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A

HISTORY

OF

INVENTIONS AND DISCOVERIES.

BY JOHN BECKMANN,

PUBLIC PROFESSOR OF ECONOMY IN THE UNIVERSITY OF
GOTTINGEN.

TRANSLATED FROM THE GERMAN,

BY WILLIAM JOHNSTON.



SECOND EDITION.

CAREFULLY CORRECTED, AND ENLARGED BY A FOURTH VOLUME.

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HISTORY

OF

I N V E N T I O N S.

TIN. TINNING.

It is generally believed that the metal called at present tin was known and employed in the arts, not only in the time of Pliny, but so early as that of Herodotus, Homer, and Moses. This I will not venture to deny; but I can only admit that it is probable, or that the great antiquity of this metal cannot be so fully proved as that of gold, silver, copper, iron, lead, and quicksilver.

Tin is one of those minerals which hitherto have been found only in a few countries, none of which ever belonged to the Greeks or the Romans, or were visited, at an early period, by their merchants. As it never occurs in a native state,* the

* Native tin never, or, at any rate, very rarely occurs. In the year 1765 a piece was supposed to be found, of which an account may be

discovery of it supposes some accident more extraordinary than that of those metals which are commonly, or, at any rate, often found native. I cannot, however, attach much importance to this circumstance, as the ancients became acquainted with iron at an early period, though not so early as with copper. I must also admit that tin might have been more easily discovered, because it is frequently found near the surface of the earth;

seen in the *Philosoph. Transact.* vol. lvi. p. 35, and vol. lix. p. 47. also in *Abhandl. der Schwedischen Akadem.* vol. xxviii. p. 237. But the truth of this was denied by most mineralogists, such for example as Jars in *Memoires de l'Acad. à Paris*, année 1770, p. 540. At first it was thought that quartz and spar could be observed on the piece found; but as these, on closer examination, were declared to be arsenic, the reality of its being native tin was more confidently believed, as arsenic has little durability in the fire. I have in my possession scoriae, from Goslar copper ore, the cavities of which contain crystallised arsenic, which of course must have several times withstood a roasting as well as a fusing heat. The crystals are four-sided, but not regular pyramids. Soon after the above-mentioned piece of tin was found in Cornwall, some dealers in minerals sold similar pieces to amateurs at a very dear rate; but all these had been taken from roasting-places, where the tin exudes; and very often what is supposed to be tin is only exuded bismuth, as is proved by some specimens in my collection.

I shall here observe, that it may not be improper, in the history of tin, to show that it was believed more than two hundred years ago that this metal was found in a native state. Some instances are related by Mathesius in the ninth sermon of his *Sarapta*. Leipsic, 1618, 4to. p. 451 and 453. and by Pet. Albinus in *Meisnischer Bergk-Chronik*, Dresd. 1590, fol. 130. Native tin is mentioned also in *Tollii Epist. itinerariæ*, p. 98; and a piece, in a kind of yellow stone, from Malacca, was preserved in Richter's collection. See *Museum Richter.* p. 75.

does not require a strong heat or artificial apparatus for fusing it, and therefore can be more easily won than copper.

But if tin was known so early as has hitherto been believed, it must, on account of the circumstance here first remarked, have been scarce and therefore exceedingly dear. In this manner, the aurichalcum or Corinthian brass, according to the expression of Plautus, was *auro contra carum*. The metal of the ancients, however, which is believed to have been tin, was not so rare and costly. Vessels of it are not often mentioned, in general; but they never occur among valuable articles. The circumstance also, that vessels of tin have never or very seldom been found among Greek or Roman antiquities, and that when discovered the nature of the metal has been very doubtful, though tin is not apt to change from the action of the air, water, or earth, and, at any rate, far surpasses in durability copper and lead, ancient articles made of which are frequently found, appears to me worthy of attention. It possesses also so many excellent properties, that it might be expected, that the people of every age, to whom it was known, would have employed it in a great variety of ways. It recommends itself by its superior silvery colour; its ready fusion; the ease with which it can be hammered and twisted; its lightness, and its durability. It is not soon tarnished; it is still less liable to rust or to be-

come oxygenated; it retains its splendour a long time, and when it is lost easily recovers it again. It is not so soon attacked by salts as many other metals; and this till lately has been considered a proof of its being less pernicious than it possibly may be. After an accurate investigation, should every thing said by the ancients of their supposed tin be as applicable to a metallic mixture as to our tin, my assertion, that it is probable, but by no means certain, that the ancients were acquainted with our tin, will be fully justified.

The oldest mention of this metal, as generally believed, is to be found in the sacred scriptures. In the book of Numbers, chap. xxxi. ver. 22, Moses seems to name all the metals then known; and, besides gold, silver, brass (properly copper), iron, and lead, he mentions also *bedil*, which all commentators and dictionaries make to be tin. When Ezekiel, chap. xxvii. ver. 12, gives an account of the commerce of Tyre, he names, among the commodities, silver, iron, copper, and *bedil*. In Zecharias, chap. iv. ver. 10, the plummet of the builder or architect is said to be made of the *bedil* stone. In Isaiah, chap. i. ver. 25, the word occurs in the plural number, and appears there to denote either scoriæ, or all those inferior metallic substances which must be separated from the noble metals. In the old Greek versions of these Hebrew books, *bedil* is always translated by *cassiteros*, except in the passage of Isaiah, where no

metal is mentioned. In Zecharias, the translator calls the *bedil* stone *τον λιθον κασσιπερινον*. There can hardly be a doubt, that for the purpose here mentioned, people would employ not the lighter metal tin, but lead, and that the plummet was called the lead-stone, because at first a stone was used.

