years, by which he realized a hundred thousand crowns.

1789. Was sold in London, the completest specimen known to exist of manuscript written upon papyrus, dated 572 A. D.

1790. About this time the practice of bluing paper pulp had its origin. A paper-maker's wife, superintending the washing of some fine linen, accidentally dropped her bag of powdered blue into the midst of some pulp in a forward state of preparation. The paper-maker beheld in great astonishment a peculiar color in his pulp, which his wife, perceiving that no great damage had been done, took courage to disclose the cause of. Being pleased with an advance of four shillings a bundle upon his *improved* paper in the London market, he purchased his wife a costly cloak, which he presented with much satisfaction to the sharer of his joy.

1790. Samuel Hooper, of London, produced paper of various qualities from leather cuttings and refuse paper.

1790. The annual increase of printing presses in Germany, and the want of rags and paper stock, induced the manufacture of many more quires of paper from a hundred weight of rags than formerly, which rendered the German printing paper very disagreeable.

1792. A Mr. Campbell of England obtained a patent for a mode of bleaching rags for the manufacture of paper.

1793. The first paper-mill in the northern part of the state of New York was erected at Troy by Messrs. Websters, Ensign and Seymour, in which from five to ten reams were manufactured daily. An earnest appeal was made by the proprietors to the patriotism of the ladies, who were invoked to aid domestic manufactures by the preservation of rags. They were besought to patronize

the saving of all kinds of linen and cotton rags, for which would be paid at the mill, 3d for clean white, 2d for white, blue, brown and check, and a proportionate price for all other rags.

1794. A paper-mill was built at Fairhaven, Vt., by Col. Lyon, at which paper for wrapping was manufactured from the bark of the bass-wood tree.

1794. A patent was granted to Mr. Cunningham of Edinburgh for an improved method of making paper.

1795. John Bigg, of England, obtained a patent for a simple and effectual process for bleaching rags and other substances suitable for the manufacture of paper. It consisted in using manganese and sea-salt for the bleaching department, and also in the vat.

1798. M. Louis Robert of France, a workman in the establishment of M. Didot at Essonnes, announced that he had discovered a way to make, with one man, and without fire, by means of machines, sheets of paper of a very large size, even twelve feet wide and fifty feet long.

1799. The largest paper-mill in France was at Montargis, having thirty vats, requiring 1,620,000 pounds of rags, and 135,000 pounds of size. Another at Vougeot had twelve engines and twenty vats. The capacity of a mill in those times was computed by the number of vats it contained, handwork usually requiring a vat to each engine.

1799. The revenue from the excise duty on paper in England amounted to £140,000. The importation of rags from the continent was 6,307,117 pounds. It was estimated that twenty-four millions pounds of rags were annually manufactured into paper.

1799. The first attempt to produce paper in an endless web was successfully made in France by M. Robert

at the paper-mill of Francois Didot, and a patent was procured for the same this year.

1800. The first paper-mill in Columbia county, N. Y., was transformed from a flour-mill on the upper great fall of Stuyvesant falls, by Elisha Pitkin. Its capacity was one vat.

1800. The marquis of Salisbury presented to the king of England a book printed upon paper manufactured of straw, which treated of the manner in which the ancients employed different materials to perpetuate the remembrance of events before the invention of paper.

1800. Was printed by Burton, of London, a historical account of the substances which have been used to describe events, and to convey ideas, from the earliest date to the invention of paper; printed on the first useful paper manufactured only from straw.

1800. The duty on paper manufactured in England was £315,802.

1800. The government of France awarded Louis Robert, the inventor of the paper machine, 8000 francs, in consideration of the usefulness of his invention, and a patent for fifteen years; but the troubles in which France was involved caused delay in the necessary experiments, which were both tedious and expensive, and permission was given to carry over the small working model to England, with a view of getting the benefit of British capital and mechanical skill to bring it into an operative state on the great scale.

1800. A successful experiment was carried out in England by Matthias Koops, by which 700 reams of clean and white paper were turned out weekly from old waste and written and printed paper alone, which had previously been thrown away.

1800. A paper-mill at Jaroslow, in Russia, with twenty-eight engines and seventy vats, manufactured

1100 reams of paper weekly, and consumed 800 tons of rags annually ; and another of thirteen engines and thirteen vats ; they made paper-hangings principally for Moscow.

1800. There were upwards of 200 paper-mills in Spain, of which thirty-one were at Alcoi, and it was said that one Francisco Guarro manufactured paper as good as any Dutch.

1801. M. Seguin, an inventor of some note, obtained a patent in France for the manufacture of paper from straw, hemp and other vegetables, which he alleged produced an excellent quality of paper when prepared by his process ; but this was so lengthy and expensive that it was not encouraged by paper-makers.

1801. John Gamble, an Englishman, who had accompanied Leger Didot from Paris with Robert's invention for making an endless web of paper, obtained the first patent in England for that machine. Didot had agreed to pay Robert 25,000 francs for the patent and model.

1801. There were twenty-six paper mills in Russia, and notwithstanding the plenty of rags, the exportation of which was prohibited, they imported paper annually to the amount of 220,000 rubles.

1801. The number of paper-mills in Germany proper was estimated to exceed 500, manufacturing two and a half millions pounds of paper annually. But they made principally coarse paper, the finer qualities being imported.

1801. Matthias Koops succeeded in making "the most perfect paper from straw, wood, and other vegetables, without the addition of any other known paper stuff." He printed a book on these fabrics, from which many of the facts here given have been gathered. He asserted that paper could be manufactured from any vegetable substance. He seems to have been the first to discover

a mode of extracting printing and writing ink from waste paper, and obtained a patent for manufacturing paper from straw, hay, thistles, waste and refuse of hemp and flax, and different kinds of wood and bark, fit for printing and almost all other purposes for which paper is used. He claimed to have produced the first useful paper that had ever been made from straw alone.

1801. There were 500 paper-mills in France, notwithstanding the diminution during a great number of years caused by the gradual decrease of export, arising from the activity with which the neighboring countries pursued the manufacture at home. These mills were supposed to consume annually twenty millions pounds of rags and coarse paper stuff; and that fourteen millions pounds of rags were annually exported, notwithstanding the severe prohibition.

1801. Robert Bage, an English paper-maker, died. William Hutton, the celebrated bookseller and author at Birmingham, purchased nearly all the paper which Bage made during forty-five years.

1802. A patent was secured in England by W. Pless for a mode of coloring paper pulp, which consisted of mixing with the pulp snuff, bran, hay, or any substance possessing the color which was desired to be imparted to the paper.

1802. Several patents were granted at this time in England and France, for improvements in paper-making machines, most of which were of value, and caused more progression in the art than the substances offered for the production of paper.

1802. Burgess Allison and John Hawkins obtained a patent for making paper of the husks of Indian corn.

1802. M. Lozanna offered to the Society of Agriculture at Turin, a number of specimens of paper made of

the *papus* of the *seratula ervensis*, the *carduus nutans*, and of the bark of the *erigerone* of Canada.

1802. The fourteen paper-mills at Alsace in France, which manufactured about 40,000 reams annually, exported about two-thirds thereof to Switzerland and Germany. The manufacturers in Languedoc, Lyons, Guienne, Bretagne and Poitou wrought also principally for exportation.

1803. Mr. Bryan Donkin, after nearly three years of intense application, succeeded in producing a self-acting machine on the plan of M. Robert of France. It was to him that Didot and Gamble, on their arrival in England, entrusted the attempt to construct the novel automaton. It performed in such a manner as to surprise every body.

1803. The average yearly import of rags into Great Britain was 3111 tons for this and the two previous years.

1803. In the cantons of Bern and Basil were several paper-mills, which manufactured paper so much admired for its strength and whiteness, that it tended to diminish the importation from France.

1804. About this time William Baily began the erection of a paper-mill on the river Chateaugay, above the town of that name, in Franklin county, N. Y.; but it was never completed.

1804. Peignot estimated the quantity of printing paper consumed in Paris annually at 228,000 reams.

1804. The American Company of Booksellers offered a gold medal of the value of fifty dollars for the greatest quantity of paper, of the best quality fit for printing, not less than fifty reams, of other materials than linen, cotton or woolen rags; and a silver medal of the value of \$20, for the greatest quantity of wrapping paper, not less than forty reams, manufactured of other materials than those usually employed for that purpose.

1804. Messrs. Henry and Sealy Fourdrinier, wealthy stationers and paper manufacturers of London, purchased the patents of Didot and Gamble in Robert's paper machine. It was by their improvements and extensive manufacture that the invention came to be called the Fourdrinier machine, by which it is still known, on both sides of the Atlantic. Their first experiments were made at Boxmoor, where they erected a machine and pursued their experiments at great expense.

1804. Mr. Donkin, since so celebrated as a paper-machine maker, put up his second machine at Two Waters, in England, which was completely successful; and the manufacture of continuous paper became one of the most useful discoveries of the age.

1805. Mr. Donkin, the builder of the Fourdrinier paper-machine, altered the position of the cylinders, so as to dispense with the use of the upper web, in improvement by which the machine was much simplified—the paper on the web being slightly pressed before passing through the pressing rollers—thus an all-important advantage was attained. It was now capable of doing the work of six vats in twelve hours.*

1805. It was about this time that the *rice-paper* of the Chinese, used for artificial flowers, was introduced into England. It was an item of the gossip of the day that the princess Charlotte paid seventy guineas for a bouquet made of this paper, which is not a manufactured article, but a vegetable production, cut spirally, and afterwards flattened by pressure. It seems to have come from the island of Formosa originally.

1806. Francis Guy, of Baltimore, procured a patent

*By the hand process it took three months to complete the paper ready for delivery, from the time of receiving the rags into the mill; by the machine the paper may now be delivered the next day.

for paper carpets, which he claimed were equal to canvas floor cloths, much more beautiful and above 50 per cent cheaper.

1806. The patentees of the Fourdrinier machine laid a statement before the public containing a comparative estimate of the expense attending seven vats, and that attending a machine employed upon paper sized in the engine, performing the same quantity of work as seven vats, at the rate of twelve hours a day. The expense of seven vats per annum was £2,604:12; a machine doing seven vats' work was £734:12; balance saved by the machine per annum, £1,870. The expense of making paper by hand at this time was 16s. per cwt.; by machine, 3s 6d.

1807. The paper-mill of Nathan Benjamin at Catskil took fire by accident, and burnt, with a stock valued at \$9,000.

1807. Messrs. Fourdrinier stated before parliament that they had withdrawn from their stationery business the large sum of £60,000 to further the object of their enterprise; so many difficulties did they encounter, in bringing the machinery to its then comparatively complete state, and so little encouragement or support did they receive from the paper manufacturers throughout the kingdom. The prices of their machines were from £715 to £1040.

1807. Gen. Walter Martin, proprietor of the township of Martinsburgh, Lewis county, N. Y., erected a paper-mill, which was run by John Clark & Co. They gave notice that rags would be received at the principal stores in Upper Canada and the Black River country, which (like many of the advertisements of the early paper-makers, both in England and America), was accompanied by a poetic address to the ladies, one stanza of which ran thus:

“ Sweet ladies pray be not offended,
 Nor mind the jest of sneering wags:
 No harm, believe us, is intended,
 When humbly we request your rags.”

1808. The Sultan Selim III was assassinated, and the printing office and paper manufactory which he had established a few years before, at Sentari, the Asiatic suburb of Constantinople, were destroyed.

1808. John Gamble, who had superintended the construction and improved the paper machine in England, after losing both his time and money savings during eight years of irksome diligence, assigned over to Messrs. Fourdrinier, the whole right of his share in the patent to which he was entitled under the act of parliament, for improvements.

1808. Van Veghten & Son, who printed the *Western Budget* at Schenectady, issued their paper several weeks on a half sheet, alleging that they had posted to all the mills within thirty miles, without being able to procure a full supply, but only the promise of a sufficient quantity within two or three weeks. They took occasion to request the ladies to pack up all their rags, and send them to the office, where they would be paid three cents a pound ready cash.

1809 Mr. Dickinson, an English paper maker of note, invented another method of making endless paper, which competed with the Fourdrinier machine. Instead of the traveling wire-cloth, he conceived the plan of a polished, hollow, brass cylinder, perforated with holes, and covered with wire-cloth, which revolves over and just in contact with the prepared pulp, sucking up the water by rarefaction, and leaving the filaments sufficiently strong to be carried by the usual process to completion.

1809. A paper-mill was erected near the Schoharie

bridge, New York, on the Great western turnpike, by Wood & Reddington, and was ready for operation in February.

1810. M. Didot having failed to fulfill his obligations to Louis Robert, in the purchase of the paper machine, the latter instituted a suit at law, and recovered his patent.

1810. The paper-mills in Massachusetts were constructed for two vats each, and could make, of the various descriptions of paper, from two to three thousand reams per annum. Such a mill required a capital of \$10,000, and employed twelve or more persons, consisting of men, boys and girls. Collecting rags and making paper gave an employment to not less than 2500 persons at this time. The quantity gathered of rags, old sails, ropes, junk, and other substances of which the various kinds of paper were made, was computed to amount to not less than 3500 tons yearly.

1810. Thomas estimated the number of paper-mills in the United States at 185; of which seven were in New Hampshire, thirty-eight in Massachusetts, four in Rhode Island, seventeen in Connecticut, nine in Vermont, twelve in New York, four in Delaware, three in Maryland, four in Virginia, one in South Carolina, six in Kentucky, four in Tennessee, sixty in Pennsylvania; that they manufactured 50,000 reams of paper, averaging \$3 a ream, and weighing about 500 tons; and 70,000 tons of cheap book paper, at \$3.50, weighing 630 tons; 111,000 reams of writing paper at \$3, about 650 tons; and 100,000 reams of wrapping at 83 cents; besides paper hangings and a number of other articles sufficient for home consumption.

1810. The Chevalier Landolina died in Sicily, an antiquarian who maintained that the ancients used the pith of the papyrus for the purpose of making paper;

and supported his opinion by ingenious experiments made with a plant growing near Syracuse in that country, and which corresponds to the description given by the ancients of the papyrus.

1810. The census returned twenty-eight paper-mills in the state of New York, which manufactured 77,756 reams of paper, the average value of which was three dollars a ream.

1810. The second paper-mill in Columbia county, N. Y., was erected at Stockport by George Chittenden, whose sons continue its operation.

1810. The United States began to import rags largely from Europe. Previous to this the materials for paper making were procured in the country.

1811. Edward Smith of London theorized on the production of paper from nettles and the threads of worn-out sacks; originating many valuable suggestions relative to the manufacture.

1812. Gabriel Desetable of Caen, in France, presented specimens of paper made from straw by means of an instrument said to be so simple that any person who pleased could make paper equal to the most practical workman.

1812. The number of paper-mills in the United States was computed to be 190.

1813. Dr. Colquhoun estimated the value of paper annually produced in Great Britain at £2,000,000; but Mr. Stevenson, an incomparably better authority upon such subjects, estimated it at about half that sum.

1813. It was announced that a discovery had been made of a method of preparing paper, on which, by writing with water only, the impression would be as legible and durable as with ink. It soon proved to be unworthy of notice.

1813. A machine was patented in England for cutting

waste paper, &c., into shreds, preparatory to remanufacture.

1813. The Fourdrinier machine was now so much simplified, that instead of 5 men formerly employed upon one machine, 3 were fully sufficient without requiring that degree of attention and skill which were formerly indispensable.

1815. The first paper machine was constructed in France. Although the idea of producing an endless web of paper was first attempted to be carried out in that country sixteen years before (see 1799), strange enough, this was the Fourdrinier machine, invented by Louis Robert, which had been improved in England; but it was very imperfect when compared with an English machine imported about the same time into France.

1816. It was a day's work for three men to manufacture four thousand small sheets of paper, at this time, by the hand process.

1816. A paper-mill went into operation at Pittsburgh, Pa., with a steam engine of sixteen-horse power, on the principle of Oliver Evans, which employed forty persons, consuming 10,000 bushels of coal and 120,000 pounds of rags per annum; and manufactured \$20,000 worth of paper annually.

1816. Of a quantity of Bibles printed by the British and Foreign Bible Society, one was found two years later crumbling to dust, although it had not been used, owing to the process used in bleaching the paper at the mill.

1817. Thomas Amies, a noted paper-maker of Philadelphia, produced a quantity of paper for the purpose of printing the Declaration of Independence, which was designed to surpass everything that had been attempted in that way in America. The mould and felts were got

up expressly for the purpose, the size of the sheet was 26x36 inches, and nothing was used but the finest linen rags. Each ream weighed 140 pounds, and the price was \$125.

