manufacturing district, and the future good or bad effects of this pursuit, must in time have a great influence upon our prosperity.

In 1822, that part of Somersworth called Great Falls, contained but *two* dwelling houses. Now the eyes of the visiter are greeted with a pleasantly situated, and beautiful village, of between sixty and seventy buildings, chiefly erected within the last two years, either built of brick, or painted, and many of them of the same size and appearance, laid out with so much regularity, that if exhibited in a picture, it would partake too much of formality to appear natural. This is exclusively a manufacturing village—nothing is to be seen but what has some relation to the establishment.

Here are four factories—one for cotton, built of wood, 5 stories (including basement and attic,) 35 feet wide and 65 feet long, containing 1500 spindles, and manufactures 7000 yards No. 20 cotton cloth weekly.

One of brick, 5 stories, 45 by 156 feet, containing nearly 6000 spindles, and will manufacture from 16,000 to 18,000 yards No. 40 cloth per week.

One of Brick, 6 stories, 49 by 220 feet, exclusively for broadcloths.

One recently erected, of brick, 6 stories high, 49 by 390 feet, for cotton and woolen manufacture. This is the most extensive building devoted to the manufacturing purposes in New Hampshire, if not in N. England.

There is also a building of brick, 4 stories high, 32 by 134 feet, occupied as a dyehouse for the manufacture of carpets, &c., another house of brick, 3 stories, 28 by 100 feet, for drying. A building of brick, 35 by 65, for trip hammers and machine shops. There is also an extensive range of work shops; 40 dwelling houses of wood, 2 stories high, 24 by 40 feet; 5 extensive boarding houses: 5 brick blocks, of 30 by 80 feet each, 3 stories; and a great number of buildings occupied by mechanics. A spacious and elegant brick hotel, 3 stories high, has also been erected, where the traveller meets with good accommodations.

The village contains about 1500 inhabitants—about 1000 of whom are enrolled in the factory books. This establishment is situated on Salmon Falls river, about three miles from tide waters.—The resources of the river are abundant, having extensive ponds for reservoirs. The fall at the control of the Great Falls Company is 120 feet, and only about one-sixth of the power will be used for the factories now built.

Essays on Bleaching. By JAMES RENNIE, A. M. Lecturer on Philosophy, &c. &c. London.

NO. I.—HISTORY OF THE ART.

Section II.—THE art of bleaching was known to our ancestors in Britain as early, at least, as the first century, as we are informed by Pliny, (Hist. Nat. lib. XXX. c. 50.) who tells us, “that the flax, after being spun into yarn, was pounded several times in a stone mortar

with water; and when it was woven into cloth, it was beaten again upon a smooth stone, with broad headed cudgels; and the more frequently this process was repeated, the whiter and softer the cloth became." A more accurate description could not be given, of a process which every Scotsman, who has lived in the country, must have seen employed by the peasants of the present day. This simple process, however, is aided by boiling with soap or kelp, and by crofting; but even in Pliny's time, they had recourse to vegetable alkalies, as he tells us, in the following book, that the process was much facilitated by macerating in the water the roots of a kind of wild poppy, which was much sought after for this purpose, and made the linen look "wonderfully pure and white." Might not this wild poppy be the cuckoo pint, (*Arum maculatum*, Lin.) which even in modern times has been used in bleaching in France and other parts of Europe? (Parkes' Chem. Ess. IV.) We are told by Lewis, (Newman's Works, II. p. 226.) that the juices of this plant have the property of destroying the resinous colouring matter of vegetables; but I think the effect might be better accounted for by a peculiarity in this plant, first observed by Lamarck and Sennebler, namely, that it contains a greater quantity of sensible heat than any other plant whose temperature has been examined. (Smith's Intr. to Bot.) The use of plants in bleaching is not peculiar to Europe. The Indians in North America, as M. De Lery tells us, make a detergent water from certain fruits, with which they wash and bleach their cotton beds and garments. (Voyage de J. De Lery, p. 276.) It is likely that he here alludes to the fruit of the *Myrica Cerifera*, of the mode of making soap from which, M. Cadet gives an excellent account in the *Annales de Chimie*. Dec. 131.