It seems, however, probable, that in the first-quoted passage *bedil* is our tin; but must it not appear astonishing that the Midianites, in the time of Moses, should have possessed this metal? Is it not possible that the Hebrew word denoted a metallic mixture or artificial metal, which formerly was an article of commerce, as our brass is at present?*

* Having requested professor Tychsen, to whose profound knowledge of the Oriental history, languages, and literature I have been already indebted for much assistance, to point out the grounds on which *Bedil* is considered to be our tin, I received the following answer, with permission to insert it in this place.

“*Bedil*, בדיל, according to the most probable derivation, means *the separated*. It may therefore, consistent with etymology, be what Pliny calls *stannum*, not tin, but lead from which the silver has not been sufficiently separated. The passage in Isaiah, chap. i. ver. 25, appears to afford a confirmation, because the word there is put in the plural, equivalent to *scoriæ*, as something separated by fusion. The Alexandrian version by its *ανομους* intended merely to explain the figurative expression.

“Others derive *Bedil* from the meaning of the Arabic word *بدل* *badal*, that is, *substitutum, succedaneum*. In this case indeed it might mean tin, which may be readily confounded with silver.

“The questions, why *Bedil* has been translated tin, and how old

The Greek translators considered *bedil* to be what they called *cassiteros*; and as the moderns

this explanation may be, are answered by another: Is *κασσιτερος* tin? If this be admitted, the explanation is as old as the Greek version of the seventy interpreters, who in most passages, Ezekiel, chap. xxii. ver. 18 and 20, and chap. xxvii. ver. 12, express it by the word *κασσιτερος*. In the last mentioned passage tin and iron have exchanged places. The Targumists also call it tin; and some, with the Samaritan translation, use the Greek word, but corrupted into *kasteron*, *kastira*. It is also the usual Jewish explanation, that *Bedil* means tin, as *Oferet* does lead.

“ In the oldest passage, however, where *Bedil* occurs, that is in Numbers, chap. xxxi. ver. 22, the Seventy translate it by *μολιθος*, lead, and the Vulgate by *plumbum*, and vice versa, the Seventy for *Oferet* put *κασσιτερος*, and the Vulgate *stannum*. This, as the oldest explanation which the Latin translator found already in the Septuagint, is particularly worthy of notice. According to it, one might take *בריל*, *μολιθος*, *stannum*, for the *stannum* of Pliny, lead with silver; the gradation of the metals still remains; the *κασσιτερος* of the Seventy may be tin or real lead. It may have denoted tin and lead together, and perhaps the Seventy placed here *κασσιτερος*, in order that they might have one metal more for the Hebrew *Oferet*. But from this explanation it would follow that Moses was not acquainted with tin.

“ The East has still another name for lead and tin *אנאס*, *anac*, which occurs only in Amos, chap. vii. ver. 7 and 8, but is abundant in the Syriae, Chaldaic, and Armenian, and comprehends *plumbum nigrum* and *candidum*.

“ In the Persian tin is named *Kalai*, *Resás*, *Arziz*, which are all of Arabia, or, like *Kalai*, of Turkish extraction. None of these have any affinity to *κασσιτερος* and *Bedil*.

“ As tin is brought from India, it occurred to me whether the oldest name, like *tombak*, might not be Malayan. But in the Malayan, *Tima* is the name for tin and lead. Relandi *Dissertat. miscell.* iii. p. 65. It would indeed be in vain to look for Asiatic etymologies in regard to *κασσιτερος*, since, according to the express assertion of Herodotus, the Greeks did not procure tin from Asia,

translated this by *stannum*, these words have thus found their way into the Latin, German, and other versions of the Hebrew scriptures, which therefore can contribute very little towards the history of this metal. The examination of the word *cassiteros* would be of more importance; but before I proceed to it I shall make some observations on what the ancients called *stannum*.

This, at present, is the general name of our tin; and from it seem to be formed the *estain* of the French, the *tin* of the Low German and English, and the *zinn* of the High German. It can, however, be fully proved that the *stannum* of the ancients was no peculiar metal; at any rate not our tin, but rather a mixture of two other metals, which, like our brass, was made into various articles and employed for different purposes, on which account a great trade was carried on with it. This, at least, may with great certainty be concluded from a well-known passage of

but from the Cassiterides islands. The name may be Phœnician; and though Bochart has not ventured to give any etymology of it, one, in case of necessity, might have been found equally probable as that which he has given of Britannia. But it appears to me more probable that the word is of Celtic extraction, because similar names are found in Britain, such as *Cassi*, an old British family, *Cassivelaunus*, a British leader opposed to Cæsar; *Cassibelanus*, in all probability, the same name in the time of Claudius. *Cassi-ter*, with the Greek termination *os*, seems to be a Celtic compound, the meaning of which might perhaps be found in Pelletier, Bulletin, &c."

Pliny;* though to us, because we are not fully acquainted with the metallurgic operations of the ancients, it is not sufficiently intelligible. What I have been able to collect, however, towards illustrating the passage, with the assistance of my predecessors, and by comparing myself the account of the Roman with our works, I shall here lay before the reader; and perhaps it may induce others to improve and enlarge it.

But I must first observe, that there can be no doubt that the *nigrum plumbum* of the ancients was our lead. This metal, according to Pliny's account, they obtained in two ways. First from their own lead mines or lead ore, which immediately on its fusion gave pure or saleable lead. To comprehend this, it is necessary to know that most kinds of lead ore contain also silver, and many of them in such quantity that they might with more propriety be called silver ores, or rather argentiferous lead ores or plumbiferous silver

* Plin. lib. xxxiv. cap. 16. § 47. p. 669. Plumbi nigri origo duplex; aut enim sua provenit vena, nec quidquam aliud ex se parit; aut cum argento nascitur, mixtisque venis conflatur. Ejus qui primus fluit in fornacibus liquor, stannum appellatur; qui secundus, argentum; quod remansit in fornacibus, galena, quæ est tertia portio additæ venæ. Hæc rursus conflata, dat nigrum plumbum, deductis partibus duabus. This has been repeated verbatim by Isidorus in *Origin.* xvi. 21, only that the last words are changed: quod remanet, superaddita vena rursusque conflata, fit nigrum plumbum. Instead of *additæ venæ* in Hardouin's edition, all the others have *addita venæ*.