1817. Thomas Gilpin & Co., paper-manufacturers at Wilmington, Delaware, put in operation a machine for making paper, at their mill on the Brandywine, which appears by the notices of it to have been a cylinder machine, and an American invention. It was stated that it would do the work of *ten paper rats*, and delivered a sheet of greater width than any other made in America, and of any length required.

1817. Mr. Heath, an English pasteboard manufacturer, first introduced high glazing, now universally adopted; but for many years his process was unknown.

1817. E. B. Ball, an English paper-maker, obtained a patent for making paper by the combination of new floss silk, flax, hemp, and Russia linen. These substances, under the usual process, were said to produce a white and durable paper.

1818. Roger Didot, formerly a paper-maker in France, but at this time carrying on the business in England, obtained a patent for certain improvements upon the machine already in use for making wove and laid paper in continuous lengths or separate sheets.

1818. The *Prince of Wales Island Gazette* was printed on paper which was said to have been made from rice, by which was probably meant rice straw.

1818. The value of rags gathered in the United States was estimated at \$900,000 per annum.

1818. A bill was brought before congress to increase the duties on certain articles manufactured in America, among which were, paper for copperplate printing, or writing, 12½ cts. a pound, and on all other papers 10 cts. a pound.

1818. The first paper-machine was established at Berlin in Prussia.

1819. The London Society for the Encouragement of Arts and Manufactures, awarded 30 guineas to Mr. Finsley, for the invention of ivory paper, which was said to possess a surface having many of the properties of ivory, and at the same time the advantage of a much greater surface than ivory can possibly furnish.

1819. The paper-mill of Simonds, Case & Co., in Farmington, near Canandaigua, N. Y., took fire from a kettle of coals placed in the drying room to force the process of drying a lot of paper which had begun to mildew. Loss \$5,000.

1820. Notwithstanding the great benefits derived by the perfection of the Fourdrinier paper-machine and the immense quantity of paper produced by these machines, the old and tedious process of drying in lofts was still practiced.

1820. M. Huygeron, of France, secured a patent for making paper from pure straw. The invention related to a process of fabrication; however, a white and durable paper was the result of his improvements.

1820. About this time machinery for the manufacture of paper began to be introduced into the United States from England and France; but, being found expensive, was not much encouraged. It is believed to have been first used by Gilpin, on the Brandywine.

1820. Solomon Stimpson, of Putney, Vt., advertised that he had discovered the art of making green paper for writing and printing, the utility of which was "to strengthen and preserve the eye."

1820. A patent was granted for five years by the government of Denmark, to the inventor of a mode of making paper from seaweed. It was claimed to be

whiter and stronger than the paper in common use, and cheaper.

1820. The paper-manufacturers of Baltimore petitioned congress for a tariff of 25 per cent on foreign paper. Congress was at this time using English paper, although the Gilpins on the Brandywine, with a capital of half a million, were manufacturing paper which was claimed to be equally as good as the English, which they desired to furnish 25 per cent less.

1820. The paper-manufactures of the United States were estimated at an annual average of three millions of dollars; and the cost of materials and labor at two millions; employed 5000 persons, of which 1700 were males over 16 years of age, and the rest women and children.

1820. The paper-makers of Pennsylvania and Delaware, petitioning congress for a tariff on paper, say that in their district there were 70 paper-mills with 95 vats in operation until the importations after the war, since which they had been reduced to 17 vats. When paper was taxed; the amount paid by a vat was from \$200 to \$250. That these establishments cost about \$500,000, and had employed 950 persons, consuming 2600 tons of rags, and producing paper to the amount of \$800,000 annually.

1821. M. Janbeurt, an inventor, of Marseilles, obtained a patent in France for the production of paper from beaten hemp and liquorice wood, which were reduced to a pulp, and prepared for paper in the usual manner.

1821. A very useful improvement was added to the paper machine by T. B. Crompton, of England, who obtained a patent for drying and finishing paper by means of a cloth against heated cylinders, and the

application of a pair of shears to cut the paper off into suitable lengths, as it issued from the machine, or rollers. The paper was much better finished and cut than had been found possible until this improvement.

1821. A paper-mill containing two vats, was destroyed by fire at Esperance, Schoharie county, N. Y., owned by Henry W. Starin.

1822. The Philadelphia publishers consumed 30,000 reams of paper in printing Rees's *Cyclopaedia*. It was the largest work in the English language.

1822. The paper-makers united with the printers and booksellers in memorializing congress not to reduce the duty on imported books, stating that the cash value of books manufactured in this country was considerably more than a million of dollars annually, every article used in which was manufactured here, and a very important item, rags, of no value whatever, except for this purpose.

1822. An extensive paper-mill on Bronx river, New York, owned by David Lydig, was destroyed by fire, with all the machinery and a large quantity of paper stock. It was insured for \$32,000.

1823. A roll of papyrus measuring eleven inches in length and five in circumference was discovered in the island of Elephanta, in the East Indies. It contained a portion of the *Iliad* written in large capitals, such as were in use during the time of the Ptolemies and under the earlier Roman emperors.

1823. It was complained by the newspapers that congress was using paper with a French water-mark, "*Napoleon empereur et roi, 1813.*"

1823. There were 192 paper-merchants in France.

1823. France possessed only one manufactory of the *papier continue*, that of M. Canson, at Annonay, who had one of the Fourdrinier machines, made in England.

1823. A paper-mill was erected in England for the purpose of manufacturing paper from old sacks, ropes, &c. The paper produced was used for wrapping purposes.

1824. M. Laferet, of France, obtained a patent for making paper of beaten hemp, macerated in water. The Japanese macerate the same substance in lime-water.

1824. J. McGuaran patented in England a mode of producing paper from hop vines, which was of a dusky-brown color, and employed for wrapping. The vines were immersed in water, by which the rind was separated from the woody portion, when it was cut in small pieces and sent to the engine.

1824. A. Nesbit procured a patent in England for a mode of producing paper from moss, which afforded a pulp suitable for the manufacture of coarse paper.

1824. A beautiful paper was produced by the Japanese at this time from the mulberry tree, which was also of an excellent quality. It was prepared for manufacture in the usual manner.

1824. Louis Lambert, a Frenchman, took out a patent in England for certain improvements in the material and manufacture of paper. They consisted in reducing straw to pulp and extracting the coloring and other deleterious matter, so that it could be introduced into the ordinary rag engine, and employed in making paper.

1825. William Van Houten, a Hollander, had a patent taken out in England, for a mode of manufacturing moss into paper and felt. He had patented the same in France a year earlier.

1825. One of the paper-mills belonging to Messrs. J. & J. Gilpin, on the Brandywine, was destroyed by fire.

1825. Messrs. D. & J. Ames, Springfield, Mass., were said to have the most extensive paper-manufactory in

the United States; employing 12 engines, and more than 100 females, besides the requisite number of males.

1825. Specimens of brown wrapping and bleached and unbleached writing papers were exhibited in Boston, which were manufactured in England from pine shavings. The fabric was said to be firmer than that of any paper manufactured from the ordinary materials.

1826. A letter from Paris states that "There is much talk here about a new sort of paper, made of hemp stock, which is to be so cheap that a handsome octavo volume of 480 pages, manufactured of it, may be sold for about 1 shilling, 2 pence half-penny sterling."

1826. About this time a Mr. Sharp took out a patent in England for a mode of manufacturing paper of pine shavings. He had a mill at Hampshire.

1826. M. Canson, of France, applied to the Fourdrinier machine the principle of Mr. Dickinson, of England, of rarefying the air below the surface of the web, (see 1809) by means of suction pumps; an improvement which he kept secret for six years.

1826. M. Firmin Didot introduced into his mill at Mesnil, the drying process invented by Mr. Crompton, of England, which was the first employment of it in France.

1826. The first machine for making paper that was put up in Denmark, was built this year by Messrs. Donkin, of England. The first paper-mill in that country had been established at Fredericksburg by order of Christian III.

1826. There were 80 printing offices in the city of Paris besides the government establishment, which consumed 280,800 reams of paper annually.

1827. Messrs. Canson Brothers, paper-makers of Annonay, in France, obtained a patent for a method of

sizing paper. With respect to sizing machine-made paper, it is well known that sizing in the vat offers many advantages; but as a gelatine can not be employed without injury to the felt during the process of manufacturing paper, substitutes for gelatine were desirable. The base used by M. Canson was wax. M. Delcambre in the same year made another, the base of which was rosin.

1827. Mr. Obry conceived a plan of using alum and rosin previously dissolved in soda, and combining it with potato starch, for the purpose of sizing paper in the vat, which is the method now generally followed in France for writing and printing papers.

1827. MM. Firmin Didot Brothers and Lefevre established the first paper-machine, under a patent of importation, in Sicily.

1827. White & Gale, of Vermont, obtained a patent for a mode of finishing paper.

1827. Louis Pierre Poisson, of Paris, obtained a patent in France, for a process of making paper of liquorice root and pasteboard scraps; which were mixed together, macerated, and converted into paper in the usual manner.

1827. Pierre Balilliat, of Macon, in France, obtained a patent for a chemical substance to substitute for linen rags in the manufacture of paper.

1827. A patent was granted to the Count de la Garde, in England, for a method of making paper of various descriptions, from the bullen or ligneous parts obtained from certain textile plants, which were prepared by a rural mechanical brake; which substances were to be used alone in making paper, or mixed with other suitable articles, such as refuse paper and rags.

1827. Benjamin Devaux, of Paris, obtained a patent for a mode of making paper and pasteboard of hemp.

1827. William Van Houten made experiments with moss, and succeeded in producing paper from it. He had taken out patents in England and France two years before. (See 1825.)

1827. There were but four paper-machines in France, although they had now been in use in England about twenty-five years.

1828. William Magaw, of Meadville, Pa., obtained a patent for a mode of preparing hay, straw, or other vegetable substances in the manufacture of paper; it was represented as being of a yellow color, but even and strong, and receiving the ink as well as common writing paper.

1828. Paper was made at Chambersburg, Pa., from straw and blue grass according to a patent obtained by William Magaw. The paper was said to be firm and strong, and that machinery was being constructed sufficient to make 300 reams a day.

1828. It was estimated that the newspapers printed in New York consumed 15,000 reams of paper a year, worth from four to five dollars a ream. And that the newspapers in the whole United States required 104,400 reams, the cost of which was \$500,000.

1828. Thomas Bonsar Crompton and Enoch Taylor obtained a patent in England for a mode of cutting the web of paper lengthwise, in slips of any required width, by means of revolving circular blades.

1828. James Palmer, an English paper-maker, obtained a patent for the invention of certain improvements in the moulds, machinery or apparatus for making paper.

1828. George Dickinson, an English paper-manufacturer, obtained a patent for improvements in paper-making machinery, which came into extensive use. The lateral shaking motion of the wire web in the Fourdrinier machine, as originally made, was injurious

to the fabric of the paper, by bringing its fibres more closely together breadthwise than lengthwise, thus tending to produce long ribs or thick streaks in its substance. This he proposed to obviate by giving a rapid up and down movement to the traveling web of pulp. A similar contrivance was introduced by Mr. Donkin, in which the vibrations were actuated in a much more mechanical way.

1828. Elisha Hayden Collier, of Plymouth county, Mass., obtained a patent for the invention of a mode of manufacturing paper from a marine production, called *ulva marina*.

1828. Moses Y. Beach, of Springfield, Mass., invented a machine for cutting rags in the manufacture of paper, for which he obtained a patent.

1828. Victor Odent, of Courtalin, in France, obtained a patent for a machine to manufacture paper with economy and ease.

1828. Prof. Cowper, of England, obtained a patent for a paper-cutting machine. As other machines were introduced, his ingenious arrangement ceased to be used, except as a model for others to improve upon.

1828. Richard Waterman and George W. Annis, of Providence, R. I., obtained a patent for a mode of making double paper. It consisted in bringing a sheet previously formed in contact with the stuff on the felt, and passing both between the press rollers. They claimed that any number of thicknesses might be treated in that way successfully.

1828. T. B. Crompton and Enoch Miller obtained a patent for cutting the endless web of paper lengthwise, by revolving circular blades, fixed upon a roller parallel to a cylinder, round which the paper is lapped, and progressively unwound.

1828. This 21st November, says Cobbett, I have not

only received a parcel of paper, made of the husks of my corn, but have sent it to have printed on it the title page of this very book (*Treatise on Corn*).

1828. Cyprian Prosper Brard, of Frejus, in France, obtained a patent for a mode of making paper from decayed wood, which was converted into pulp, and mixed with old waste paper.

1828. Mason Hunting, of Watertown, Mass., obtained a patent for an improved top press-roller, by means of which paper of any thickness might be made by a single and simple operation.

1828. A patent was taken out in France by Bernadotte and others, for a mode of making paper of animal substances, called aporentype.

1828. A mode of sizing, glazing and beautifying paper was patented in England, which consisted of the use of a fluid compound of alkalies dissolved in water, with beeswax and alum.

1828. Marsden Haddock, of New York, obtained a patent for a machine to manufacture paper in the sheet by the dipping process. It seems to have been a mode of dipping faster than by the old hand process.

1829. William Debit, of East Hartford, Ct., obtained a patent for a machine for cleansing rags and preparing them for use in the manufacture of paper.

1829. John Dickinson, an English paper-manufacturer, obtained a patent for a new improvement in the method of manufacturing paper by machinery, and also a new method of cutting paper and other materials into single sheets or pieces by means of machinery. He also announced an improvement in the manufacture of paper, which consisted of introducing cotton, flaxen, or silken thread, web or lace into the paper, in such a way as to form the inner part.

1829. John W. Cooper, of Washington township,

obtained a patent for an improvement in the art of making white paper from rags of cotton, linen or silk, be their colors ever so various, and of extracting from all kinds of rags all kinds of mineral colors, &c., &c.

1829. Rondeaux & Henn patented in France a process of making paper from leather cuttings, mixed with refuse paper. (See 1790.)

1829. Messrs. Sprague, paper-makers at Fredonia, New York, obtained a patent for a mode of making paper from husks of Indian corn. Their process was, to 28 gallons of water, 10 quarts of good lime, or 6 pounds of good alkalies, and 110 pounds of clean corn husks or flag leaves; heat over a moderate fire two hours, when they will be ready for the engine.

1829. Louis Bomeisler, of Philadelphia, obtained a patent for making from straw, white and handsome writing paper. From 120 pounds of straw, after the knobs were cut off, he claimed that he could produce 100 pounds of pulp, which would make fine, white and handsome writing paper, not before known or used.

1829. Isaac Saunderson, of Milton, Mass., obtained a patent for improvements in the cylinder paper-machine, which obviated the defect of cylinder-made paper, the inequality of its strength when tried lengthwise and across, in consequence of the greater number of fibres running in one direction than the other, and a consequent want of that perfect interlocking which takes place upon mould-made paper. To effect this improvement he introduced a horizontal whirl-wheel, and sheet-forming rollers, by which he was enabled to manufacture press papers, pasteboard and bandbox paper.

1829. Reuben Fairchild, of Trumbull, Ct., obtained a patent for an improvement in the mode of manufacturing paper, the object of which was to obviate the defect in the paper made upon cylinder machines, in its being

easily torn in one direction, in consequence of the fibres being mostly arranged longitudinally with the length of the sheet. The improvement was effected by what was called an agitator, a semi-cylindrical cradle of metal lying in the vat, and vibrating in the direction of the length of the cylinder. Culver & Cole, of Massachusetts, applied at the same time for a patent for a machine identical in principle with the above, but afterwards arranged a mutual ownership.

1829. The excise duty on paper in England amounted to £728,000.

1829. M. Jullien patented in France a mode of manufacturing paper from hay; also a process of coloring paper.

1829. Paper was obtained from the magney in Mexico, equal to that made of rags; and congress passed a law prohibiting the government from using any other paper.

1829. Quirini obtained a patent in France for the production of paper from straw and refuse pasteboard.

1829. The paper-makers of Turin during this and the previous year, produced various qualities of paper from willow twigs, poplar, &c., which were extensively used. Schaffers had made the same experiment more than sixty years earlier. (See 1765, 1772.)

1829. The French paper-makers sought for the Fourdrinier paper-machine in England alone, and a French author makes the following painful acknowledgment for his countrymen: "La construction de ces machines, qui n'offre pourtant rien de difficile, est restée jusqu'à ce jour exclusivement dans les mains des Anglais."

1829. It is stated that a French paper-machine was introduced into Windham, Conn., which is now used in the best mills in that state.