We need not wonder that attention would be paid to this art among the Greeks and Romans, when we are aware of the delicate fineness to which they brought their linen cloth, and the value at which certain sorts were estimated. We are informed by Pliny, that a kind of lawn, made from the flax denominated Byssus, which grew in Achaia, was so much esteemed in the first century as an ornamental dress, that it was sold for its weight in gold. We are at no loss from this to see, why its use was considered, by some austere Romans, as a mark of unpardonable luxury and effeminacy, (Hist. Nat. lib. II. c. 1;) and the same author tells us, that the threads of the Retovine linen are even, if even may be, than that of a spider: he himself had seen so fine and small a thread of Cumes flax, that a whole net knit of it would pass through the ring of a man's finger; and he had seen also some so fine, that one man could easily carry as much yarn as would go round and compass a whole forest. But the *finest cloth*, he says, (lib. XII. c. 10,) which was made in his time, was manufactured from the cotton which grew in India and Persia. There was a great difference, however, in the whiteness of the several sorts of linen, either from the mode of bleaching, or from the nature of the materials. The Faventine, for example, was always whiter than the Allian, which was commonly brown before it was bleached. Pliny likewise gives an account of

the earths and plants employed by the Romans in bleaching and washing; but it is likely that these methods were soon improved after his time, as we know that the manufactory of soap contrary to the assertion of Beckman, was carried on to some extent in Italy; and it is not long since a complete manufactory for boiling soap was discovered in the subterranean Ruins of Pompeii. This soap had been made by combining alkalis with an oil. (See Starke's Letters from Italy.) Immediately subsequent to the time of Pliny, the Romans indulged in what their fathers had considered to be effeminate; and white cloaks of linen were almost universally worn. (Beckman's History of Inventions, III. p. 270.) May we not then consider it rather as a poetical flourish than a correct description, which we find in Valerius Flaccus, of the dress of a warrior who was slain at Colchis during the Argonautic expedition; especially when we consider, that this author lived near the time of Pliny, when linen was still of inestimable value? The passage runs thus:

Cadit—Taulantis alumnus—
Tenina non illum candentis carbasa lini,
 Non auro depicta chlamys, non flava galeri
 Cæsaris, pictoque juvant subtemine bracal.

Val. Flaccus, VI. 221.

We cannot however distrust an eye witness :

²Ἐπορεύσαν δια Χαλυβάν—ἔλεον δὲ βαρεῖας λίνος μέχρι τε ἡτέρας.

Xenoph. Anab. IV.

The preceding notices, it must be confessed, are scanty and imperfect; but they are all which I have been able to collect from my limited acquaintance with antiquities. In the ages which succeeded those of which we have now been speaking, our information upon this, as upon almost every other topic, is altogether imperfect. It is probable that the art in question, remained nearly as it had been transmitted to the people of the middle ages from the ancients. This amounts nearly to a certainty, when the earliest of our modern processes are compared with what we know of antiquity. In Iceland, which, from its remoteness, we may suppose comes but accidentally acquainted with the improvements made in the other parts of Europe, they bleach with a ley made of ashes and urine. (Hist. de l'Islande, I. 266.)