ores. Those which contain no silver, are so scarce, that I am ignorant whether any other has yet been found, except that of Bleyberg, not far from Villach, in the duchy of Carinthia. As Villach lead, according to the latest experiments, made on a large scale, is entirely free from silver, it is well known, and particularly useful for assaying.*

It may, therefore, appear singular that the ancients had lead of this kind in such abundance that Pliny was able to make of it a particular division. But it is to be observed that, in ancient times, people paid little attention to a small admixture of silver; and that they were accustomed to separate this metal only when it was capable, by the old imperfect process of smelting, to defray the expenses, which certainly would not be the case, when a quintal of ore contained only a few ounces, or even a pound of silver. Strabo says this expressly of some Spanish ores.† Such poor ores were then used merely for lead; and our silver-refiners, without doubt, would separate silver with considerable advantage from the lead of the ancients. Hence has arisen the common opinion

* See a description of the Bleyberges in the *Physikalischen arbeiten der einträchtigen Freunde in Wien. Erster Jahrgang.*

† Strabo, lib. iii. p. 221: *ιδιον εστι μεταλλον ορυκτου μελυβδου: παρα-μεμικται δε τε και τουτω του αργυριου μικρον, ουχ ωστε λυσιτελειν αποκαθαιρειν αυτον.* Peculiare est ibi metallum plumbi fossilis, cui admixtum est paululum argenti, sed quod ab eo separare non sit opera pretium.

that lead and also copper, with which some of the oldest buildings are covered, had in the course of time become argentiferous. This is impossible; but it is possible for us to separate from them the noble metal, which the ancients either could not do, or did not think it worth the trouble to attempt.

Secondly, the ancients obtained, as we do, a great deal of lead from argentiferous ores, from which they separated the silver and revived the lead. The ore was pounded very fine, or, as we say, stamped; it was then washed and roasted, and formed into a powder or paste.* This was then put into the furnace, and by the first fusion gave a regulus consisting of silver and lead, which was called *stannum*, and was the same substance as that known to our metallurgists by the name of *werk*. If it was required to separate the silver, it was again fused, not in the first furnace, but in a particular refining furnace with a hearth of lixiviated ashes. This circumstance Pliny has not mentioned; perhaps it appeared to him unnecessary; perhaps he did not fully understand every part of the process; and were one inclined to say any thing in his defence, modern travels and other works might be quoted, in which metallurgic operations are described in a manner no less im-

* Quod effossum est, tunditur, lavatur, uritur, molitur in farinam, Plin. xxxiii. 4.

perfect. The produce obtained by the second fusion, called in German *treiben* or *abtreiben*, was silver, and besides that half-vitrified lead, *glütte*, which in part falls into the hearth. This substance, called by Pliny *Galena*, a word which denotes also *molybdæna*,* was once more fused or revived, and then gave lead. In this manner were obtained three different productions, which were all used in commerce, namely, *stannum*, *argentum*, and *galena*, or revived lead, *plumbum nigrum*. These Pliny seems to have considered as component parts of lead ore; but not indeed according to the present signification.†

* The last meaning is found in Pliny, xxxiii. 6. § 31. p. 621, and xxxiv. 18. § 53. p. 671: est et molybdæna, quam alio loco galenam vocavimus, vena argenti plumbique communis. Adhærescit et auri et argenti fornacibus; et hanc metallicam vocant. Here then there are both the significations, first *bleyglanz*, secondly *ofenbruch*. The name *galena* seems to have been borrowed from foreign metallurgic works, perhaps from the Spanish, as was conjectured by Agricola in *Bermannus*, p. 434. This, at any rate, is more probable than the derivation of Vossius from *γελειν*, *splendere*, especially as the Greeks have not the word *galena*.

† I explain the passage in this manner, but I acknowledge that difficulties still remain. I have, however, thought that it might perhaps be thus understood: that in the process of fusion, as then used, the *galena* formed the third part of the weight of the ore or paste, and lead a third part of the *galena*; though I doubt whether the products of metallie works were then so accurately weighed. I shall leave the reader to determine whether the two explanations of Savot are better. He supposes either that Pliny gives three ways of obtaining lead, namely, from lead ore, argentiferous ore, and *galena*; or that he says that silver forms a third, lead a third, and

Though it must be confessed that this passage of Pliny cannot be fully understood by any explanation, it proves to conviction, that the *stannum* of the ancients was neither our tin nor a peculiar metal, but the *werk* of our smelting-houses. This was long ago remarked by those writers who were acquainted with metallurgy, of whom I shall here mention Agricola,* Encelius,† Fallopius,‡ Savot,§ Bernia,|| and Jung.¶

The ancients used, as a peculiar metal, a mixture of gold and silver, because they were not acquainted with the art of separating them, and

slag the remaining third. But if the first opinion be correct, why did Pliny say, *plumbi origo duplex*?

* Bermaunus, p. 450. 485.

† De re metallica libri iii. auctore Christ. Eneelio. Francof. (1551) 271 pages, 8vo. i. 32. p. 62.

‡ De metallis, cap. 22. Fallopii Opera omnia. Francof. 1606. fol. i. p. 322.

§ Discours sur les medailles antiques par Louis Savot. Paris 1627, 4to. ii. 2. p. 48. Of this work, which contains valuable information in regard to the mineralogy of the ancients, a Latin translation may be found in *Thesaur. Antiquit. Roman.* vol. xi. p. 1168. The greater part of it also was reprinted in *Les Anciens mineralogistes de France, par Gobet*, Paris, 1779, 8vo. p. 812.

|| Aldrovandi *musæum metallicum* auctore Mar. Ant. Bernia. Bononiæ 1648. fol. p. 181.