1829. Thomas Cobb, of England, obtained a patent for a mode of manufacturing tinted paper and embossing

during the process of making, by pressing the pulp between rollers or plates, engraved with suitable devices. He claimed to have invented a mode of producing an embossed surface, giving a beautiful effect to papers colored in the pulp, and not stained after the paper is made, as usual with paper-hangings; and by which also silks, velvets, or other colored goods could be put upon the surface of paper, and when embossed produce a rich and beautiful appearance.

1829. There were about 60 paper-mills in Massachusetts, six of which had machines. They were all supposed to consume about 1700 tons of rags, &c., and produced about \$700,000 worth of paper in a year.

1829. M. Montgolfier introduced a new fabric called *papier linge*, for table-cloths and hangings, which was said to be as soft to the touch as the finest Silesian linen but sold at Lyons for the price of mere paper. They were made in imitation of silk, or stamped with the most graceful *arabesques*, and sold at four and five sous the French yard.

1829. Straw paper was used for packing *Niles's Weekly Register*, which circulated to the remotest parts of the country, and was regarded as the best paper then made for that purpose, and was cheap. It was manufactured at Chambersburgh, Pa., at less than \$2 a ream, imperial size, and was machine-made.

1829. It was estimated that the quantity of paper manufactured in the United States amounted to nearly seven millions of dollars, and employed more than ten thousand persons. The quantity of rags and paper-stock saved annually was computed to be two millions of dollars in value.

1830. M. Brand, a French officer, made successful experiments in producing coarse paper from the pine

tree, an account of which was published in the *Courier Francais* of Nov. 27, 1830, issued in New York city.

1830. At Whitehall mill, in Derbyshire, Eng., a sheet of paper was manufactured which measured 13,800 feet in length, and 4 feet in breadth.

1830. At the custom house in London, a duty of £2,200 was levied on rags; £1,400 on superior kinds of papers for artists; and £701,000 upon paper.

1830. Wooster & Holmes, of Meadville, Pa., obtained a patent for an improvement in the mode of making paper from wood, by which one hundred pounds of wood should be productive of from five to seven reams of paper, according to their estimates.

1830. Joseph E. Holmes and Lewis Wooster, of Ohio, manufactured paper of the lime and aspen, upon which an edition of the *Crawford Messenger* was printed. They also made wrapping paper and bookboard of superior quality. They had a process of reducing wood to shavings with great rapidity. But Magaw, who had obtained a patent for making paper of "straw and other vegetable substances," claimed that their use of alkalies was an infringement of his patent, and the process was abandoned.

1830. Richard Ibotson, of England, invented an apparatus for separating the knots from paper-stuff, which the sieves or strainers in use were inadequate to do effectually. It superseded the operation of picking the lumps from paper after it was made, which caused much damaged paper, and freed it from imperfections which caused serious damage to types and wood cuts.

1830. About this time Messrs. Phelps and Spafford, of _____, Ct., succeeded in constructing paper-machines which did good execution.

1830. Ephraim F. and Thomas Blank, of the city of

New York obtained a patent for a composition called leather paper. The art consisted of making paper from the refuse shavings or parings of leather, adapted to sheathing vessels. The process was the same as with rags.

1830. John Hall obtained a patent in England for a modification of Dickinson's cylinder mould continuous paper-machine, communicated to him by a foreigner. The leading feature of the invention was a mode of supplying the vat in which the wire cylinder is immersed, with a copious flow of water, for the purpose of creating a considerable pressure upon the external surface of the cylinder, and thereby causing the fibres of the paper-pulp to adhere to the mould.

1830. John Wilks, an English machinist, improved the Fourdrinier machine by adding a perforated roller to facilitate the escape of the water from the pulp web, previously to its being subjected to the pressing rollers which was denominated a *dandy*.

1830. John Dickinson, of England, patented a mode of making paper in two layers or strata, which were brought together on the second cylinder, and formed into a single substance, a mode chiefly advantageous in producing thick paper.

1830. A patent was granted to Thomas & Woodcock, of Brattleboro', Vt., for an improvement in the manufacture of paper by means of a machine called a pulp-dresser.

1830. Thomas Gilpin, of Philadelphia, obtained a patent for an improvement in the mode of finishing paper, which consisted of calenders, or cylinders between which the paper passed to give it a polished surface.

1830. Thomas Barratt, an English paper-maker, obtained a patent for inserting the water mark and

maker's name to continuous paper, so as to resemble in every respect paper made by hand. It is to this ingenious man that we are indebted for the improved means of finishing paper, owing to the perfection he attained in making cast iron rollers truer than was possible by the old mode of turning them in a lathe. This consists in grinding the rollers together, allowing merely a small stream of water to flow over them, without emery or any other grinding material; and, by continuing the operation for many weeks, true cylinders are obtained. This is the mode now adopted in finishing rollers for all purposes requiring great accuracy.

1831. Jean Jaques Jaquier obtained a patent for making continuous paper with wire marks, similar to the laid papers usually made by hand; to which the preference was still given for their greater strength and peculiar appearance.

1831. Frederick A. Taft, of Dedham, Mass., patented an improvement in making pasteboard or other paper intended for sheathing.

1831. Edward Pine, of Troy, patented a machine for cutting paper made by cylinder machines, while it was wet.

1831. George Carvil, of Manchester, Ct., obtained a patent for a mode of cleaning rags. His apparatus was a common screen, with or without pins and knives, having wings composed of thin pieces of wood or metal, affixed upon its outside, extending from end to end, in order to create a wind by their motion.

1831. An impetus was now given to the manufacture of paper in the United States, by the recent introduction of machinery, and changes in the mode of manufacture, as well as the materials used. Old junk, rope, hemp, tow, bagging, raw cotton, cotton waste, colored and filthy rags, and other materials which had previ-

ously only been used in the making of coarser papers, were gradually brought into use for the finest grades, by the introduction of chlorine and other means of cleansing and bleaching, until they have risen 300 per cent in value.

1831. E. N. Fourdrinier invented a very ingenious apparatus for cutting the web of paper transversely into any desired lengths, which performed its duty well.

1831. Mr. Turner, an English paper-maker, obtained a patent for a peculiar strainer, designed to arrest the lumps mixed with the finer paper pulp, whereby he can dispense with the usual vat and hog in which the pulp is agitated immediately before it is floated upon the endless wire web of the Fourdrinier apparatus. It could also be applied advantageously to hand paper-machines.

1831. The *chiffonniers*, or rag-collectors, of Paris, rose against the police because it was ordered in certain municipal regulations, that the filth of the streets should be taken away in carts, without time being allowed for its examination by those diligent savers of capital.

1831. John Ames, of Springfield, Mass., introduced a wire cloth cylinder for carrying off the dirt and filth which is beaten from the rags in the engine, as a substitute for the screens or washers then in use.

1831. There were about 600 persons engaged in the manufacture of paper in Ireland.

1832. James Sawyer, of Newbury, Vt., took out a patent for a machine for cleansing paper, called the piston pulp strainer, which differed in its mode of action from that of Thomas L. Woodcock.

1832. Francis Goncher, of Pennsylvania, made an improvement in the machinery for washing pulp, for which he took out a patent.

1832. Samuel Foster, of Brattleboro', Vt., introduced a machine for cleaning and dusting rags.

1832. Nearly 12,000 quintals of paper were imported into Germany to supply the deficiency of its manufacture.

1832. Thomas French, of Ithaca, patented a filtering machine, which was designed to supersede the pulp-dresser.

1832. John Ames, of Springfield, Mass., obtained a patent for an improvement in the mode of sizing paper by machinery, and for a pulp-dresser.

1832. M. Goumar received a medal of 200 francs value for a mode of neutralizing the acid in paper used for lithographic work. He simply passed it through lime water.

1832. The excise duty on paper in England had increased nearly £100,000 in three years, being £815,000.

1832. It was said by the *New York Journal of Commerce*, that the improvements of paper-machinery had been so great in five years, that though they used a sheet a quarter larger, it cost them a quarter less money.

1832. Henry Brewer, of England, modified the parallel rod-strainer of Mr. Ibotson, by constructing square boxes with gridiron bottoms, giving a powerful up-and-down vibration in the pulp-tub, by levers, rotatory shafts and cranks.

1832. Joseph Amies, an English paper-maker, improved the paper-machine by a peculiar mode of constructing the bottom of a strainer or sieve for arresting the knots and lumps in pulp.

1832. Jarvis & French, of Tompkins county, N. Y., invented a mode of pressing paper by passing it between two hollow metallic rollers, which was used at the Falls

Creek mill at Ithaca, by which the quality of the paper was improved and much labor saved.

1832. The manufacture of paper in the United States was estimated at \$7,000,000 per annum, of which \$3,000,000 was paid for rags, and \$1,200,000 for labor. The price of paper had declined from 20 to 25 per cent, while the quality had advanced in about the same ratio.

1832. Coleman Sellers, of Philadelphia, obtained a patent for a pulp-dresser, for separating knots and all gross particles from pulp.

1832. Mr. Towgood, of England, patented a paper-cutting machine, which dispensed with the reel and cut the paper as it came from the steam cylinders.

1832. Frederick A. Taft, of Dedham, Mass., obtained a patent for paper designed for covering buildings. He mixed finely ground coal and sulphur in the pulp, and added salt and lime to render it less combustible.

1832. Samuel E. Foster, of Brattleboro', Vt., patented a mode of cleaning paper-makers' felts. They were passed over a perforated roller filled with water or steam.

1832. The paper-mill erected at Martinsburgh, N. Y. (see 1807), fell into ruin. It manufactured writing, wrapping and wall paper by the hand process, having no machinery but an engine for grinding rags.

1833. Henry Davy, of England, patented a rag-cutting and lacerating machine, the invention of a foreigner, which consisted of an endless feeding cloth, which conducted the rough rags to a pair of feed rollers, on passing through which they were subjected to the operation of rotatory cutters; thence passed down an inclined sieve, upon which they were agitated to separate the dust.

1833. The value of paper exported from France was 5,323,261 francs.

1833. M. Tripot, of France, patented a process of manufacturing paper from seaweeds.

1833. Howland & Griswold patented a mode of applying the shearings or flocks of cloth, taken from the same in the manufacture thereof, for the purpose of covering the surfaces of papers, muslin, linen, leather and wood, for useful and ornamental purposes.

1833. Sydney A. Sweet, of Tyringham, Mass., invented a pulp-sifter, which was simply a sieve with a slight modification of similar machines.

1833. The *Penny Magazine* of the Society for the Diffusion of Useful Knowledge, in London, consumed 14,000 reams of paper a year. This required the constant working of two machines through the year. At the same time a paper-mill with one machine was held to carry on a notable business, requiring the labor of forty workmen.

1833. Edmund Blake, of Alstead, N. H., invented an apparatus for sizing paper in the sheet, without handling it in the usual manner, thereby preventing the liability to tear, and facilitating the operation by sizing a much larger portion at once than could be done in the way ordinarily pursued.

1834. Of an edition of 30,000 copies of a book published in England in 1818, it was said that not a perfect copy existed; all of them having fallen to pieces owing to the process of excessive bleaching with chlorine, in manufacturing the paper.

1834. The quantity of paper annually manufactured in Great Britain during the five years ending with 1834, was 70,988,131 pounds.

1834. Clark Rice, of Watertown, N. Y., made an improvement in the washers for paper engines, which consisted in the peculiar manner in which the vellum or wire cloth is kept free from rags or pulp, in the various

stages of washing, and in which the egress of water is accomplished.

1834. A French inventor patented a mode of producing paper from the leaves of trees and the ligaments of asparagus. It was of no utility whatever.

1834. John Ames, of Springfield, Mass., invented an apparatus for cutting machine-paper into sheets of any required length, as it comes from the drying cylinders. He at the same time patented machinery for cutting or trimming paper in the ream, which was said to have been an old and well known contrivance.

1834. Writing paper was introduced in England, which, by means of a chemical operation it underwent, became perfectly black where it was touched with a fluid. On writing with a pen dipped in water, a legible character was produced.

1834. Joseph Truman, of Bridgeport, Pa., conceived a mode of preventing the fibres, in the manufacture of paper, from arranging themselves in one direction, as they were inclined to do. He did not seem to know what had already been done to obviate that difficulty by the *agitator*.

1834. A book was published this year in Sweden, the paper of which was made entirely of beet root. The paper was strong and durable, but not of a fine texture, nor white in appearance. Paper was also manufactured in that country at the same time, of husks and of Russia matting.

1834. There were about a dozen paper machines in operation in France at this time, mostly constructed in England. They were henceforth to afford the only mode of manufacturing paper which could be pursued without loss; before which the ancient system of hand-work was rapidly to disappear.

1835. Paper was made in Ireland from peat, but was of inferior quality.

1835. Hayti exported 31,192 pounds of rags.

1835. William Debit, of Hartford, Ct., improved the common duster by a combination with it of a shaft and knives and beaters.

1835. The Thibetans had a process of reworking old paper made from the bark of the *Sultarua*, which, however, was inferior to the paper of the Hindoos, made of the same material.

1835. John Ames, of Springfield, Mass., took out a patent for an improvement in the machinery for manufacturing paper, which seems to have been the manner of applying a drying cylinder to the machines in use.

1835. The quantity of paper manufactured in England was 70,655,287 pounds, on which the government duty was £838,822.

1835. The royal printing office at Paris consumed about three hundred reams of paper a day, nearly a hundred thousand reams a year.

1835. There were 750 paper-mills in operation in England, and the annual value of paper manufactured is stated by McCulloch as high as \$6,000,000. Paper was burdened with an excise duty amounting to more than three times as much as the total wages of the workmen employed in making it, and the quantity annually produced did not exceed 50,000,000 pounds of first class, and 16,000,000 of second class paper, requiring a supply of about 100,000,000 pounds of rags.

1836. James Brown, of Esk Mills, near Edinburgh, adopted a new contrivance for rarefying the air under the web of the paper-machine, by using a rectangular box transversely beneath the horizontal wire-cloth without the interposition of any perforated covering.

1836. Robert Rose's administrator, of East Hartford, Ct., patented an improvement in the paper machine, which consisted of a mode of sustaining the web of wire in a slanting position, so as to form the end and in part the bottom of the vat containing the stuff, which by draining through the web was properly deposited on the web for the formation of the paper.

1836. The quantity of paper charged with duties of excise in the United Kingdom was 82,145,287 pounds, and 8,032,577 yards of paper-hangings. The amount of duty was £812,782.

1837. Edmund Shaw, of London, claimed to have made an improvement in the manufacture of paper, by the application of a certain vegetable substance not before used for that purpose. This was none other than the husks and stalks of Indian corn. He was aware that some attempts had been made to produce paper from these materials, and also that they were abandoned because of the failure to produce good white paper from them.

1837. John Ames, of Springfield, Mass., patented a machine for sizing paper, without the use of feltings or jackets.

1838. The gross amount of paper-duty in Great Britain for the year, ending on the 5th January, was £554,497.

1838. J. V. Degrand, of London, obtained a patent for a certain pulpy product or material for manufacturing paper and pasteboard. He claimed to use only white woods, such as poplars, and excluded every possible bark or epidermis.

1838. Homer Holland, of Westfield, Mass., obtained a patent for preparing the fibrous portion of corn husks, so as to be a suitable base for paper. His patent was for a process of macerating the husks in a solution of carbonated alkali, and then rendering the alkali caustic

by adding the hydrate of lime, leaving the fibre strong and capable of being perfectly bleached.

1838. M. De Breza, of Paris, invented a chemical compound for rendering paper and other substances indestructible by fire, and for preserving them from the ravages of insects.

1838. The quantity of paper imported into the United States during this year was \$164,179; the quantity exported \$94,335. The import of rags was \$465,448.

1839. The import of paper into the United States amounted to \$186,418; the export was \$80,146. The import of rags was \$588,318.

1839. Henry Crosby of London, obtained a patent for manufacturing paper from refuse tan (after it had been used for tanning, or any other purpose in which the fibre had not been destroyed), and hops. The latter substance was only used in combination with the tan (a species of bark) when it retained its fibre. These substances, when combined, were treated the same as rags. The claim of the invention was to the combination and products.

1839. Mr. T. B. Crompton, of England, succeeded in producing a uniform rarefaction under the wire-cloth of the paper-machine, by means of a fan.

1839. At the French exhibition of this year were specimens of paper made of the leaves of the banana tree and similar plants, but the experiments showed great waste in converting them into paper. With a view of reducing the cost of carriage by freeing the substances from foreign matter, M. Rocques established powerful works at Havana, to wash and convert them into pulp for the European markets; but even in this state the absolute necessity of strong bleaching caused a waste of more than one-third of the original weight.

1840. The number of paper-mills in England was computed to be 700; nearly 80 in Scotland, and an incon-

siderable number in Ireland. About 27,000 individuals were supposed to be engaged in the trade in the United Kingdom, producing about £1,200,000 worth of paper.