The earliest account which has come to my knowledge of the mode of bleaching in modern times, is given in a book now become scarce, but a copy of which I was so fortunate as to procure from Stirling's Public Library; it is entitled, "Select Essays on Commerce," &c. (8vo. Lond. 1754.) The mode of bleaching there described, was practised in Holland and Flanders, and consisted in souring with milk or bran, in boiling with alkaline leys, and in exposing the goods for a whole summer to the sun and air. This book, however, must be comparatively modern with the processes it describes; for long before this we find "*Holland white as snow*" mentioned in our old ballad poetry. There are indeed few of our oldest ballads and traditionary legends which do not mention shirts

and other garments made of "Holland fine." The Dutch and Flemish process being unknown in the other parts of Europe, it began to be supposed that there was something in the air or the water of Holland which produced linen of so clear a white; and the adjacency of the sea was mentioned as one of the causes of this. All the bleaching grounds in Holland, indeed, were situated near the sea, as it had been found by experience that the sea air seemed to produce a fairer white, than that farther inland. If the cause of this had been inquired into with any degree of philosophical acuteness, it might have led rapidly to the unexampled chemical improvements which have been lately made in the art of bleaching. But the period of which we speak, was only the dawn of the philosophical arts. Every process was conducted by blind precedent, without the slightest hint ever intruding itself *why* such things were done. But this dawn, faint as it was, soon brightened into all the splendours of noon-day; and if I am not misinformed, the world is indebted to Scotland for the first application of chemistry to the art of bleaching.

Two years after the publication of the Select Essays, Dr. Home, the Professor of Chemistry in the University of Edinburgh, published his inestimable Experiments on Bleaching, in which he proved that employing oil of vitriol (sulphuric acid) for souring linen goods was both more economical, more efficacious, and less liable to uncertainty than the Dutch mode of souring with milk or bran. Previous to Dr. Home's experiments, the art of bleaching was quite in its infancy in Britain. Even so late as 1752, British linens were sent to Haarlem to be bleached at a considerable expense and much loss of time. The Dutch process is commonly supposed to have first been practised by the Scotch; but it was certainly first known to the Irish. The Scotch linens were usually sent over to Holland in March, and were not returned in a finished state till October following, when they were sent to the London market under the name of Scotch Hollands. On the authority of Patrick Milne, Esq. M. P., Mr. Parkes states, (Chem. Es. IV. p. 18,) that an Irishman who had learned something of bleaching, settled, in 1749, in the North of Scotland, and was entrusted with the linens to bleach which had formerly been sent to Holland. His first attempts, however, were unsuccessful, and after he had done his utmost, the Goods had to be sent to Holland to be finished. But several years' inquiry and experience made him an excellent bleacher, and by assiduously practising the art, he soon realized an opulent fortune. At the same time the Scotch manufacturers were greatly benefited by having their goods sooner ready for the market, and their capital more quickly circulated. Dr. Home's improvements, which immediately followed this, gave our countrymen a decided superiority in this art, and the North of Scotland soon stood as high as Holland and Flanders had previously done.

In order to show the advantages of Dr. Home's improvements, it may not be out of place to give an account of the mode which was previously followed, a little more in detail. For this purpose, I shall select the process for bleaching linen yarn, which was very operose, and required four times the expense of cotton yarn; inasmuch as the

colouring and resinous matter is in much greater quantity in the former. Most sorts of linen yarn, for example, will lose 27 per cent. of their original weight before they are thoroughly bleached, while cotton yarn will lose only $4\frac{1}{2}$ or 5 per cent. by the same process. The following account is given by Parkes, of the mode of bleaching linen yarn about half a century ago. The brown yarn was first immersed in hot water for three or four days, or macerated in cold waste alkaline leys for about forty-eight hours, which by producing a fermentation in the vegetable substance, or otherwise acting chemically upon the fibres, loosened the saliva of the spinner, or such foreign and heterogeneous matters, and rendered them easy to be removed by simple washing. The yarn was next boiled and steeped in alkaline ley, the apparatus being so contrived that the ley was poured over the goods, through which it percolated till it reached the bottom of the vessel, whence it was drawn off into a heated copper; and from this again it was pumped back over the goods, and so on alternately and uninterruptedly for many hours. The yarn was then well washed and exposed on the grass for two or three weeks. It was now bucked again, washed, and crofted as before; and these processes were alternately continued four or five times, the strength of the ley being gradually reduced in each successive bucking. After the yarn had been bucked four or five times, it was immersed in soured milk, in which it lay two or three weeks, till the scum, formed by the matters disengaged by fermentation, began to crack and subside. The yarn was then taken out of this *first sour*, and well washed; and the processes of bucking, washing, crofting and souring, were alternately repeated till it was thought to be clean and of a good colour. For cleansing and finishing they employed soap, which renders the goods soft and delicate, and makes them handle better than when they are simply washed in pure water. Now, from this account it is evident, that the old mode of bleaching was extremely tedious, troublesome, and liable to great uncertainty of result. If goods were sent to the field in March, they were not ready for the market before September; and if at midsummer, they could only be half-bleached that year; because it was found, that crofting succeeded best in the spring, and when any were unfinished in autumn, they were laid aside till March following.