¶ Joachim Jungii *Doxoscopia*, Hamburgi 1662. 4. cap. 5. *de metalli speciebus*. Of the writings of this learned man, and the service he rendered to mineralogy, an account may be seen in *Vorrath Kleiner Anmerkungen über mancherley gelehrte gegenstände*, von B. v. H. Leipsie 1795, 8vo. p. 94.

afterwards gave it the name of *electrum*.* In the like manner, they employed *werk* or *stannum*, which was obtained almost in the same manner in the fusion of silver. In all probability it was employed before people became acquainted with the art of separating these two metals, and continued in use through habit, even after a method of separating them was discovered. If the ore subjected to fusion was abundant in silver, this mixture approached near to the noble metals; if poor in silver, it consisted chiefly of lead. When it consisted of silver and lead only, it was soft and ductile; but if other metals, difficult of fusion, such as copper, iron, or zinc, were intermixed, it was harder and more brittle, and in that case approached nearer to what the German silver-refiners call *abzug* and *abstrich*.

That this *stannum* was employed as an article of commerce, and that the ancients made of it vessels of various kinds, cannot be doubted. The *vasa stannea*, however, may be considered as vessels which were covered with tin only in the inside; for that this was customary I shall prove hereafter. In general, these *vasa stannea* are named where mention is made of saline or oily things, or such as would readily acquire a taste

* See J. M. Gesner's Dissertation *de electro veterum* in *Comment. Societ. Gottingensis*, tom. iii. an. 1753.

and smell from other metals, were they boiled or preserved in them for any length of time.*

It has been long ago remarked that most of the Roman vessels were made of copper, and that these people were acquainted with the art of tinning or silvering them; but that tinned vessels have never been found, and silvered ones very rarely. Hence so many things appear to have been made of what is called *bronze*, which is less liable to acquire that dangerous rust or oxyde, known under the name of verdigrise than pure

* I shall here point out all the passages, with which I am acquainted, where such vessels are mentioned, because they have not yet been collected by others. Plinius xxix. 2. § 20. p. 499: in stannea pyxide conditur. Dioscorides, who gives this recipe for a salve, ii. 84. p. 109, mentions only an earthen vessel. Plin. xxx. 5. § 12. p. 526, and xxx. 7. § 19. p. 805: in cacabo stagnco decoquitur. Columella xii. 41. p. 805: in cacabo stagnco decoquitur. Vegetius i. 16. p. 1050: in vase vitreo vel stagneo rcondita servabis. Plautus in a fragment, according to Taubmann's edition, p. 1253: muriatica autem video in vasis stagncis. Apuleius *de Asino aureo*, p. 841, in the edition *in usum Delphini* de stanneo vasculo multo sese perungit oleo balsamo. In Palladius, lib. vi. Maio. 7. p. 958, *regulis ligncis* must certainly be read instead of *stagneis*, as is the case in Columella, from whom Palladius has borrowed the whole prescription. Our farmers use for the same purpose a couple of wooden rods, which answer exceedingly well. Scribonius Largus *Composit. medic.* edit. Rhodii. Patavii 1655. 4to. § 230. p. 115: reponitur pyxide nigri plumbi; hæc pyxis in ampliorecm stagneam mittitur. § 268, 269. 271: stagncum vas; and § 30: stagnea pyxis. Plin. Valer. lib. i. cap. 31. and lib. ii. cap. 30. lib. iii. cap. 2. and 31: has *stagnatum* for *vas stanneum*. In l. 9. § 2ff. *de l. Corn. nummi stagnei*. Marcellus Empir. in the fourth century: *vasa stannea*: cap. 21.

copper. This bronze is sometimes given out as Corinthian and sometimes Syracusan brass, as the gold-coloured coins of the first size were considered to be Corinthian brass also. But in my opinion, a great and perhaps the greater part of all these things were made of *stannum*, properly so called, which by the admixture of the noble metals, and some difficult of fusion, was rendered fitter for use than pure copper. We are told by Suetonius, that the emperor Vitellius took away all the gold and silver from the temples, and substituted in their stead *aurichalcum* and *stannum*.*

Whether the Greeks worked *stannum*, and under what name, I do not know: perhaps we ought to class here the *κασσιτερινα* of the oldest times, of which I shall speak hereafter.

What I have already said in regard to *werk* will be rendered more certain by the circumstance, that, even two centuries ago, vessels of all kinds called *halbwerk* were made of it, in Germany. This we are told by Encelius† as a thing

* Sueton. *Vitell.* 6. p. 192: dona atque ornamenta templorum subripuisse et commutasse quædam ferebatur, proque auro et argento, stannum et orichalcum supposuisse. The last words ought properly be transposed; tin, which was of a white colour, was to serve instead of silver.

† In the work already quoted, i. cap. 32. p. 64: Vides stannum Plinio esse quiddam de plumbo nigro, nempe primum fluorem plumbi nigri; so that when our lead ore is fused, the first part that flows would be the *stannum* of Pliny. Et hoc docet Plinius adulterari plumbo candido; with our tin, and properly considered the

well known in his time, which however I should wish to see further examined. I have searched, in vain, for this name in a great many works of the sixteenth century; but I have long entertained an idea, which I shall take this opportunity of mentioning:—Among the oldest church vessels, I have seen some articles which I considered to

stannum of Pliny is merely our *halbwerk*, of which those cans called *halbwerk* are made.