1840. Lagrange Bull, of Martinique, made known the invention of a paper pulp which was manufactured from the leaves of the banana tree.

1840. The quantity of paper imported by the United States this year was \$146,790; the export \$76,957. The import of rags was \$564,580.

1840. Nothing, says Dr. Ure, can place the advantage of the Fourdrinier machine in a stronger point of view than the fact of there being 280 of them now at work in the United Kingdom, making collectively 1600 miles of paper, of from four to five feet broad, every day: that they have lowered the price of paper fifty per cent, and that they have increased the revenue, directly and indirectly by a sum of probably £400,000 per annum.

1841. The rags used in the manufacture of writing paper in Great Britain were collected at home. But those used in the manufacture of the best printing paper were imported principally from Italy, Hamburg, and the Austrian States, by the way of Trieste.

1841. The United States imported paper this year to the amount of \$60,193; and of rags \$496,227. The export of paper was \$83,483.

1842. Es gingen zwar noch ungefähr 10,000 Ctr. aller Gattungen, ganz abgesehen von den Papiertapeten, welche das Ausland noch zum grossen Theil liefert, ein, besonders nach Sachsen und Schlesien aus Böhmen, nach Baden aus der Schweiz, dafür aber auch über 12,000 Ctr. wieder aus.

1842. Der Zollverein besass 950 Fabriken für Papier, worunter mindestens 50 für Maschinenpapier; die Totalproduction ist, da alle Anhalte fehlen, schwer zu berechnen, steigt aber alle Jahre, ohne der Consumption vorauszuzeilen.

1842. The United States imported paper to the amount of \$92,771; and \$468,230 of rags. The export of paper was \$69,862.

1842. There were 356 paper machines employed in the mills of Great Britain and Ireland, having 372 vats.

1843. James Phelps, of West Sutton, Mass., made improvements in the washing machine, which consisted of an adjustable, rotating water elevator and strainer, which could be raised or lowered in the vat of the washing or beating engine. Also a rotating prismatic screen, or strainer, for straining the water from the paper-stock, in the vat of a washing or beating engine, in combination with devices for discharging the strained water, being not only more efficient than a cylindrical screen, but also admitting of more ready repair.

1843. The number of machines employed in the paper-mills of England, Ireland and Scotland, was 367, requiring 362 vats.

1843. The United States imported paper to the amount of \$19,997; and exported \$51,391; the import of rags \$79,853: a great diminution in the annual business of these articles, owing to the enforcement of a new duty upon rags, which affected the paper trade also.

1843. The English, although they made a sufficient quantity of most sorts of paper for their own use, and exported annually about £100,000 worth of books, still continued to import certain descriptions of paper for engravings, from France, and a small supply of paper-hangings; the duty on both of which amounted to about £2800 a year.

1844. There were 600 paper-mills in operation in the United States, giving active use to a capital of \$16,000,000, manufacturing at least a sum equal to its capital per annum, and affording maintenance to at least 50,000 persons.

1844. The amount of paper imported into the United States was \$104,648, and of rags \$295,586. The export of paper was \$83,108.

1844. The paper-mills of England, Scotland and Ireland employed 370 machines, and 359 vats.

1844. The German Zollverein imported annually about 8000 thalers worth of gray blotting and packing paper, and exported papers of finer qualities, to the amount of more than 256,000 thalers.

1845. The quantity of rags consumed in the United States was estimated to amount to \$6,000,000.

1845. There were 89 paper mills in Massachusetts which consumed annually 15,886 tons of stock, producing 607,175 reams of paper, valued at 1,750,200, and employing 1369 workmen.

1845. The amount of paper imported into the United States was \$98,000; the export \$106,190. The import of rags amounted to \$421,080.

1845. The number of paper-mills in Austria having machines was 40; the number working by the old process was 940. The total product was 314,000 quintals, selling at an average of 13 cents a pound. The number of persons employed was 12,000, besides rag sorters.

1845. R. A. Brooman, of London, obtained a patent for producing paper from gutta percha, and an intermixture of other substances. The fibre of the gutta percha tree is said to be very strong.

1846. The import of paper into the United States this year was \$194,220; of rags \$385,397, being 3.89 cts per pound. The export of paper was \$122,597.

1846. The Thuringian States of Germany had 41 paper-mills, with 53 vats, and employing 274 persons.

1746. E. F. Vidocq, of Paris, secured a patent for obtaining paper, by the usual process, from a combina-

tion of leather cuttings, scraps, &c., hemp, cotton, wool, oakum, and other substances.

1846. There were in Prussia 394 paper-mills, employing 6,393 workmen, and having 503 vats and 72 paper-machines.

1846. Bavaria had 176 paper-mills, with 257 vats and 11 machines, giving employment to 1884 workmen.

1846. The number of paper-mills in Saxony was 66, having 68 vats, and 6 machines, giving employment to 997 workmen.

1846. There were in the Grand Duchy of Hesse 21 paper-mills, employing 170 workmen; having 18 vats and 1 paper-machine.

1846. The Electorate of Hesse, belonging to the Zollverein, had 28 paper-mills, having 39 vats and 6 machines, giving employment to 299 workmen.

1846. Baden in Germany had 32 paper-mills, having 33 vats and 14 machines, and employing 624 workmen.

1846. Nassau in Germany employed 196 persons in the manufacture of paper; having 27 mills, with 30 vats and 6 machines.

1846. The annual imports of paper by the German Zollverein was upwards of 9,000 Prussian dollars; the exports \$270,589. The exports were mostly fine papers, and the imports were of the coarser qualities.

1846. Genoa exported 1,178 tons of paper to Mexico, Spain and the Brazils.

1846. The quantity of rags imported into the United States from all countries was 9,837,706, of which 8,002,865 came from Italy. The aggregate value was \$385,397, or 3.89 per pound. (See p. 71.)

1846. The quantity of paper manufactured in Great Britain and Ireland was 127,412,482 lbs., of which 4,836,556 pounds were exported. The paper-mills of those countries employed 334 machines and 378 vats.

1847. The quantity of paper manufactured in Great Britain and Ireland was 121,965,315 lbs., of which 5,852,979 pounds were exported. This gave employment to 405 machines, with 373 vats.

1847. The paper-machine had been so universally introduced into all the new, as well as the old vat-mills in the United States, that there were now only two mills of any note engaged in making paper by hand, and those were employed in producing particular sorts, requiring great strength and firmness.

1847. Denmark imported about 300 tons of paper from Belgium, France and other countries.

1847. The Netherlands imported chiefly from Belgium and the Zollverein, 219 tons of paper valued at \$7,167.60. The importation of rags was 700 pounds only. The exportation of paper the same year was 148 tons; principally to Java. The exportation of rags was only 1200 pounds.

1847. There were 66 paper-mills in the kingdom of Saxony, with 6 machines, employing 992 persons. The exports and imports were trifling.

1847. The proprietors of the New Orleans *Bulletin* announced that they printed their paper on an article manufactured by themselves, at a mill in the third municipality, which they believed to be the only successful attempt to manufacture paper so far south.

1847. The quantity of paper manufactured in the United States at this time was computed at 18 millions of dollars in value per annum.

1847. Two paper-mills were erected in Georgia this year, an event which the editor of the *Savannah Republican* remarked that a few years before he despaired of living long enough to see.

1847. The quantity of rags imported into the United States this year was 8,154,886, of which 6,529,234 came

from Italy; the aggregate value was \$304,216, being 3.73 cents per pound; of paper \$195,571. The export of paper was \$88,731.

1847. The quantity of paper imported into Denmark this year was 334,000 kilogrammes, paying \$13,020 duties.

1848. The import of rags from Denmark was 53,290 pounds, amounting to \$1,614.

1848. The United States imported paper to the amount of \$415,668; and of rags \$626,607. The quantity imported from all countries was 17,014,587, of which 13,803,036 came from Italy; the average price per pound was 5.68 cents. The export of paper was \$78,507.

1848. The quantity of paper manufactured in Great Britain and Ireland was 121,820,229 lbs., of which 5,180,286 pounds were exported. The number of machines employed was 407, with 367 vats.

1848. Zenas M. Crane, of Dalton, Mass., obtained a patent for an improvement in machinery for cutting paper. Patents were also obtained for the same purpose by George L. Wright, of Springfield, Mass.; by Mark Wilder, of Peterborough, N. H.; by J. C. Kneeland and George M. Phelps, of Troy, N. Y.; and Alonzo Gilman, of Troy, N. Y.

1848. The importation of paper in Hamburg was of the estimated value of \$239,568.

1848. Leghorn exported rags and paper to the amount of 30,000 pounds, about half to England, and the other half to the United States.

1848. Sardinia produced paper which amounted in value to \$2,400,000, none of which was exported.

1848. Spain exported 140,000 reams of paper, to the following countries: Cuba, 94,000 reams; Chili, 16,000 reams; Porto Rico, 10,000 reams; to other countries, 20,000 reams.

1849. There were 74 paper-manufacturers in Belgium, employing 1893 persons; 22 steam engines of 254 horse power in the aggregate; 2 horse mills of 2 horses each; 68 water mills, and 7 wind mills. The United States imported paper to the amount of \$19,950 francs from Belgium.

1849. W. Brindly obtained a patent in England for a mode of rendering paper water-proof. This was accomplished by saturating the web of paper as it passed from the machine, with linseed oil, and subjecting it to a high temperature until dried, by which it was rendered impervious to water.

1849. Grimpe & Colas, of France, invented paper for bank notes, which was intended to defy fraud and forgery. A committee of the Academy of Science had encouraged rival artists to make all possible experiments to test the infallibility of the paper, and no effort was spared to the accomplishment of that end, but without avail.

1849. An Englishman invented a method of splitting paper. The Bank of England sent him a one pound note, much worn, to test his skill. He returned it in two sections.

1849. The United States imported paper this year to the amount of \$395,773; and of rags \$524,755. The quantity imported from Italy was 11,009,668; the aggregate quantity brought from all countries was 14,941,236, at an average of 2.51. The exports were \$86,827.

1849. The export of paper from Belgium amounted to £36,040.

1849. France exported paper-hangings to the United States, to the amount of 214,000 lbs.; and imported upwards of 1,620,000 pounds of rags. The total export of paper was over 9,250,000 pounds.

1849. Messrs. Chambers, of Edinburgh, petitioned parliament for a removal or reduction of the excise duty on paper, which was especially severe on low-priced books.

1849. The importations of rags and other materials into Belgium for the manufacture of paper, amounted to only $14\frac{1}{2}$ tons. Their exportations of paper were about \$12,000.

1849. Amos & Clarke obtained a patent in England for a strainer used in the paper machine.

1849. The quantity of paper manufactured in Great Britain and Ireland was 132,132,660 pounds, of which 5,966,319 pounds were exported.

1849. Messrs. Amos & Clarke, of England, patented a paper-cutting machine, which obviated the difficulty that grew out of the increased velocity of the machines, by which the sheets were cut into irregular lengths.

1849. The number of paper-machines employed in the mills of England, Scotland and Ireland, was 406, with 353 vats

1849. The exports of rags during this year from Trieste to the United States were \$9,656.

1850. The German Zollverein consumed over 1,180,000 cwts. of rags annually, in the manufacture of paper; employing 794 paper-mills, having 116 paper-machines, producing annually about 36,964 tons of paper.

1850. Henry Pohl, of Paterson, N. J., improved the regulator, or pulp meter, to measure the quantity of pulp for webs of different thicknesses.

1850. Specimens of paper were made in Algiers from the dwarf palm, which abounds in that country, and of which it was thought that four millions of quintals could be obtained every year, by causing it to be gathered by women and children, at a cost of about 18

cents a hundred pounds; which if beat into half stuff in its green state, would yield 36 per cent of its weight; and dry, 50 per cent: and that two hours beating would be sufficient to render this half stuff fit for making fine paper.

1850. M. Didot stated that there were 200 paper-machines in France, producing 195 tons each per year, making a total of 39,000 tons; and 250 vats, producing over 2,000 more tons per year; being a gross amount of 41,000 tons, of all the kinds of paper. A paper-machine occupied about 60 persons, and a vat 10.

1850. The export of paper and stationery from the United States to foreign countries was not less than a hundred thousand dollars.

1850. The number of paper-mills in England was 327; in Scotland, 51; in Ireland, 37. The number of beating engines in England was 1,374; in Scotland, 286; in Ireland 86. The number of machines employed was 412, with 344 vats.

1850. A German named Evert, owning a large manufactory in Neustadt Elberwald, invented an incombustible and impermeable paper, which he termed stone paper, suitable for roofing houses, not easily broken, and capable of being produced at a low price.

1850. The amount of capital employed in the manufacture of paper in the United States was estimated at 18 millions of dollars; the annual product of paper, 17 millions; the number of mills, 700; the number of operatives employed, 100,000.

1850. The quantity of paper charged with excise duty manufactured in Great Britain and Ireland, was 141,032,474 pounds.

1850. The amount of duty paid on paper in England was £693,741; in Scotland, £187,687; in Ireland, £44,096.

1850. The quantity of paper manufactured in Great Britain and Ireland was 141,032,674 pounds, of which 7,762,686 pounds were exported.

1850. Great Britain imported 8,124 tons of rags, among which were 32 tons from the United States, and 23 tons from Egypt.

1850. The United States imported rags from nineteen countries. The quantity imported was 20,696,875 pounds at 3·61 cents a pound. Of these 15,861,266 pounds came from Italian and Austrian ports. The total value was \$748,707. Paper was imported to the amount of \$496,563.

1851. The quantity of paper manufactured in Great Britain and Ireland was 150,903,543 pounds, of which 8,305,590 pounds were exported. The number of machines employed in those countries was 413, with 330 vats.

1851. The United States imported rags of the value of \$903,747, at 3·46 cents a pound. Of the 26,094,701 pounds imported, 18,512,673 were from Italy.

1851. There was exhibited at the World's fair in London, a roll of paper, being a continuous sheet 2500 yards long.

1851. The export of paper and stationery from the United States was to the amount of \$155,664 for the year ending June 30.

1851. It was estimated that there were produced at this time in Great Britain, 5,500,000 pieces of paper-hangings, valued at £400,000.

1851. In the kingdom of the Two Sicilies there were 12 paper-machines, and 12 vats, employing 300 persons. The whole produce amounted to 306 tons annually, and paper was exported to Rome, Sicily, Leghorn, Malta, the Ionian Isles, and Greece.

1851. Messrs. Donkin & Co., of England, who per-

fectcd the Fourdrinier paper-machine, constructed their 191st machine. Of these 83 were made for Great Britain, 23 for France, 46 for Germany, 22 for the north of Europe, 14 for Italy and the south of Europe, 2 for America, and 1 for India. It was Mr. Bryan Donkin, who, as engineer, carried out the desired plans in perfecting the Fourdrinier machine, and produced, after intense application, a self-acting model, of which he afterwards constructed so many for home use and for exportation, which were perfectly successful in the manufacture of continuous paper.

1851. The quantity of paper produced in Austria was stated at 650,000 cwts. per annum. There were 900 vat-mills, and 49 mills using machines; two-fifths of the product of paper was from the latter, which were chiefly driven by water-power.

1851. Brewer & Smith, who had made improvements in paper-moulds in England, patented the same in the United States.

1851. The paper-mill belonging to the Goodman Manufacturing Company, at South Hadley, Mass., was destroyed by fire. The company had failed a short time before, involving a loss of \$20,000.

1851. There were 6 paper-machines in operation in Denmark, besides one in Holstein, and 20 vats, producing altogether about 1,312 tons per year.

851. There were five paper-mills employing seven machines, in Sweden, and eight vat-mills.

1851. There were 17 paper-machines in operation in Spain, which were imported from England, France, and Belgium; also 250 vats. The annual produce of paper is 4,741 tons.

1851. There were 12 paper-machines and 60 vats in the kingdom of Sardinia.

1851. There were 20 paper-mills in Tuscany, and 2 English machines at the mill near Florence.

1851. In Switzerland there were 26 paper-machines and 40 vat-mills, producing together annually 11,607 tons. The wages of the men are about 16 cents a day, and the women about 11 cents. No paper was exported.

1851. There were 6 paper-machines distributed among four mills in the Lombardo-Venetian kingdom of Italy.

1851. There were three paper-machines in operation in the Roman states.

1851. There was a paper-mill at Smyrna, having a machine, and a vat-mill at Constantinople, which was all the Turkish empire proper afforded.