The improvements of Dr. Home, then, were of great importance in saving time; for, by making the sours of sulphuric acid, instead of milk, the process of souring, which formerly took two or three weeks at each repetition, could be finished in as many hours. A great deal of trouble was also saved; for great quantities of milk being requisite, it could not easily be collected, and carried from great distances to the manufactory, as would frequently be necessary. The expense, likewise, of sulphuric acid, was considerably less than that of milk, owing to the improved process which was about this period invented by the ingenious Dr. Roebuck, for the extensive manufacture of this acid.* They

* The first large leaden chamber for this purpose, was erected by him at Birmingham, in 1746; and, in three years afterwards, he established extensive
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found that sours composed of it, acted with more certainty and effect; while they did not, in the least, injure the fabric of the cloth. A prejudice long subsisted, indeed, which is not even yet wholly removed, that the fabric is weakened by vitriol sours; but Dr. Home proved, in the most satisfactory manner, by repeated experiments, that it is altogether unfounded. He kept, for example, a piece of linen in a strong sour of vitriol during several months, and the fabric of the cloth remained as firm and strong as before it was immersed. Even in the present improved state of chemical bleaching, this improvement of Dr. Home's is of importance, and is still used in conjunction with those which are much more powerful.

(TO BE CONTINUED.)

On the Nature and Properties of Timber, extracted from "The Elementary principles of Carpentry, by THOMAS TREDGOLD."

(Continued from page 178.)

Effect of continued Moisture with Heat.

Wood, in common with other vegetable products, when exposed to a certain degree of moisture, and at a temperature not much under 45 degrees, nor too high to evaporate suddenly all the moisture, gradually decomposes. This decomposition is called putrefaction by chemical writers, but is called the *rot* in common language. It proceeds with most rapidity in the open air, but the contact of air is not absolutely necessary. Water is, in all cases, essential to the process; indeed, it is a principal agent in all processes of decomposition.

As the rot goes on, certain gaseous matters are given out; chiefly carbonic acid gas and hydrogen gas.

Pure woody fibre, alone, undergoes this change slowly; but its texture is soon broken down, and it is easily resolved into new elements, when mixed with substances more liable to change. "Any process," observes Sir H. Davy, "that tends to abstract carbonaceous matter from it, must bring it nearer in composition to the soluble principles," and this is done by fermentation. Hence it is, that the sap-wood is of a more perishable nature than the heart-wood; for the sap-wood abounds more in saccharine and fermentable principles, and, consequently, sooner ferments. Dr. Darwin took part of the branch of an oak tree, cut in January, and divided it carefully into three parts, the bark, the alburnum, or sap-wood, and the heart-wood. These were each shaved, or rasped, and separately boiled in water, and then set in a warm room to ferment. The decoction of the sap-wood passed into rapid fermentation, and became acid; but not either of the others.

Duhamel tried some experiments to ascertain the effect of confining the sap in green timber; and found, that the pieces thus confined soon exhibited signs of rapid decay; and, therefore, he strongly recom-

works on the same plan at Prestonpans, whence he supplied not only bleachers and other manufacturers of Scotland and Ireland, but also those on the continent, who soon learned to prefer it to milk sours.—*Parkes*,