This man deserves that I should here revive the remembrance of him as well as I can. Entzel was a native of Salfeld; preacher, *pastor Osterhusensis*, as Wallerius says in *Lucubratio Acad.* p. 19, and a friend of Melanchthon, who recommended the book for publication to Egenhoff, a bookseller of Franckfort, in a letter dated 1551, in which year it was printed. It was reprinted at the same place, in 1557. Professor Böhmer, in *Biblioth.* iv. 1. p. 19, speaks of an edition which came out at Basle, in 1555, 8vo. A bad German translation may be found in *Corpus juris et systema rerum metallicarum*, or *Bergbuch*. Franckf. 1698. fol. the first edition of which was superintended by Peucer. The editor says in the preface that Entzel's book was printed so early as 1524 and 1526, at Franckfort; which however from Melanchthon's letter appears to be improbable. This book was inserted also in a collection edited by the well-known Becher at Franckfort, 1698, fol. under the following title: *Scriptorum rci metallicæ dodecas*. This small work, however, is so scarce, that I have never yet been able to procure it. In Gesneri *Biblioth. per Simlerum*, it is said, p. 121, that Entzel wrote also on fishes, and a commentary on Dioscorides, with which I am unacquainted. A dissertation *De uva quercina* is mentioned by Haller in *Methodus studii med.* p. 179; and in *Biblioth. botan.* i. p. 356: he says that it was printed with the edition of 1577 *de re metallica*. The size he improperly calls folio, in *Meth. stud. med.* Information of this kind will always be read with satisfaction, even in places where, according to the opinion of severe judges, it might not belong, by those who are fond of tracing out the history of inventions and of the sciences in general.

be *vasa stannea*, I mean such as when newly scoured and polished had a silvery brightness, and when they remained long without being cleaned acquired a dull gray colour, and a greater weight than bronze. Those who show these things commonly say, that the method of composing the metal is lost; but that it contains silver, and, according to the assertion of many, even gold. Such articles deserve, undoubtedly, to be examined by our chemists.

I shall further remark, on this subject, that the *abstrich*, as it is called, which in many respects has a resemblance to *stannum*, and contains also lead and silver, but at the same time metals difficult of fusion, is employed in the arts, and collected for the use of the letter-founders.* For this purpose it is well adapted, on account of its hardness and durability; and in want of it lead must be mixed with regulus of antimony. At the lower Harze the workmen began so early as 1688 to revive this *abstrich* in particular; and as the lead thence obtained, on account of its hardness, could not be disposed of like common lead, it was sold to the letter-founders at Brunswick, at first at the rate of a hundred weight for two and a half dollars, and in the year 1689 for three

* The French letter-founders take four fifths of lead and one fifth regulus of antimony; those of Berlin use eleven pounds of antimony, twenty-five of lead, and five of iron. Many add also tin, copper, and brass.

dollars.* But in Schlüter's time a small quantity of it only was made annually, because the *abstrich* could be used with more advantage for other purposes. This lead, says Schlüter, had the appearance of bronze, and was so brittle, that a piece of it broke into fragments when struck.†

Speise also, which is obtained at the blue colour-works, can be employed in the same manner. Under this term is understood a metallic mixture deposited during the preparation of blue glass, and which is composed of various metals combined with cobalt, but particularly iron, copper, arsenic, and perhaps also bismuth. It is hard, brittle, sonorous, and assumes a good polish, though it is not always of the same quality in all manufactories. As it contains some colouring particles, it is in general again added to the glass residuum. But when I lately paid a visit to the colour-mill at Carlshafen, Mr. Birnstein the inspector told me, that the regulus of cobalt was manufactured at Halle into buttons of every kind. This probably is the case there in those button-manufactories established by G. H. Schier, in which at present buttons of all patterns are made annually to the value of 30,000 dollars.‡ The

* Gatterer Anleitung den Harz zu bereisen 3. p. 52.

† Von Hutten-werken, p. 376.

‡ A good account of this manufactory may be found in the *Journal für Falrik, Manufact. Handlung und Mode* 1793. We are told there that the buttons were made of a composition which had a white silver-like colour, and was susceptible of a fine polish.

ancients, in my opinion, employed in a similar manner the *werk* of their silver smelting-houses.

I shall now proceed to examine that metal which the Greeks named *κασσιτερος*, or, as Pliny says, *Cassiteron*, and which he expressly adds was called by the Latins *plumbum candidum* (white lead). I have no new hypothesis to recommend; my sole object is truth. I wish for certainty, and, when that is not to be obtained, probability; at the same time, however, I cannot rest satisfied with the judgment given by the compilers of dictionaries, and the translators and commentators of ancient authors, because I firmly believe that they never made any researches themselves on the subject.

That the ancients were acquainted with our tin as early as we find the word *cassiteros* mentioned by them, I am not able to prove, and I doubt whether it is possible to do so; the contrary seems to me to be more probable. In my opinion it was impossible for the Phœnicians, at so early a period, to obtain this metal from Portugal, Spain, and England, in such quantity that it could be spread all over the old world. The carriage of merchandise was not then so easy. If all the *cassiteron* was procured from the north-west parts of Europe, it appears to me that it must have been much dearer than it seems to have been in the oldest times, to judge from the information that has been preserved.

In my opinion the oldest *cassiteron* was nothing else than the *stannum* of the Romans, the *werk* of our smelting-houses, that is, a mixture of lead, silver, and some other accidental metals. That this has not been expressly remarked by any Greek writer, is, to me, not at all surprising. The works of those who might be supposed to have possessed knowledge of this kind have not been handed down to us. We should not have known what *stannum* was, had not the only passage of Pliny which informs us been preserved. I am as little surprised that Herodotus should say, he did not know where *cassiteron* was obtained. How many modern historians are ignorant of the place from which zinc, bismuth, and tombac are brought; and however easy it might be for our historians to acquire knowledge of this kind if they chose, it was in the same degree difficult for Herodotus, in whose time there were not works on mineralogy, technology, and commerce, to furnish such information. At the period when he lived, *cassiteron* perhaps was no metallurgic production of any neighbouring mines, but a foreign commodity, a knowledge of which, mercantile people endeavoured in those early ages, much more than is the case in modern times, to conceal, and which also could be better concealed than at present.