1851. There was a paper-mill in Egypt, at Boulae, near Cairo, which was a vat-mill.

1851. There were 13 paper manufacturing companies in Lee, Mass., running 25 mills, and producing at the rate of about 25,000 pounds of paper per day, valued at \$6,300, or two millions a year.

1851. George West, of Tyngham, Mass., invented an improvement in the pulp strainer, which consisted of a better separator of the impurities by a strainer, operated upon by a bellows.

1852. The quantity of paper manufactured in Great Britain and Ireland was 154,469,211 pounds, valued at two millions sterling, of which 7,328,886 pounds were exported.

1852. The number of paper-mills at work in England was 304; in Scotland, 48; in Ireland 28; total 380. There were 1616 beating engines at work, and 130 silent.

1852. Sharp's *Gazetteer* states the number of paper-mills to have been 800, employing 30,000 workmen; but the *Jury Report* of the London Exhibition of Industry,

gives the number of mills as being only 415, including England, Scotland, and Ireland; some of them were idle.

1852. J. Mansell, of London, patented a mode of ornamenting paper, which consisted of imparting to it a resemblance to plain damask weaving, by passing it between plates.

1852. Jean A. Farina, of Paris, obtained a pulp for the manufacture of paper from the plant called *spartum*, or waterbroom, using both the stalks and roots.

1852. Joseph Kingsland, of Saugerties, and Norman White, of New York, patented an improvement in the mode of drying sized paper.

1852. There were exported from Cape Haytien during this year, 1436 pounds of rags.

1852. G. W. Turner, of London, improved the paper-machine by the application of the endless wire web in combination with and passing round the cylinder, and taking the pulp up from the vat, carrying it forward and submitting it to the action of the dandy roller and pneumatic trough, taking the place of the fixed wire web and endless felt, in the cylinder machine, and the wire web upon which the pulp flows in the Fourdrinier machine. Also for a mode of passing the paper through a trough of size, between two endless felts, obtaining a uniform and thorough saturation.

1852. The export of paper from Germany was 40,000 quintals, a country which twenty years earlier imported largely.

1852. The prices of rags in England were:

For 1st quality 26s per cwt.

2d " 16s

3d " 11s 6d.

4h " 7s.

1852. The export of rags from England, had seldom

exceeded 500 tons a year, but this year no less than 2462 tons, mostly British and Irish, were exported.

1852. The United States imported rags from thirty-two countries, to the amount of 18,288,458 pounds, at 3.46 cents a pound, amounting to \$626,729. The consumption of paper was equal to that of England and France together. Of the supply of foreign rags 12,220,570 pounds came from Italy.

1852. The United States exported to foreign countries paper and stationery to the amount of \$119,535, during the year ending June 30.

1853. The value of rags imported into the United States from abroad for the year ending June 30, was \$982,837, the quantity being 22,766,000 lbs., at 4.31 cts. Of this quantity 2,666,000 lbs. were obtained in England. Italy was the greatest source of supply, the quantity furnished being 14,171,292 pounds. Rags were imported from 26 different countries.

1853. The value of paper and articles manufactured of it, imported into the United States for the year ending June 30, was \$602,659, exclusive of books.

1853. The export of paper and stationery from this country was \$122,212.

1853. The import of rags into Great Britain during this and the two preceding years averaged yearly 9,332 tons.

1853. The quantity of paper manufactured annually in Great Britain during the five years ending with this year, was 151,234,179; which was an increase of 114 per cent in twenty years, while the whole population in that period had increased not more than 16 per cent.

1853. It was estimated that in France about 70,000 tons of paper were produced yearly; in England 66,000 tons; and that the production in this country was nearly equal to both France and England.

1853. France, with a population of 36,000,000 turned into paper annually 105,000 tons of rags, of which 6,000 tons were imported. Great Britain, with 28,000,000 population, required yearly 90,000 tons of rags, of which 15,000 were imported. The annual value of paper manufactured in Great Britain was estimated at \$17,760,000.

1853. Watt & Burgess patented in England a mode of producing paper from wood. The wood was first reduced to shavings or fine cuttings. They took out a patent for the same in the United States in the following year.

1853. Brown & McIntosh, of Aberdeen, invented hollow moulds, composed of perforated metal, wire, or other suitable material, covered with felt, within which, after their immersion in pulp, a partial vacuum is created, so as to cause the pulp to adhere or be deposited on the felt surface in a layer of uniform thickness.

1853. B. A. Lavender and Henry Lowe, of Baltimore, Md., produced samples of paper from southern canes, and from white pine shavings. They were sanguine that with proper apparatus, paper could be made of reeds, or wood, as the main staple, by their process, worth from $12\frac{1}{2}$ to 16 cents a pound, at a cost not exceeding $6\frac{1}{4}$ cents a pound.

1853. The quantity of paper manufactured in Great Britain and Ireland was 177,633,010 pounds, of which 13,296,874 pounds were exported. The imports of paper during the year was not far from 200,000 pounds; the consumption therefore was about 5.40 pounds *per capita* of the population.

1853. The value of paper imported into the city of New York was \$340,824.

1853. A German patented in England a machine for

manufacturing paper from wood. It planed and cut the wood into small particles and shavings preparatory to being acted upon by the engine. The inventor stated that paper was manufactured in the cheapest manner from fir, pine and willow trees.

1853. G. Stiff obtained a patent in England for forming paper by using lime water in place of the ordinary alkaline solution, in making paper of straw, grass, and other materials.

1853. The importation of paper into France did not exceed 337,104 pounds; the exports were 17,053,667 pounds. This gave 16,716,553 excess of exports. Deduct this amount from 156,800,000 pounds, the quantity manufactured, and we have left for consumption, 140,083,447 pounds, or 3.89 pounds *per capita* of the population.

1853. J. P. Conely, of Dayton, Ohio, patented an improvement for separating paper by single sheets.

1853. The paper imported into the city of New York was 3,418 packages, valued at \$860,628.

1854. A practical chemist exhibited in New York specimens of paper made entirely of straw, and others of grass, of a superior quality, which he asserted that he could produce for about half the cost of rag paper. He claimed the knowledge of a process for depriving straw of its silex, and other properties detrimental to the strength, opacity and pliability requisite in paper for general use.

1854. Samuel Nolan and Prof. Antisel announced the invention of a new paper-making machine, for the purpose of working a new material into paper, which should greatly reduce the high price to which paper had arisen.

1854. It was stated on the authority of the *Demarara*

Royal Gazette, that paper of a good quality had been successfully manufactured in that region from the plantain.

1854. M. Vivien, of Paris, attempted to convert leaves into a paper suitable for wrapping. The leaves were collected at a suitable season, and cut into small pieces and pressed into a kind of cake, which was afterwards steeped in lime water and reduced to pulp in the ordinary manner.

1854. The quantity of rags annually consumed in Great Britain and France combined was stated at 436,800,000, producing 291,200,000 pounds of paper, which was 4.55 pounds *per capita*; while the *per capita* of the United States was 10.80.

1854. The entire body of paper-makers in Holland, more than 160 in number, petitioned the government against the free export of rags, which they alleged would destroy their business, the neighboring states having prohibited such exports or charged them with high duties.

1854. M. Kelin, of Belgium, invented a process for converting straw into paper, which differed from any other in use. The straw was steeped in water sixty hours, when the liquid was run off and the straw washed with a plentiful supply of water. It was then flattened by being passed between two rollers while in a damp state, and afterwards cut into fibres of suitable length, and exposed to the sun's rays, until sufficiently bleached. It was now submitted to another steeping process, of three or four days and subjected to the action of a solution of hyper-chloride of potash or soda until the straw acquired a sufficient degree of whiteness, when it was put into the engine.

1854. T. G. Taylor patented a mode of manufacturing paper from the stalks of the hop plant, in England.

1854. John Evans also obtained a patent in the same country for a new manufacture of paper from Brazilian grass; and John Jeyes for the manufacture of paper from twitch or couch grass.

1854. S. G. Levis, of Delaware co., Penn., patented an improvement in the mode of making thick paper.

1854. Messrs. Cushman, of Amherst, Mass., patented an improvement for drying thick paper.

1854. E. L. Perkins, of Roxbury, Mass., obtained a patent for an improvement in polishing paper.

1854. E. Maniere obtained a patent in England for fire-proof paper. The invention consisted in applying asbestos to the manufacture of paper. The asbestos was rendered very fine and pulpy, and was mixed with the pulp of rags.

1854. A French paper-maker experimented with wood in the manufacture of paper. Having taken off the bark, the wood was cut into shavings, and the shavings, which were very thin, were placed in water six or eight days; then dried; then reduced to the finest powder possible. This was mixed with rag pulp and subjected to the ordinary process. All white woods, such as poplar, lime, and willow, were deemed suitable.

1854. A French paper-maker exhibited at the World's fair in New York, specimens of paper made of straw, which for whiteness, strength and beauty of finish appeared to be nearly equal to rag paper. It was manufactured by Coupier & Mellier, who patented the process in this country. Their success was superior to any of the 150 inventors who had patented as many different processes in England and France alone.

1854. The *Ledger*, a Philadelphia daily paper, having a very large circulation, perhaps 20,000 or 30,000 a day, was printed on paper made of straw, costing 9 cents a pound. It was a very inferior quality for the purpose.

1854. There were 6 paper-mills in North Carolina, consuming over 3 million pounds of stock.

1854. The quantity of paper manufactured in Great Britain, chargeable with excise duty, was 179,896,222 pounds, being an increase of more than a hundred million pounds in twenty years. Of this quantity the exports were 16,112,020 pounds. The estimated value of the paper manufactured was £2,000,000 sterling.

1854. There were 750 paper-mills in the United States, in active operation, having 3000 engines, and producing annually about 250 million pounds of paper, averaging about 10 cents a pound. This required 405 million pounds of rags, costing 4 cents a pound, for which our seamen have to scour every quarter of the globe. The cost of labor was estimated at $1\frac{3}{4}$ cents a pound; the cost of labor and stock united would be nearly 20 millions of dollars. The total cost of manufacturing \$27,000,000 worth of paper was supposed to be \$23,625,000.

1854. The annual consumption of rags in Great Britain was computed to exceed 120,000 tons, three-fourths of which were imported, principally from Italy and Germany.

1854. The imports of paper and its manufactures into the United States during the year ending June 30, amounted to \$757,829.

1854. The prices of rags in England were:

1st quality,	32s. to 34s.	per cwt.
2d	“	20s.
3d	“	15s.
4th	“	10s.

1854. The demand for paper in England affected the market in Jamaica so much that the two principal journals were compelled to reduce the size of their papers.

1854. The rise in the price of paper, $2\frac{1}{2}$ cents a pound,

obliged the publishers of cheap papers to increase their prices or reduce their sizes. Complaints of the price and scarcity of paper were universal. The *New York Tribune* was forced to go back to its former size. The *Journal of Commerce* said that it paid from forty to fifty thousand dollars a year for paper. The *New York Times* said that their bill for paper was sixty thousand dollars. The *Daily Evening Register* of Philadelphia was discontinued on account of the high price of paper. *The Sun*, the oldest of the New York penny papers was also reduced in size. Others put up their prices.

1854. George W. Beardslee, of Albany, made experiments with basswood, which resulted in obtaining a beautiful paper; the woody fibre was reduced to a pulp of fine whiteness, and the paper was soft and strong.

1854. A paper-manufacturer in Otsego county, N. Y., patented a mode of working the fibrous parts of swingle-tow into paper, in such a way as to produce a firm and very white article.

1854. By the reciprocity treaty with Great Britain, rags, the growth of the British North American colonies or of the United States, were to be admitted into each country, respectively, free of duty.

1854. R. & J. C. Martin secured a patent in England for obtaining a pulp from wood, by first saturating with water, planks and other pieces of wood, then subjecting their surfaces to a toothed cylinder, or other instrument having teeth resembling a saw or rasp; by which the wood was reduced to a suitable pulp.

1854. A patent was granted to Alexander Brown, in England, for the production of paper from the bracken or fern plants, of Scotland. Every part of the plant possesses strong fibres, producing a powerfully cohering pulp, requiring little or no sizing.

1854. James Sinclair patented in England the disco-

very of the use of thistles in the manufacture of paper, which had been known and experimented upon nearly a century.

1854. C. Hill manufactured paper in England from the stems and roots of horseradish, the rush and flag, and the vegetable remains of manures, which were bleached and reduced to pulp by the usual modes.

1854. The exports of paper and stationery from the United States is said to have been 187,325, and of books and maps, \$191,843.

1854. J. Lallemand, of Besançon, France, patented a mode of making paper from peat.

1854. The quantity of rags imported into the United States this year was 32,615,753, of which 24,240,999 pounds came from Italy. The total value of them was \$1,010,443, at 3.09 cents a pound.

1854. Herr von Parmewitz, inventor of a process of making wool from pine trees, presented to the king of Prussia specimens of paper made of the same material. Paper was also made of the red pine at Giersdorf, which was said to be so white and good as to be fit for writing or drawing, and needed no sizing because of its resinous quality.

1854. Obadiah Marland, of Boston, Mass., obtained a patent for an improvement in paper-making machines.

1854. Woodward & Bartlett, of Massachusetts, patented an improvement in the machines for cutting rags.

1854. The paper-mill at Little Falls, which was burnt in November, 1853, was rebuilt by Pease, Satterly & Co., with 3 engines and 62 inch machine, and is capable of making 1500 pounds a day; the power is one of the best in the state, and available for another engine; building lighted with gas, and warmed by steam; known as Phenix Mill.

The other mills at Little Falls are Pease, Satterly & Co's Island Mill, 2 engines of 500 lbs. capacity, and 62

inch machine, in which hanging and wrapping paper is manufactured. The print mill of S. M. & A. Richmond, 4 engines. Messrs. Page & Son's print mill, 6 engines. The Ligneous Paper Company's mill, 4 engines, for the manufacture of basswood. This mill is of a very superior construction, and intended for 12 engines and 2 machines.

1855. A specimen of paper manufactured from the common cane, the bamboo of the Mississippi river, was exhibited at St. Louis, and highly approved of.

1855. Watt & Burgess, of London, made elaborate experiments for the conversion of woody fibre into pulp. The wood was first boiled in caustic soda ley, and washed free from alkalies; it was then subjected to the action of chlorine, or an oxygenated compound of chlorine, and again washed to remove the hydrochloric acid, when the wood was again treated with caustic soda ley, and became immediately reduced to pulp; which being well washed and bleached was ready to be manufactured into paper. Paper of this material, it was claimed, would cost only £24 a ton, which if made of rags would cost £40.

1855. Henry Fourdrinier, surviving partner of the great firm engaged in the paper-manufacture, in England, died, aged 90. The Messrs. Fourdrinier exhausted a vast fortune in perfecting the paper-machine which bears their name, and died in poverty.

1855. J. N. Nevin, of Scotland, succeeded in fabricating rope and paper from the common garden hollyhock. It had the appearance and texture of such paper as was used for bags and parcels by grocers, and was very clean and firm.

1855. A French paper-hanger was engaged in producing a design requiring upwards of three thousand blocks, at a cost of \$10,000, the design alone costing \$6,000.

1855. The *London Economist* asserted that so great was the consumption of paper by the reading and writing population of Great Britain, that rags could not be procured in sufficient quantity to meet the demand.

1855. The paper-mill belonging to Messrs. Parker, at Westville New Haven, Conn., was destroyed by fire.

1855. The paper-mill of B. B. Bradley, at Niagara Falls, was destroyed by fire.

1855. James N. Kellogg, foreman of Dupont's paper-mill at Louisville, Ky., made experiments in manufacturing paper from undressed flax.

1855. The *Saratoga Whig* was printed on paper made principally of straw, by Messrs. Buchanan & Kilmer at Rock City. These manufacturers employed a French process of bleaching, and were successful in making printing and writing papers of good quality from three-fourths straw.

1855. An Englishman by the name of Watts patented a mode of producing paper from wood shavings and bran, which he expected would take the premium of £1000 offered by *The Times* for the discovery of a new material for the production of paper.

1855. The rise of one halfpenny a pound in the price of paper in England affected the public journals so much that the loss thereby sustained by the *The Times* alone, was upwards of \$10,000 per annum, inducing the proprietors of that journal to offer a reward of \$1000 for the discovery of a new and readily available material.

1855. The extensive paper-mill of Gaunt & Derrickson, at Trenton, N. J., was almost totally destroyed by fire. The loss was estimated at \$150,000.

1855. M. D. Whipple, of Charlestown, Mass., obtained a patent for preparing wood for paper-pulp.

1855. A paper-mill which had stood twenty years at Essex, Vt., was destroyed by fire, with its contents; loss \$12,000.

1855. George W. Beardslee, having made satisfactory experiments for the conversion of woody substances into paper, commenced the erection of a mill at Little Falls, N. Y., for the purpose of manufacturing paper of bass-wood and other ligneous substances.