That real tin was afterwards known to the Greeks, I readily believe; but I find no proof of it, nor can I determine the time at which they

first became acquainted with this metal. It is not improbable that they considered it only as a variety of their old *cassiteron*, or the *stannum* of the Romans, as the latter declared both to be a variety of lead. It might be expected that the Greeks would have given a peculiar name to the new tin, in order to distinguish it from the old, as the Romans really did; but this appears not to have been the case. I think, however, to have remarked that, so early as the time of Aristotle, real foreign tin was called the Tyrian or Celtic, because Tyre undoubtedly was, at that period, the market for this commodity.* It is to be recollected also, that the modern languages do not so speedily make and adopt new names for new articles as our present chemists and mineralogists. How long were zinc and bismuth called marcasite or lead; and how long was platina named white gold? Even at present the French call brass yellow copper.

* Aristot. de cura rei famil. lib. ii. according to du Val's edition iii. p. 695: Pythocles Atheniensibus consilium dedit, ut plumbum Tyrium, του μελυδου του εκ των Τυριων, respublica a privatis ad se reciperet, eo pretio quo vānibat, nimirum duobus denariis, ut civitas deinde illud venderet, constituto pretio denariorum sex. I shall take the liberty to remark, that monopolies, which many princes have claimed under the false name of *regalia*, such as the trade in rhubarb, saltpetre, mastic, and the like, do not belong to the finance operations of modern invention. --- In Aristotle's *Auscultat. mirabil.* cap. 51. p. 100, the author relates a phenomenon which, in general, is applicable to tin; and he calls the metal του κασσιτερον του Κελτικου.

According to the conjectural accounts hitherto given, there is no necessity for believing the word *cassiteron* to be Phœnician or Celtic. The Greeks seem to have used it before they had Phœnician tin; and because they afterwards considered the Phœnician ware as a kind of their *cassiteron*, and at the same time heard of islands from which it was brought, they named these islands the *Cassiterian*, as Herodotus has done, though he expressly says that he did not know where they were situated. This ancient historian seems to have entertained nearly the same opinion in regard to the origin of the name; for he adds: At any rate the name Eridanus is not foreign, but originally Greek.* It is, however, very possible that every thing said of these islands, in the time of Herodotus, was merely a fabrication of the Greek merchants, none of whom had the least knowledge of the Phœnician trade to England.† In this case the *Bedil* of the Hebrews might be only *stannum*, and thus would be removed the wonder of Micha-

* Lib. iii. p. 254: De extremitatibus Europæ ad vesperam quod pro comperto referam, non habeo, neque enim assentior fluvium quendam Eridanum a barbaris vocitari, unde electrum venire narratur. Ne Cassiteridas quidem novi insulas, unde ad nos venit cassiteros, nam vel ipsum coarguit nomen Eridanus, quod Græcum est, et non barbarum, ab aliquo poeta fictum.

† That the merchants, in the oldest periods, endeavoured by false information to conceal the sources of their trade, might be proved by various instances. Ptolemy says, *Geograph.* i. 11: mereatura occupati veritatis indagacionem haud curant; quin sæpius distantias arroganti quadam jaetatione augere solent.

elis, how the Midianites could have obtained tin so early.* I will not, however, deny that the contrary of what has been here stated is equally possible. The Greeks might have obtained real tin at a very early period by trade, and along with it the foreign name, from which was formed *cassiteros*. The art of preparing *stannum* may not have been known among them, and therefore under the *cassiteron* of the Greeks we must undoubtedly understand tin. In this case one could comprehend why *stannum* is not mentioned in the works of the Greeks; and if the *plumbum album* of Pliny be our tin, of which there can be scarcely a doubt, his testimony that the *cassiteron* of Homer was the same belongs to this place.

In regard to the question, which opinion seems the most probable, I will not enter into any dispute; but I must maintain that, in regard to the periods of Homer and Herodotus, no certainty can be obtained. To justify this assertion, I shall here point out every thing I have found relating to *cassiteron*, and, as far as possible, in the original words, quoting the different works in the manner in which all the words for dictionaries of natural history ought to be arranged.

I. Vocatur Latinis *plumbum candidum*¹ sive *album*^{1 2}, et Græcis jam Iliacis temporibus teste Homero *cassiteron*¹.

* Supplementa in Lexica Hebraica, p. 151.

II. *Mineræ* (calculi) coloris nigri, quibus eadem gravitas quæ auro ¹.

III. Non nascitur cum argento, quod ex nigro fit ¹.

IV. Nascitur summa tellure arenosa ¹; sed etiam ex profunda effoditur ⁸.

V. Arenæ istæ lavantur a metallicis, conflataeque in album plumbum resolvuntur ¹.

VI. Plumbum candidum est pretiosius nigro ¹.

VII. Facile in igne fluit, ita ut plumbi albi experimentum in charta sit, ut liquefactum pondere videatur, non calore rupisse ^{1 3}. *Celticum* citius quam plumbum fluit, atque adeo in aqua; colore inficit, quæcunque tangat ³.

VIII. Nulli rei sine mixtura utile ¹.

IX. Adulteratur plumbo nigro ⁴.

X. Stannum adulteratur addita æris candidi tertia portione in plumbum album ¹.

XI. Incoquitur æris operibus, Galliarum invento, ita ut vix discerni possit ab argento, eaque *incoctilia* vocant ¹.

XII. Adhibetur ad ocreas heroum ¹⁶; ad thora- ces exornandos ^{17 18}; ad scuta ornanda ^{19 20}; ad specula ²⁵.

XIII. Ex eo nummos percussit Dionysius tyrannus Syrac. ^{21 22}.

XIV. Secum jungi nequit sine plumbo nigro, nec plumbum nigrum inter se jungi potest sine albo ^{1 24}.

XV. Gignitur in *Hispania* ⁸; Lusitania ^{1 8} Gal-

læcia¹, in Iberia^{11 12}, apud Artabros⁸, in *Britannia*¹⁰: in insulis quæ Cassiterides dictæ sunt Græcis^{5 6 8 11 23}, in insula quam Mictim vocat Timæus, et a Britannia sex dierum navigatione abesse refert⁷; in insulis Hesperidibus^{13 14 15} apud *Drangas* populos Persicos regionis Arianae⁹. *

To this I shall add the following illustration. The name *cassiteron* is supposed, in general, to be derived from the Phœnician or Chaldaic; † but on this point I am not able to decide. Mela, where he explains the name of the Cassiterian islands, calls it only *plumbum*, without the addition of any epithet, unless it has been lost in transcri-

* The authors here quoted, corresponding to the above figures, are as follows: (1) Plinius, xxxiv. 16. p. 668. (2) Cæsar de bello Gallico, v. 12. (3) Aristot. *Auscult. mirab.* cap. 51. p. 100. (4) Galenus de *Antidot.* i. 8. p. 209. ed. gr. Basil. vol. ii. p. 431. (5) Plin. iv. 22. p. 630. (6) Herodot. lib. iii. p. 254. edit. Wess. (7) Plin. iv. 16. p. 223. (8) Strabo, lib. iii. p. 219. ed. Almel. (9) Strabo, lib. xv. p. 1055. (10) Diodor. Sic. lib. v. p. 347. ed. Wess. (11) Diod. Sic. lib. v. p. 361. (12) Stephan. Byzant. v. *Tantessus*, p. 639. (13) Dionys. *Penegesis*, v. 563. (14) Prisciani *Perieg.* v. 575. (15) Avienus *Descript. urbis*, v. 743. (16) Homeri *Iliad.* xviii. 612. (17) *Iliad.* xi. 25. (18) *Iliad.* xxiii. 561. (19) *Iliad.* xviii. 565, 574. (20) Hesiod. *Scut. Herculis*, v. 208. (21) Aristot. *Æconom.* lib. ii. p. 594. (22) Pollux *Onomast.* p. 1055. (23) Mela *de situ orbis*, iii. 6. 24. p. 275. (24) Plin. xxxiii. 5. p. 621. (25) Plin. xxxiv. 17. § 48. p. 669; and lib. xxxiii. § 45: Optima specula apud majores fuerant Brundisiana stanno et ære mixtis. From a similar mixture the best metallic specula are cast at present.

† Bochart *Chanaan*, p. 719. Borlase's Observations on the Antiquities of Cornwall. Oxford 1754. fol. p. 29.

bing. But Pliny himself says* *Cassiterides dictæ Græcis a fertilitate plumbi*. It is possible, therefore, that the leaden vessels, which are often mentioned in the works of the ancients, were in part tin; but I cannot possibly agree with Millin,† who makes the *cyanos* of Homer to be tin. This word evidently denotes mountain-green, or some species of stone coloured by it, which in former times, like the lapis lazuli at present, was employed for making various kinds of ornaments. Besides, *cyanos* and *cassiteros* are mentioned in the Iliad,‡ as two different things.§

What Pliny says of the colour and weight of those minerals that produced tin, corresponds exceedingly well with tin ore, which, as is well known, is among the heaviest of minerals, though the specific gravity of the metal itself is but small. It is also true that lead is seldom found without silver; and tin perhaps has never been found with the latter. What we read in regard to the obtaining of tin ore, agrees very well with our washing-works. Even at present the greater part of the tin ores are found in fragments and washen.

* Lib. iv. cap. 22. p. 230.

† *Mineralogie Homérique*, par Aubin-Louis Millin, Paris 1790. 8vo. p. 90. This small treatise is much esteemed. A translation of it was printed at Königsberg in 1793, in octavo. I have not seen it; but the translator seems to be one of those who translate the names used by the ancients in natural history, without giving themselves much trouble to obtain full proofs.

‡ Lib. xi. 24, 25.

§ See what I have already said, vol. ii. p. 324.

The smelting of this metal, even when all the rules of art are not employed, is attended with little difficulty, though Goguet is of a different opinion. As of all metals it melts easiest in the fire, it requires only a small degree of heat and no artificial furnace; but as it is readily calcined, and after repeated reduction loses its malleability, care must be taken that the reduced metal can immediately flow off; and on that account our furnaces have an aperture always kept open. It is probable that the ancients, in their small furnaces, could easily make a similar arrangement.

Tin, at all times, must have been dearer than lead, as the latter was found in abundance, but the former in small quantities. In England, at present, tin costs about five times as much as lead. At Hambugh, in 1794, a pound of English block tin cost eleven schillings and a half, and tin in bars thirteen schillings; but a hundred pounds of English lead were worth, at that time, only fourteen marks, and Goslar lead eleven and a half marks ready money.

That tin melts easier than lead is very true. According to the latest experiments the former fuses at 420 degrees, whereas lead requires 550 of Fahrenheit's thermometer. Both metals can be fused in paper when it is closely wrapped round them. Aristotle and Pliny meant to say the same thing of their paper; and the latter adds that the paper, even when it became torn, was not burnt.

What the first says of melting in water, some have too inconsiderately declared to be a fable; but it is not entirely false. Tin melts in water over the fire before the water is converted into steam; and when mixed with lead and bismuth it is so fusible that it melts in boiling water, because it requires less heat to be fused than water does to be brought to a state of ebullition. That the Celtic tin contained a great deal of lead, appears from the observation, that when rubbed it made the fingers black; an effect which would not have been produced by pure tin.

That tin in the time of Pliny was mixed with lead, and in various proportions, we are told by himself. At that period a mixture of equal parts tin and lead was called *argentarium*; and that of two parts lead and one part tin, *tertiarium*. Others mixed the latter composition with an equal quantity of tin, and named the mixture also *argentarium*, and this was commonly used for tinning.