1855. Improvements in machinery and mode of manufacture, and the application of steam, had reduced the number of mills in Great Britain and Ireland to 380, or nearly one-half, in twenty years; while the quantity of rags annually consumed had risen to 201,600,000 pounds, or over a hundred per cent.

1855. S. R. Andries, of Chamblee, Canada, exhibited paper made of *gnaphalie*, or life everlasting, which he claimed could be produced cheaper than any other substance for the purpose of being manufactured into paper.

1855. Horace W. Peaslee, of Malden Bridge, obtained a patent for a machine for washing paper stock.

1855. G. E. Simon obtained a patent in England for a mode of manufacturing paper from plants of the different species of the family *sparganium*.

1855. G. Martonoi patented in England a peculiar process for producing paper from seaweed.

1855. W. Barabee undertook the introduction of perfumes into the pulp of paper, which he thought of sufficient importance to secure by a patent, in England.

1855. The drawback on paper used in printing Bibles and Prayer Books in England, was £9958; in Scotland, £2088.

1855. The United States imported 40,013,516 pounds of rags, of which 23,948,612 came from Italy. The value of these rags was \$1,225,151, or very nearly 3.06 cts. a pound.

1855. The consumption of paper by *The Times* of London was nearly 9 tons a day; a quantity of paper which, the sheets being laid open and piled upon each other would rise to the height of fifty feet; so that the supply for eight days would exactly equal the height of St. Paul's Cathedral.

1855. Richard Herring published a work, in London, on ancient and modern paper and paper-making, with 25 specimens of paper, and an engraving of the paper-making machine.

1855. Henry Glynn, of Baltimore, Md., obtained a patent for an improvement in the manufacture of paper-pulp.

1855. Louis Koch, of New York city, patented an improvement in manufacturing paper-pulp.

1855. Charles H. Hall, of Portland, Me., made experiments with barks of trees, and succeeded in producing wrapping paper advantageously. He fitted up a mill at Waterville for the purpose of manufacturing on a large scale.

1855. The Kayaderoseros paper mill, near Ballston Spa, N. Y., erected in 1854, was stopt. It was designed for the manufacture of hanging paper, and had 4 engines of 500 pounds capacity, one of Gavit's 72 inch machines, revolving iron bleach, and all the modern machinery for staining, printing, and decorating in the highest style of the art, costing about \$85,000. It was altered in the following year, and put in operation with extensive improvements, by Messrs. Pease & Stone, who are engaged in manufacturing colored papers, and is capable of turning out 2,500 pounds a day.

Besides the mills on the same stream mentioned at page 91, there are Ingersoll's straw board mill, with 4 engines; Crane's tissue paper mill, 4 engines; and Buchanan's two mills, manufacturing chiefly manilla.

1855. The paper mill of C. & O. Clark, at Woodville, Jefferson county, N. Y., 4 engines, was burnt; loss \$12,000. It was rebuilt the next year, and furnished with 4 large engines, and a 62 inch machine, and turns out 1 ton of print a day.

1856. The New York Mercantile Library received a unique work on paper-manufactures, prepared by T. H. Saunders, of London, for the Paris exhibition. It contains a history of this department of industry, followed by specimens of the different varieties of hand and machine made paper, and of papers destined to special uses, as bank notes, checks, photographs. It is estimated that the work could not have cost less than a thousand dollars.

1856. Henry Lowe, of Baltimore county, Maryland, made an experiment with southern cane, and produced a creditable specimen of paper, which was used in printing the *Baltimore County Advocate*. His mill was employed exclusively in manufacturing wrapping paper.

1856. The sum of £9094 was paid in England for drawback of duty on paper used in printing Bibles, Testaments and Prayer Books, and £1200 in Scotland.

1856. The mills of the Chelsea Manufacturing Company at Norwich, Conn., supposed to be the largest in the United States, if not in the world, produced seven tons of paper in a day.

1856. The consumption of paper in the United States was computed to equal that of England and France together. Thus in France, with 35 millions of inhabitants, only 70,000 tons of paper are produced in a year, of which one-seventh is for exportation. In Great Britain, with 28 millions of inhabitants, only 66,000 tons are produced. While in the United States, young and but little advanced in manufactures, 200,000 tons are annually manufactured.

1856. The extensive paper-mills of Piersse & Brooks, at Windsor Locks, Conn., were burnt, involving a loss of \$75,000, two-thirds of which were insured.

1856. Edward Grantless, a marble cutter, of Glasgow, obtained a patent for a mode of making paper of stone!

1856. It was claimed that an excellent pulp for paper was obtained by subjecting to a newly invented process, the Scotch fern plant, the stems, stalks, and even the roots of which possessed a strong fibre, which was found to be peculiarly adapted to the manufacture of a powerfully cohering paper-pulp; that the plants might be used either green or dry, but the latter was preferable.

1856. It was estimated that if all the paper consumed in one year by the newspapers in the city of New York was put upon wagons, containing two tons each, they would form a procession thirty miles in length, requiring 6,000 wagons.

1856. Paper for wrapping purposes was made at a mill near Hagarstown, Md., from refuse leather scrapings about curriers' shops.

1856. Lasare Ochs, of Belgium, patented a mode of obtaining paper from cuttings, waste, and scraps of tanned leather. The scraps are placed in sieves on the ends of arms or spokes on a wheel, and are made to revolve in a stream of water, which operation, when continued long enough, washes out the tannin from the leather. After this about 20 per cent of old hemp rope is mixed and the whole is cut up and reduced to pulp, from which the paper is made. A very strong, coarse wrapping is the result.

1856. Wm. Clark, of Dayton, O., patented improvements in making paper of the bark of the cotton stalk. Instead of using lime or other alkalies, he boiled coal tar with the material used, in a peculiar manner.

1856. Francis Burke, of Montserrat, West Indies, invented a mode of preparing paper-pulp from the fibres of endogenous plants, without having recourse to the process of separating the fibrous matter from the other component parts of vegetable substances, which is described in the Wells's *Annual of Scientific Discovery* for 1857, p. 89.

1856. Pierre J. Davis, of Paris, patented an improvement in bleaching paper, which is described in the same work as the above. Also, H. Hodgkins, of Belfast, Ireland. *Ibid.*

1856. M. Didot, of Paris, patented a new method of bleaching paper-pulp. He immersed the pulp in a solution of bleaching liquor, made by saturating chloride of lime in water, and using the clear liquor, and then passes carbonic acid gas through it.

1856. Cowley & Sullivan, of England, patented a mode of bleaching straw pulp. The liquor (chlorine) is $1\frac{1}{2}$ to 2° in Twaddle's hygrometer, in strength; that a lower strength will not bleach the pulp, and a stronger liquor will injure it, and not produce so good a color. When the straw is undergoing bleaching, it is carefully watched, and as soon as it assumes a reddish color, just merging on the white, a jet of steam is cautiously let on and continued two hours, until the liquor has attained a blood heat, or 90° , which is kept up about two hours longer, when the straw will be completely bleached, and fit for the beating engine. Unless the steam is gradually introduced the color will not be good.

1856. P. H. Wait, of Sandy Hill, N. Y., patented an improvement in felt guides.

1856. J. Kingsland, Jr., of Franklin, N. J., patented an improvement in the engine for grinding pulp.

1856. Vespasian O. Balcom, of Bedford, Mass., obtained a patent for improvement in grinding paper-stock.

1856. The straw-paper mill of John R. Hoes, at Stuyvesant Falls, Columbia county, New York, was destroyed by fire, with all the stock and machinery. The loss was \$8,000, there being no insurance upon any part of it.

1856. The *Overland Mail*, published at Hong Kong, China, was printed on stout and heavy paper, of fine texture, made from the shavings of bamboo.

1856. There were twenty paper-mills with seventy-five engines in the town of Lee, Mass. These consumed 1,100,000 pounds of rags annually, and gave employment to 1000 people; the quantity of paper manufactured was 780,000 reams, worth \$1,300,000.

1856. Israel Kinsey, of Hohokus, N. J., patented an improvement in feeding pulp to machines.

1856. William Clark, of Dayton, Ohio, patented a mode of making paper from straw.

1856. July 31. The paper-mill of G. W. Ingalls, at Ballston Spa, was destroyed by fire. Loss \$20,000; insured \$12,000.

1856. An English manufacturer produced pasteboard from beet roots.

1856. Dr. Terry, of Detroit, experimented upon a species of moss obtained in the Lake Superior region, and obtained a beautiful white paper, without any peculiar process. The moss existed in great quantities, on Isle Royal and other localities, and could be procured at a very moderate cost.

1856. An unusual freshet occurred in the Kayaderosseras river, by which the paper-mills situated upon it suffered to great extent by the loss of their dams or damage to the mills and machinery.

1856. The *Syracuse Standard* boasted that its daily was printed on paper made of rags imported directly from the land of the Pharaohs, on the banks of the

Nile. These were said to have been stripped from the mummies.

1857. J. S. Blake, of Claremont, N. H., obtained a patent for an improvement in making paper.

1857. Messrs. Laffin Brothers disposed of their extensive paper-mill at Herkimer to a New York firm for \$70,000.

1857. A new mode of preparing straw for white paper, has been discovered, which is expected to become valuable; not yet published.

CONTENTS.

- Aberdeen, 83.
Acid neutralized, 62.
Adolphus, 13.
Agitator, 56, 65.
Albany Institute, 32.
 rags wanted, 30.
 Register, 32.
 scarcity of paper, 32.
Alcoi mills, 36.
Alexandria, 10.
Alga marina paper, 25.
Algiers, 76.
Allison & Hawkins, patent, 37.
Aloes for paper, 27.
Alsace mills, 38.
Alstead, N. H., 64.
Alum sizing, 51, 54.
America, machines, 79.
American booksellers' medal, 38.
 paper extraordinary, 44.
Ames, D. & J., mill, 49.
 John, patent, 61, 62, 65, 66, 67.
Amies, Joseph, 62.
 Thomas, 44.
Amos & Clarke, 76.
Anru, Joseph, 11.
Andalusia, rags, 23.
Anderson, 21.
Andries, S. R., 92.
Angoumois, 22, 33.
Animal substances for paper, 54.
Annonay, 48.
 Johannot d', 30
Antisel, Prof., 84.
Aphorisms of Hippocrates, 12.
Aporentype paper, 54.
Arabians made paper, 4, 11.
Arabic manuscripts, 12.
Arroche paper, 27.
Asbestos, 20, 86.
Asparagus paper, 65.
Aspen paper, 27, 58.
Austrian exports, 78.
 mills, 71, 79.
 rags, 69.
Babylonian bricks, 1.
Baden, mills, 72.
Bage, Robert, 37.
Bagford, John, 23.
Bagging paper, 60.
Bailey, Wm., 38.
Balcom, V. O., 96.
Balilliat, Pierre, patent, 51.
Ball, E. B., 45.
Ballston Spa, mill, 93, 97.
Baltimore, 39.
 Co. Advocate, 94.
 request tariff, 47.
Bamboo paper, 3, 90, 97.
Banana paper, 68, 69.
Bank-note paper, 75.
Barabee, W., 92.
Bark paper, 10, 26, 32, 37, 66, 90.
 of cotton stalk, 95.
Barley straw paper, 27.
Barratt, Thomas, patent, 59.
Bartolus, 15.
Basil manufactures, 138.
Baskerville, 25, 26.
Basle, mills at, 17.
Basswood paper, 7, 29, 34, 88,
 90, 92.
Bavarian mills, 72.
 peat paper, 27.
Beach, Moses Y., patent, 53.
Beardslee, G. W., 6, 88, 92.
Bedford, Mass., 96.
Beech paper, 27.
Beeswax used for sizing and glaz-
 ing, 54.
Beet root paper, 65, 97.
Belgium, 22, 73, 75, 76, 85, 95.
Benjamin, Nathan, 40.
Benington mill, 30, 32.

- Berlin, machine in, 46.
 Bern manufactures, 38.
 Bernadotte, patent, 54.
 Bibles crumbled, 44.
 Bibliotheca Americana, 32.
 Bigg's patent, 34.
 Birmingham, 37.
 Blake, Edmund, 64.
 J. S., 98.
 Blank, E. F. & T., patent, 58.
 Bleaching, mode of, 90, 96.
 new mode, 33, 34, 61.
 by chlorine, 29.
 with coal tar, 95.
 effects of excessive, 44, 64.
 Bluing paper, 33.
 Blue grass paper, 52.
 Bodleian specimen, 11.
 Bodoni, 17.
 Bohun, Edmund, 21.
 Bomeisler, Lewis, 55.
 Books destroyed by excessive
 bleaching, 64.
 Bookseller's medal, 38.
 Boston, 25.
 Boulae mill, 80.
 Boxmoot, 39.
 Bracken, paper from, 88.
 Bradford, Wm., 24.
 Bradley, B. B., 91.
 Bran, paper from, 91.
 Brand, M., experiments, 57.
 Brandywine, 46.
 Brad, C. P., patent, 54.
 Brattleboro, Vt., 59, 63.
 Brazil's imports, 72.
 Brazilian grass for paper, 86.
 Brewer, Henry, 62.
 Brewer & Smith, 79.
 Breza, M. de, 68.
 Bridgeport, Pa., 65.
 Brindley, W., 75.
 British excise, 34, 58.
 Museum, papyrus, 10.
 Merchant, 21.
 revenue from paper, 34, 58, 69.
 rags, 69.
 workmen, 69.
 Broken paper, 32.
 Bronx river mill, 48.
 Brooman, R. A., 71.
 Broom corn paper, 27.
 Brown, Alexander, 88.
 James, 66.
 & McIntosh, 83.
 Buchanan's mills, 93.
 Buchanan & Killmer, 91.
 Bull, Lagrange, 69.
 Bullen of plants for paper, 51.
 Bulls on cotton paper, 11.
 Burdock paper, 27, 31.
 Burke, Francis, 96.
 Burnely, Eustace, 21.
 Burton, of London, 35.
 Cabbage stump paper, 27.
 Caen, France, 43.
 Calendars, 60, 62.
 Campbell's patent, 33.
 Cane for paper, 83, 90, 94.
 Canandaigua mill, 46.
 Canson, M., 48, 50.
 Canson Brothers, patent, 50.
 Cape Haytien, 81.
 Carduris nutan's paper, 38.
 Carpets of paper, 40.
 Carvil, George, patent, 60.
 Case of paper traders, 22.
 Casiri, 11, 13.
 Cassim ben Hegi, 12.
 Cassiodorus, 10.
 Cast iron rollers, 60.
 Catacombs, papyrus in, 9.
 Catskill mill burnt, 40.
 Chambers, Messrs., 76.
 Chambersburgh, Pa., 52, 57.
 Chamblee, Canada, 92.
 Characteristics of paper, 20.
 Charles IX, 19.
 Charta bombacine, 11.
 Chatiangay mill, 38.
 Chelsea Manuf. Co., 94.
 Chemical substance for rags, 51.
 Chester creek mill, 23.
 Chili, imports, 74.
 Chinese, 11.
 paper, 3, 6.
 Chittenden George, 43.
 Chlorine, 29, 61.
 Christian III, 50.
 Christina of Sweden, 20.
 Churchyard's notice of Spilman, 91.
 Claremont, 98.
 Clark, C. & O., 94.
 William, 95, 97.
 Clavio, Julio, 18.
 Clematite paper, 27.
 Clum, abbot of, 12.
 Coal tar for bleaching, 95.
 Cobb, Thomas, patent, 56.
 Cobbett's corn, 54.
 Colle, mills at, 17.
 Collier, E. H. patent, 53.
 Colored papers, 93.
 Color, mode of extracting, 54, 60.

- Colors, peculiar, 29.
 Colored rag paper, 60.
 Coloring pulp, 33, 37, 56.
 Colquhoun, Dr. 43.
 Coltsfoot paper, 31.
 Columbia county mill, 35, 43.
 Conferva paper, 27, 31.
 Congress use foreign paper, 47, 48.
 Conly, J. P., 84.
 Connecticut, first mill, 27, 28.
 mills, 42.
 supplied, 29.
 Constantinople mill, 80.
 Continental army, 29.
 Continuous paper, 78, 79.
 Cooper, John W., patent, 54.
 Copper plate paper, 32.
 Corbeil, 17.
 Corn stalk paper, 67.
 Cortusius, 15.
 Cost of manufacturing, 87.
 Cotton du peuplier, 27.
 plants, 5.
 stalks, 95.
 paper, 2, 3, 4, 5, 11, 12, 14,
 15, 16, 60.
 abolished, 13.
 superseded papyrus, 2.
 used by Greeks, 5.
 Cottonian library specimen, 15.
 Couch grass paper, 31, 80.
 Couplier & Mellier, 86.
 Covering buildings, 63.
 Cowper, Prof., patent, 53.
 Cowley & Sullivan, 96.
 Crane, Z. M., 74.
 Crawford Messenger, 58.
 Crompton, T. B., patent, 53, 68.
 for drying, 47, 50.
 & Miller, 53.
 & Taylor, patent, 52.
 Crosby, Henry, patent, 68.
 Crane's mill, 93.
 Culver & Cole, 56.
 Cuba, imports, 74.
 Cunningham's patent, 34.
 Cushman, Messrs., 86.
 Cutting machine, 48, 52, 53, 54,
 74, 76.
 Cutting paper in the ream, 65.
 Cylinder machine improved, 41,
 55, 59, 66.
 adopted in France, 50.
 Daily Evening Register, 88,
 Dandy, 59.
 Dartford mill, 16.
 Davy Henry, patent, 63.
 Dalton, Mass. 74.
 Davis, Pierre J., 96.
 Dayton, O. 84, 97.
 Declaration of Independence, 44
 Debit, William, patent, 54, 66.
 Dedham, Mass., 63.
 Degrand, J. V., patent, 67.
 Delaware mills, 42.
 product, 28.
 Delcambre's sizing, 51.
 Demarets, 28.
 Demarara paper, 85.
 Denmark, 46.
 first machine, 50.
 imports, 5, 20, 73, 74.
 Desetable, Gabriel, 43.
 Devaux, Benj., patent, 51.
 Dickinson's machine, 41.
 John, patent, 54, 59.
 George, patent, 52.
 Didot, 30, 34, 36, 38, 39, 42,
 77, 96.
 Firmin, 50, 51.
 Roger, patent, 45.
 Donkin, Bryan, 38, 39, 53.
 Messrs., 50, 79.
 Double paper, 53, 59.
 Drawback, 92, 94.
 Dresden, 22.
 mill visited by Peter the
 Great, 6.
 Drying cylinder, 66.
 in lofts, 46.
 thick paper, 86.
 process, 47, 50, 81.
 Du Cange, 16.
 Du Halle, 10.
 Dupont's mill, 91.
 Duster improved, 66.
 Dwarf palm for paper, 76.
 East Hartford mill, 29, 67.
 Edinburgh mills, 30.
 Edrisi, 12.
 Egyptian mill, 80.
 rags, 97.
 Elm tree paper, 31.
 Elizabethtown, 24.
 Embossing process, 57.
 Endogenous plants for paper, 95.
 Endless web produced, 34.
 Engines introduced, 25.
 improved, 96.
 England used parchment, 14.
 decay of trade, 23.
 No. of mills, 66, 68.
 art improved in, 6.
 imports paper, 20, 21.

- England, imports from France, 5, 20, 21, 70.
 linen paper supplanted cotton, 5.
 excise, 30, 35, 36, 56, 62, 66.
 (See *Great Britain*.)
 manufacture, 21.
 paper mill, first, 18, 19.
 paper scarce, 21.
 English paper mills, 18, 19, 22, 26, 92.
 workmen depressed, 22.
 product, 22, 24, 30.
 consumption for cheap works, 22.
 Erigerone paper, 38.
 Escorial specimens, 13.
 Esk mills, 66.
 Essex mill burnt, 92.
 Esperance mill burnt, 48.
 Essonne, 15, 17, 34.
 Eustathius, 13.
 Europe machines, 79.
 Evans, John, 86.
 Oliver, 44.
 Evert, Mr., 77.
 Excise (see imports.)
 Fabriano mill, 15, 17.
 Fairchild, Reuben, patent, 55.
 Fairhaven mill, 34.
 Falls creek mill, 63.
 Fan for rarefaction, 68.
 Farina, J. A. 81.
 Felt cleaner, 63.
 Felt guides improved, 96.
 Feltings dispensed with, 67.
 Fen Ditton mill, 19.
 Ferns, paper from, 88, 95.
 Finishing, 51, 60, 62.
 Finsley invented ivory paper, 46.
 Fir for paper, 84.
 Fire proof paper, 86.
 Firmus, 10.
 Fladd, John Daniel, 15.
 Flax undressed for paper, 13, 37, 91.
 Flag leaves for paper, 55, 89.
 Floss silk paper, 45.
 Florence mill, 80.
 Fools cap, 18.
 Forgery preventer, 75.
 Formosa, 39.
 Foster, Samuel, 62.
 Foster, Samuel E., 63.
 Fourdrinier, E. N., 61.
 Henry, died, 90.
 H. & S. 30, 40, 41.
 Fourdrinier machine, 42, 44, 46, 48, 50, 52, 56, 59, 69, 79, 81.
 speed of, 40.
 France, ancient paper, 14.
 art introduced, 15.
 exports, 6, 20, 21, 22, 25, 38, 63, 73, 75, 84, 94.
 exports rags, 37.
 flourishing state of the art in, 5, 20, 22.
 first machine, 44.
 imports, 15, 19, 20, 84.
 largest mill, 34.
 No. mills, 22, 37.
 No. machines, 65.
 product, 82, 83, 94.
 uses English machines, 48.
 Franklin, Benj. 23.
 N. J., 96.
 French paper makers, 56.
 machine, 44, 56, 76, 79.
 academy, 28, 30, 75.
 experiments, 29.
 paper merchants, 48.
 refugee paper makers, 21.
 sizing, 51.
 Thomas, patent, 62.
 Frederic II, of Germany, 13.
 Fredericksburg, 50.
 Fredonia, 55.
 Frejus, 54.
 Fry, Richard, 25.
 Freshet, damages by, 97.
 Fuller, 20.
 Gamble, John, 36, 38, 41.
 Garde Count de la, patent, 51.
 Gavits' machine, 93.
 Gaunt & Derrick, 91.
 Gelatine sizing, 51.
 Genoese export, 23, 72.
 Georgia mills, 73.
 German exports, 20, 81.
 imports, 5, 20, 38, 62.
 paper deteriorated, 33.
 water mills, 28.
 work with specimens, 28.
 Germany, art introduced, 16.
 first mill in, 17.
 linen paper in, 13.
 machines, 79.
 No. mills, 31, 36. [5.
 paper introduced from Venice,
 product, 31, 36.
 used parchment, 14.
 Giersdorf, red pine, 89.
 Gilman, Alonzo, 74.
 Gilpin, Thomas, patent, 59.

- Gilpin, Thos. & Co., 45, 46.
 mill burnt, 49.
 Glazing, introduced, 45.
 Glynn, Henry, 93.
 Gnaphalie paper, 92.
 Goat skins, 9.
 Gottingen royal society, 15, 26, 27.
 Goodman, Manuf. Co., 79.
 Goncher, Francis, patent, 61.
 Goumar, M., medal to, 62.
 Grass paper, 84, 89.
 Grape vine paper, 27.
 Grantless, Edward, 95.
 Great Britain exports, 87.
 product, 24, 43, 64, 72, 73, 74,
 76, 77, 78, 80, 82, 83, 87, 94.
 imports, 67, 74, 78, 83.
 excise, 87.
 consumption of rags, 38, 87, 92.
 No. mills reduced, 80, 92.
 machines used in, 69, 70, 71,
 72, 73, 74, 76, 79.
 (See *England*.)
 Greaves, Mr., 32.
 Greece, imports, 78.
 Greeks used cotton paper, 5.
 Greek parchment, 5, 16.
 Green paper, 46.
 Grimpe & Colas, 75.
 Grinding, improvement, 96.
 Guarro, Francisco, 36.
 Guettard's experiments, 26.
 Gutenberg's Bibles, 17.
 Gutermann, 32.
 Gutta percha paper, 71.
 Guy, Francis, 39.
 Haddock, Marsden, patent, 54.
 Hagarstown mill, 95.
 Hall, Chas. H., 93.
 John, patent, 59.
 Hamburg, imports, 30, 74.
 No. mills, 30.
 rags, 69.
 Hand paper, 18.
 superseded, 65.
 process, 39, 44.
 improved, 54.
 mill, ancient, 23.
 in Austria, 71.
 abolished, 73.
 Hartford, Ct., 66.
 press supplied, 29.
 England, 18.
 Hartzberg, Ewald von, 30.
 Havana works, 68.
 Hay paper, 52, 56.
 Hayti exported rags, 66.
 Heath, Mr., 45.
 Hemp paper, 13, 27, 36, 37, 49,
 50, 51.
 Hempen rag paper, 3, 4, 10.
 Henchman, Daniel, 24.
 Henry VI, 18.
 VIII, water mark, 18.
 Herodotus on parchment, 9.
 Herculaneum, 10.
 Herring, Richard, 93.
 Hesse, grand duchy mills, 72.
 electoral mills, 72.
 Herkimer mills sold, 98.
 Hippocrates, 12.
 Hill, C., 89.
 Hindoo paper, 66.
 Hodgkins, H., 96.
 Hoes, J. R., 97.
 Hog dispensed with, 61.
 Hohokus, 97.
 Holland, art improved in, 6.
 exports, 20.
 Homer, patent, 67.
 imports from France, 5, 20, 24.
 paper makers, 85.
 invents engines, 25.
 paper, reputation of, 28, 30.
 No. of mills, 28.
 Hollyhock paper, 90.
 Holstein, machines, 79.
 Homer, 32.
 Hong Kong paper, 97.
 Hooper, Samuel, 32, 33.
 Hop stalks for paper, 68, 85.
 vine paper, 27, 31, 49.
 Horizontal whirl wheel, 55.
 Hornet's nests, 27.
 Horse mills, 75.
 Horseradish paper, 89.
 Howland & Gilswold, patent, 64.
 Hunting, Mason, patent, 54.
 Husk paper, 37, 54, 55, 65, 67.
 Hutton, Wm., 26, 37.
 Huyeron, M., 46.
 Ibotson, Richard, 58.
 rod-strainer, improved, 62.
 Impermeable paper, 77.
 Imposts, 62, 87.
 on American paper, 45.
 in England, 22, 56, 66.
 in France, 19, 20.
 in Great Britain, 76, 77, 78.
 in Massachusetts, 31.
 on foreign books, 48.
 on rags, 58.
 paper, 58.
 Improvements in 1802, 37.

- Incombustible paper, 77.
 Indestructible paper, 68.
 India, machines, 79.
 Industrial fair, 78.
 Ingersoll's mill, 93.
 Ingales, J. W., 97.
 Ink extracted, 31, 37.
 Insects, protection against, 68.
 Intestines of animals for writing upon, 1.
 Ionians used parchment, 9.
 islands, imports, 78.
 Ireland, 66.
 mills in, 69.
 No. of paper makers, 61.
 product, 73, 74, 76, 80.
 Island mill, 89.
 Isle Royal moss, 97.
 Italian workmen imprisoned, 17.
 Italy, exports, 20, 75, 78, 82.
 machines, 79.
 manufactures in, 15, 16.
 rags from, 69, 89, 92.
 Ithaca, N. Y., 62.
 Ivory plates for writing upon, 1.
 paper, 46.
 Jackets dispensed with, 67.
 Jamaica, 87.
 Japanese, 25.
 mode, 3, 49.
 Jaquier, J. J., patent, 60.
 Jaraslow mill, 35.
 Jarvis & French, 62.
 Java, imports, 73.
 Jeanbeaurt, M., patent, 47.
 Joyes, John, 86.
 Johannot, d'Ammonay, 30.
 Journal of Commerce, 62, 88.
 Jullien, M., patent, 56.
 Junk paper, 60.
 Jury Report, 80.
 Kayaderoseras, 93, 97.
 Kelin, M., 85.
 Kellogg, James N., 91.
 Kentucky mills, 42.
 Kingsland, J., 81, 96.
 Kinsey, Israel, 97.
 Kneeland, J. C., 74.
 Koch, Louis, 93.
 Kircher, Athanasius, 20.
 Knot separator, 58.
 Koops, Matthias, 35.
 Labor high, 32.
 Lace introduced, 54.
 Laferet, M., patent, 49.
 Lallin Bros., 98.
 Laid paper, rough, 25.
 Laid paper imitated, 60.
 Lake Superior moss, 97.
 Lambert, Louis, patent, 49.
 Lattenand, J., 89.
 Landolini, Chevalier, 42.
 Largest mills, 94.
 Latins used cotton paper, 5.
 Lavender & Lowe, 83.
 Leather cuttings for paper, 33, 55, 72.
 paper, 33, 59, 72.
 scraps for paper, 95.
 Leaves, paper from, 26, 27, 32, 65, 68, 69, 85.
 used for writing upon, 1.
 Ledger, Philadelphia, 86.
 Lee mills, 80, 97.
 product, 80.
 Lefevre, 51.
 Leflingwell, Christopher, 27, 28.
 Leghorn, exports, 74.
 imports, 78.
 Levant imports from France, 5, 20.
 Lewis, S. G., 86.
 Life everlasting paper, 92.
 Ligneons paper company, 90.
 paper, 92.
 Lily of the Valley paper, 27.
 Line tree paper, 31, 58, 86.
 water used, 49, 84.
 Linden paper, 29.
 Linen paper, 32.
 prize specimen, 15, 27.
 in Venice, 16.
 first book on, 16.
 oldest specimen, 12, 26.
 in Spain, 13, 15.
 in Germany, 13, 14.
 in France, 14.
 in England, 14.
 paper supplanted cotton, 5, 15.
 substituted for, 51.
 rag paper, 3, 4, 12, 13, 14, 27.
 Liquorice root paper, 51.
 Lithographic paper, 62.
 Little Falls mill, 89, 92.
 Lombardo-Venetian mills, 80.
 Lombardy exports to France, 15.
 London custom house, 58.
 Economist, 91.
 Times, consumption of paper, 91, 93.
 Long sheet, 58.
 Longobards, 10.
 Louis XIII, 19.
 XIV, 20.
 XVI, 30.
 Louisville, Ky., 91.

- Lowe, Henry, 94.
 Lozanna, specimens, 37.
 Lydig, David, 48.
 Lyon, Col., 34.
 Machine, Robert's, 34, 35, 36, 38,
 39, 44.
 Gavit's, 93.
 success of, 38.
 improved, 45, 52, 81, 89, 92.
 plaining and cutting, 83.
 separating paper, 84.
 new paper, 84.
 American, 45.
 Machines, paper, 58.
 dryer for, 47.
 cheapened paper, 62.
 patented, 37.
 in Gt. Britain, 73, 74, 76, 79.
 Belgium, 79.
 Saxony, 73.
 Spain, 79.
 Germany, 76, 79.
 France, 52, 76, 79.
 Europe, north, 79.
 Italy, 79.
 America, 79.
 India, 79.
 Austria, 79.
 Denmark, 79.
 Holstein, 79.
 Sweden, 79.
 Sardinia, 80.
 Tuscany, 80.
 Switzerland, 80.
 Lombardo-Venetian, 80.
 Roman states, 80.
 Smyrna, 80.
 United States, 46.
 Berlin, 46.
 Massachusetts, 57.
 rasping wood, 88.
 for cutting rags, 53, 63, 89.
 economy, 53.
 cutting paper, 47, 53, 54, 60,
 61, 63, 65.
 for cutting paper lengthwise,
 52.
 for cutting waste, 43.
 McGuaran, J., patent, 49.
 Macon, France, 51.
 Maffei, 16.
 Magaw, Wm., patent, 52, 58.
 Maidstone mill, 27.
 Malden Bridge, 92.
 Malta, imports, 78.
 Manchester, Eng., 26.
 wall paper, 25.
 Manchester, Ct., 60.
 Manganese for bleaching, 34.
 Manilla paper, 93.
 Manufacture, change in, 7.
 mode of, 6.
 degenerated, 14.
 Maniere, E., 86.
 Mansell, J., 81.
 Manures for paper, 89.
 Maps of parchment, 14.
 Marland, Obadiah, 89.
 Marseilles, 47.
 Marshmallow paper, 31.
 Martin, R. & J. C., 88.
 Walter, 40.
 Martinique, 69.
 Martinsburgh mill, 40, 63.
 Martonoi, G., 92.
 Maryland mills, 42.
 Massachusetts mills, 29, 42, 57, 71.
 first mill, 24, 26.
 import, 31.
 product, 57.
 Masse d'eau paper, 27.
 Mats of Muscovy for paper, 25.
 Meadville, Pa., 52, 58.
 Medal, French, 30.
 booksellers', 38.
 of World's fair, 27.
 Meerman, 15, 27.
 Memphis made papyrus, 9.
 Metal plates for writing upon, 1.
 Mexico, imports, 72.
 Miller Enoch, patent, 53.
 Milton, Mass., 55.
 mill at, 24.
 Mineral colors extracted, 55.
 Mississippi bamboo for paper, 91.
 Montargis mill, 34.
 Montfaucon, 11, 14.
 Montgolfier, 57.
 Montserrat, W. I., 96.
 Moorish paper-makers expelled
 from Spain, 5, 11.
 Moseow, 23.
 first mill, 6.
 Moss paper, 27, 31, 49, 52, 97.
 Moth-wort paper, 27.
 Moulds, hollow, 83.
 improved, 52, 79.
 Mulberry for paper, 3, 27, 49.
 Mummy cloth paper, 97.
 Nassau, Germany, mills, 72.
 Nesbit, A., patent, 49.
 Netherlands, imports, 73.
 Nettle paper, 31, 43.
 Neustadt Elberwald, 77.

- Nevin, J. N., 90.
 Newbury, Vt., 61.
 New England, first mill, 24, 26.
 New Hampshire, 29, 42.
 New Haven mill, 91.
 New Jersey product, 28.
 first mill, 24.
 New Orleans mill, 73.
 New York imports, 83, 84.
 consumption of paper, 52, 95.
 mercantile library, 94.
 mills, 42, 43.
 northern, 33.
 scarcity, 30.
 Tribune, 88.
 Times, 88.
 Niagara Falls mill, 91.
 Nicholls, 19.
 Niles Register, 57.
 Nolan, Samuel, 84.
 North America, 32.
 Carolina, mills, 87.
 Norwich, Ct., mill at, 27, 28, 94.
 Numa, used papyrus, 9.
 Nuremberg, 14, 17.
 Oak paper, 31.
 Oakum paper, 72.
 Oby's mode of sizing, 51.
 Ochs, Lasare, 95.
 Odent, Victor, patent, 53.
 Old Junk paper, 60.
 Oriental plants for paper, 13.
 Ornamenting paper, 64, 81.
 sacks, 43.
 Onvrard's speculation, 32.
 Overland Mail, 67.
 Padua, art introduced, 15.
 Painting on parchment, 18.
 water colors, 18.
 oil colors, 18.
 Palm for paper, 76.
 Palmer, James, patent, 52.
 Papyrus, 1, 2, 9, 10, 13.
 abundance of, 10.
 scarcity of, 10, 11.
 MSS. in Herculaneum, 10.
 in British Museum, 10.
 in Paris, 10.
 disused, 13.
 in France, 14.
 specimen sold, 33.
 Lindolin's theory, 42.
 discovered at Elephanta, 48.
 Parchment, 1, 12, 17.
 super-eded papyrus, 2, 11, 14.
 Greeks, 5.
 used by Ionians, 9.
 Parchment improved at Pergamus,
 9.
 substituted for paper, 13.
 paintings on, 18.
 cloth, 12.
 Paper-hangings (See *Wall paper*).
 Papier linge, 57.
 velin, 26, 30.
 Papiers peints, 25.
 Pappus for paper, 38.
 Paris consumption, 38, 50, 66.
 papyrus, 10.
 rag collectors, 61.
 Parker's mill burnt, 91.
 Parmewitz, Herr von, 89.
 Pasteboard from beet root, 97.
 scraps for paper, 51, 56.
 Paterson, N. J., 76.
 Pease, Satterly & Co., 89.
 Pease & Stone, 93.
 Peaslee, H. W., 92.
 Peat for paper, 27, 66, 89.
 Peignot, 15, 38.
 Pennsylvania, first mill, 23.
 product, 28.
 petition for tariff, 47.
 mills, 42, 47.
 Penny Magazine, 64.
 Per capita, 83, 85.
 Perforated roller, 59.
 Perfumed paper, 92.
 Pergamus improved parchment, 9.
 Perigord, 22.
 Perkins, E. L., 86.
 Persians, 11.
 Peter the Great, 6, 22.
 II, regulated paper makers, 14.
 the Venerable, 12.
 Phelps, George M., 74.
 & Spafford, Ct., 58.
 James, 70.
 Phoenix mill, 89.
 Philadelphia, 88.
 consumption, 48.
 society, premium, 31.
 Perse & Brooks, 95.
 Pine, Edward, patent, 60.
 paper, 27, 57, 84, 89.
 shavings for paper, 50, 83.
 Pitkin, Elisha, 35.
 Pittsburgh mill, 44.
 Plantain for paper, 85.
 Planing machine, 83.
 Plants, paper from, 26.
 Plees, W., patent, 37.
 Pliny, 10.
 Poetic advertisement, 40.

- Pohl, Henry, 76.
 Poisson, L. P., patent, 51.
 Poitou, 33.
 Polishing paper, 86.
 Poplar paper, 31, 56, 67, 86.
 Porto Rico, imports, 74.
 Post paper, 20.
 Pot paper, 18.
 Potato starch sizing, 51.
 Potter, Messrs., 25.
 Price of paper reduced, 63.
 Prince of Wales Island Gazette, 45.
 Printed paper used for paper stuff, 35, 54.
 Printing ink extracted, 37.
 Prussia, mills in, 46, 72.
 Ptolemy Philadelphus, 9.
 Publishing discouraged, 32
 Pulp adjuster, 83.
 dresser, 59, 63.
 superseded, 62.
 feeder, 97.
 improvement, 93
 regulator, 76.
 strainer, 61, 80.
 Putney, Vt., 46.
 Quality of paper advanced, 63.
 Queen Anne's impost, 22.
 Quirini, patent, 56.
 Rag cleaner, 54, 60.
 engines, 25, 26.
 cutting machine, 53, 63, 89.
 Rags, 13, 17, 23, 25, 26, 51, 73, 74, 75, 76, 77, 78, 81, 82, 85, 87, 88, 89, 91, 92, 95, 97.
 of no other value, 48.
 collected in Boston, 28.
 consumption of, 44, 63.
 in England, 66, 92.
 from Egypt, 97.
 excise on, 58.
 gathered in U. S., 45.
 from Hayti, 66.
 import of, 68, 69, 70, 71.
 in Germany, 69.
 in Great Britain, 69.
 in Massachusetts, 28, 42.
 price of, 34.
 required in Gt. Britain, 34.
 saved in U. S., 57.
 chemical substitute for, 51.
 scarce, 29.
 in Germany, 33.
 wanted, 40, 41.
 paper without, 27, 51.
 Ratisbon, 29.
 Reaumur, 23.
 Reciprocity, 85.
 Reed paper, 31.
 Reel dispensed with, 63.
 Rees's Cyclopaedia, 48.
 Refuse materials for paper, 55, 56, 60.
 Regensburg, 29.
 Resinous bark paper, 90.
 Revolution in France increased demand for paper, 32.
 Reward offered for new paper materials, 91.
 Rhode Island, 29, 42.
 Rice, Clark, 64.
 paper, 39, 45.
 straw paper, 3.
 Richmond, S. M. & A., 90.
 Rinteln University specimen, 13.
 Rise in price, 87, 191.
 Robert, Louis, invented a machine, 34, 35, 36, 38, 39, 42, 44.
 Rock City mill, 91.
 Rocques, M., 68.
 Roger of Sicily, 12.
 Roll of paper, long, 78.
 Roman papyrus, 2.
 Rome, imports, 78.
 machines, 80.
 Rondeaux & Henn, patent, 55.
 Roofing, paper for, 77.
 Rope paper, 60.
 Rose, Robt., patent, 67.
 Rosin sizing, 51.
 Rouen, decay of trade, 25.
 Royal library specimen, 11.
 printing office, consumption of, 66.
 Russia, imports, 20, 36.
 matting for paper, 65.
 Russian mills, 31, 35, 36.
 Rush paper, 89.
 Saardam, 28.
 Salisbury, Marquis, 35.
 Sallow tree paper, 32.
 Samarcand manufactory, 4, 10.
 Sandersheim records, 11.
 Saracens, 11.
 Saratoga Whig, 91.
 Sardinia, mills, 79.
 machines, 80.
 products, 74.
 Satin paper, 12.
 Saunderson, Isaac, patent, 55.
 Saunders, T. H., 94.
 Savannah Republican, 73.
 Saw dust paper, 27.
 Sawyer, James, patent, 61.

- Saxon mills, 72, 73.
 Scarcity of paper, 30, 32.
 Schatlörs, J. C., 27, 29.
 Schaumburgh, count of, 13.
 Schesle, 29.
 Schenectady, paper scarce, 41.
 Schoharie mill, 41.
 Scotland, 22.
 Scotch fern paper, 95.
 Scottish mills, 68.
 Scutari mill, 41.
 Sea salt for bleaching, 34.
 Seaweed paper, 46, 64, 92.
 Seba, 25.
 Seguin, M., patent, 36.
 Selim III, 41.
 Sellers, Coleman, 63.
 Separating paper, 84.
 Serapeum, 32.
 Seratula ervensis paper, 35.
 Sharp's Gazetteer, 80.
 patent, 50.
 Shavings, mode of producing, 58.
 Shaw, Edmund, 67.
 Sheathing paper, 60.
 Sheepskins, 9.
 Sheet-forming rollers, 55.
 of great length, 58.
 Shrubs, paper from, 26.
 Sicily, 16.
 No. mills, 78.
 imports, 78.
 manufactory in, 12.
 first machine, 51.
 Silk rag paper, 3, 10.
 floss, 45.
 Simon, G. E., 92.
 Simonds, Case & Co., 46.
 Sinclair, James, 88.
 Sizing, 51, 54, 81.
 apparatus, 64.
 machinery, 62.
 machine, 67.
 and glazing, 54.
 French patent, 50.
 Skins used for writing upon, 9.
 Smith, Edward, 43.
 Smithsonian Institution, 29.
 Smyrna, mill, 80.
 South Carolina mills, 42.
 Hadley, 79.
 Southern canes, paper from, 83.
 Spain, art decays, 23.
 exports, 74.
 imports, 5, 20, 23, 72.
 machines, 79.
 product, 79.
 Spain, paper made in, 4.
 Spanish manufacturers, 11.
 mills, 36.
 Sparganium paper, 92.
 Spartum, paper from, 81.
 Specimens, 93, 94.
 Spilman, his mill, 18, 19.
 Spindle tree paper, 31.
 Splitting paper, 75.
 Sprague, Messrs., patent, 55.
 Springfield mill, 49.
 Stamping process, 12, 16, 26.
 St. Domingo, 31.
 Starin, H. W., 48.
 Steam engines, 75.
 power, 44.
 Stevenson's estimate, 43.
 Still, G., 84.
 Stimpson, Solomon, 46.
 Stockholm, imports, 30.
 Stockport mill, 43.
 Stone paper, 77, 95.
 Stones used for writing upon, 1.
 Straw boards, 93.
 Strainer, 76.
 Straw paper, 6, 26, 27, 35, 36, 37,
 43, 46, 49, 52, 55, 56, 57,
 84, 85, 86, 91, 97, 98.
 mode of bleaching, 96.
 Stromer, Ulman, 16, 17.
 Stuyvesant Falls mill, 35, 97.
 Sun, New York, 88.
 Sweden, 20.
 imports from France, 5, 20.
 machines, 79.
 No. mills, 30, 79.
 Swedish paper, 65.
 Sweeney and Pannartz, 17.
 Swingtow paper, 88.
 Switzerland, 17.
 machines, 80.
 wages, 80.
 imports, 5, 20, 38.
 Syracuse, Sicily, 43.
 Standard, 97.
 Table cloths of paper, 57.
 Taft, F. A., patent, 60, 63.
 Tan paper, 68.
 Tate, John, 18.
 Taylor, Enoch, patent, 52.
 T. G., 83.
 Tennessee, 42.
 Terry, Dr., 97.
 Theodoric abolished duty on papy-
 rus, 2, 10.
 Thibet paper, 66.
 Thick paper, 59, 86.

- Thistle paper, 27, 31, 89.
 Thomas, Isaiah, 42.
 & Woodcock, patent, 59.
 Thread introduced, 54.
 Tiberius, 10.
 Times, of London, 91, 92.
 Tissue paper, 93.
 Tow for paper, 60, 88.
 Tiraboschi, 15.
 Toledo mills, 11.
 Top press-roller, 54.
 Towgood, Mr., patent, 63.
 Trees, paper from, 6, 25, 26.
 Trenton mill burnt, 91.
 Treviso, mill at, 16.
 Trieste, exports, 69, 76.
 Tripot, M., patent, 64.
 Troy, 60.
 Troyes, mills at, 15, 17.
 Truman, Joseph, 65.
 Turin experiments, 56.
 Turingian mills, 71.
 Turner, Mr., patent, 61.
 G. W., 81.
 Turkish mill, 41, 80.
 Tuscany, machines, 80.
 mills in, 17.
 Twitch (or couch) grass for paper,
 86.
 Ulva marina paper, 53.
 United States imports, 31, 68, 69,
 70, 71, 73, 74, 75, 76, 78,
 82, 87, 89, 92.
 import rags, 43.
 exports, 68, 69, 70, 71, 73, 74,
 75, 77, 82, 89.
 consumption, 52.
 products, 42, 47, 57, 63, 73,
 87, 94.
 new impetus, 60.
 capital employed, 77.
 No. mills, 42, 43, 70, 87.
 persons employed, 47.
 Upper web dispensed with, 39.
 Ure, Dr., 69.
 Valencia manufactures, 15.
 Van Houten, Wm., patent, 49, 52.
 Van Veghten & Son, 41.
 Vat requiring an engine, 34.
 Vegetables suitable for paper, 6,
 25, 29, 36.
 Vellum paper, 30.
 Velvets put upon paper, 57.
 Venice sent paper to Germany, 5.
 Vermont mills, 42.
 Vidocq, E. F., patent, 71.
 Villette, Marquis de, 31.
 Virginia mills, 42.
 Vivien, M., 85.
 Vougeot mill, 34.
 Wages in Switzerland, 80.
 Wait, P. H., 96.
 Wall paper, 25, 31, 57, 67, 75, 78,
 90.
 introduced, 19.
 Russian, 36.
 Washer improved, 61, 62, 64, 70,
 92.
 Waste for paper, 35, 37, 54.
 Wasps' nests, 23.
 Water for ink, 65.
 broom, for paper, 81.
 marks, 18.
 in continuous paper, 59, 60.
 Waterman & Annis, 53.
 Water mills, 5, 12, 28, 75.
 power, 17, 79.
 proof paper, 75.
 Watertown, N. Y., 64.
 Watkins, Thomas, 23.
 Watt & Burgess, 83, 90.
 Watts, Mr., 91.
 Watson & Ledyard, 29.
 Wax sizing, 51.
 Waxed tablets, 17.
 Wayfaring tree paper, 31.
 Web sustainer, 67.
 Websters, Ensign and Seymour, 33.
 West, George, 80.
 Western Budget, 41.
 West Sutton, Mass., 70.
 Westville mill burnt, 91.
 Watman, James, 27.
 Wheat straw paper, 27.
 Whipple, M. D., 91.
 White & Gale's patent, 51.
 Norman, 81.
 wood paper, 67.
 Whitehall mill, Eng., 58.
 Wilcox, Mr., 23.
 Wilder, Mark, 74.
 Wilks, John, 59.
 Willow paper, 27, 31, 84, 86,
 twig paper, 32, 56.
 Wilmington mill, 45.
 Windham, Ct., 56.
 Windmills, 28, 75.
 Windsor Locks mill, 94.
 paper, 21.
 Wire marks, 59, 60.
 web improved, 52.
 Woodcock, Thos. L., 61.
 Woodpaper, 23, 25, 26, 37, 54, 58,
 83, 86, 88, 91.

- Wood shavings paper, 91.
 & Reddington, 42.
 Woodville mill, 94.
 Woodward & Bartlett, 89.
 Wool for paper, 72.
 Wooster & Holmes, patent, 58.
 Works on paper-making : see Stro-
 mer, Bagford, Guettard, see p.
 26, Schallers, French, 29, Vil-
 lette, Salisbury, Burton, Herring,
 Saunders.
 Workmen, 77.
 in U. S., 57.
 in Great Britain, 80.
 World's fair, 78.
- Wove paper invented, 25.
 Wrapping paper, 90.
 from pine shavings, 50.
 from leather scraps, 95.
 paper-mill, 90, 94.
 of straw, 57.
 from sacks and ropes, 49.
 Wright, George, L., 74.
 Writing materials used for, 1.
 Wynkin de Worde, 18.
 Xativa, manufactures of, 12, 15.
 Zollverein, exports, 72, 73, 76.
 imports, 72.
 No. mills, 69.

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