I must, however, acknowledge that the last words of Pliny I do not fully comprehend. They have not indeed been noticed by any commentator; but I do not, on that account, believe that I am the only person to whom they have been in part unintelligible. Savot and Watson,* who were undoubtedly capable of giving some decisive opinion on them, have purposely left that part, which to

* Savot. p. 53. *Chemical Essays*, by Watson, Cambridge 1786. 2mo. iv. p. 187.

me appears obscure, untranslated, and without any explanation. Pliny says: *improbiores ad tertiarium additis æquis partibus albi, argentarium vocant, et eo quæ volunt, incoquant.* He seems here to throw out a reproach against those who melted together equal quantities of *tertiarium* and pure tin, and then gave it the name of *argentarium*, as if it had been of an inferior quality to the *argentarium* first named. But equal quantities of *tertiarium* and pure tin produced a mixture, in which for *one* part of lead there were *two* of tin. How then could those who made this mixture be called *improbiores*? To answer this question I shall venture to give my conjecture. Pliny perhaps meant to say, that tinning properly ought to be done with pure tin, but that unprincipled artists employed for that purpose tin mixed with lead. If this be the true meaning, his reproach was not unfounded. On the same account, because all tin was then adulterated with lead, Galen gives cautions against the use of tinned vessels,* and advises people to preserve medicines rather in glass or in golden vessels. But why does Pliny add: *ideo album nulli rei sine mixtura utile?* In using these words, it is possible he may have alluded

* Galenus *de Antidotis*, i. cap. 8: recondi debent in vase stanneo, aut vitreo, aut etiam aureo, εν αγγειω καττιτερινω. Vitro siquidem et auro nihil fraudulenter admisceri potest. Stannum autem plumbo adulteratur ὁ δὲ καττιτερινος μιξει μολυβδου δολουται, quod vitare conveniet, non solum in hoc antidoto, sed in quibuscunque aliis medicinis.

not to tinning, but to things cast of tin, which, according to the ideas of that time, or the nature of the tin, if of that metal alone, would be too brittle. This seems to be said by the preceding words, to which the *ideo* refers: *albi natura plus aridi habet, contraque nigri tota humida est ideo album* - - - I hope the reader will forgive me for entering so deeply into criticism; but if Pliny's valuable work is ever to become intelligible, occasional contributions of this kind must not be despised.

Of the process employed in tinning, in ancient times, we have no account; but the words of Pliny *incoquere* and *incoctilia* seem almost to denote that it was performed, as in tinning our iron wares, by immersing the vessels in melted tin. It appears also to have been done, at an early period, in a very perfect manner, both because the tinned articles, as Pliny says, could scarcely be distinguished from silver, and because the tinning, as he adds, with an expression of wonder, did not increase the weight of the vessels. The metal, therefore, was applied so thin that it could make no perceptible addition to the weight. This is the case still, when the work has been skilfully executed; and it affords a remarkable proof of the astonishing divisibility of metal. Dr. Watson caused a vessel, the surface of which contained 254 square inches, and which weighed twenty-six ounces, to be tinned, and found that the weight

was increased only half an ounce; consequently half an ounce of tin was spread over 254 square inches.

But, notwithstanding all this dexterity, which must be allowed to the Romans, they appear to have employed tinning, at any rate for kitchen utensils and household furniture, very seldom. It is scarcely ever mentioned, and never where one might expect it, that is to say, in works on cookery and domestic economy, where the authors give directions for preparing and preserving salt provisions. When they speak of the choice of vessels, they merely say that new earthen ones should be employed. Some of the physicians only have had the foresight to recommend tinned vessels.* It does not appear indeed that the Romans, though copper vessels were in general use among them, employed any precautions to prevent them from being injurious to the health. Pliny only says that a coating of *stannum* improved the taste of food, and guarded against verdigrise. The former part is to be thus understood; that the bad taste occasioned by copper was prevented; but he does not say that the health was secured by it. The term also *incoctilia*, usual in the time of Pliny,

* Dioscorides, lib. i. cap. 38. p. 25: εις λεβητα κηκασσιτερωμενον βαλλει, in lebetem stanno obductum. In the fifth book, chap. 110, p. 168, he names leaden and tin vessels, μολιβδινα, κασσιτερινα. This passage can hardly be right; it ought to be: in glass, but not in leaden vessels; for Dioscorides certainly must have known that quicksilver could not be kept in these metals.

is found in his works alone. It is likewise remarkable, that among the numerous vessels found at Herculaneum, as I have already remarked, the greater part of them were of copper or *stannum*, few of which were silvered, and none tinned. Had tinning been then as much used as at present, some tinned vessels must have been found.*

I shall further remark, that Pliny ascribes the invention of tinning to the Gauls; and that he extols in particular the work of the Bituriges, the old inhabitants of the province of Berry, and those articles made at Alexia or Alegia, which is considered to have been Alise in Auxois; that he speaks of tinning copper and not iron, and that according to his account not only tin was used for that purpose, but also *stannum*. By the passages already quoted it is proved, that in the time of Homer *cassiteron* was employed for ornamenting shields and certain kinds of dresses; but the further illustration of them I shall leave to others. The shields perhaps were inlaid with tin; and it is not improbable that threads were then made of this metal, and used for embroidering. That this art was at that period known may be readily believed, since the women of Lapland embroider

* *Recueil d'antiquités*, par Caylus, i. p. 269, and v. p. 291. Winkelmann's *Sendschreiben von dem Herculanischen Entdeckungen*, Dresden 1762. 4to. p. 61. Also the same author's work, entitled *Nachrichten von den Herculanischen Entdeckungen*, Dresden 1764. 4to. p. 40. De la Lande *Voyage d'un François en Italie*, vii. p. 120. Volkman *Nachrichten von Italien*, iii. p. 285.

their dresses, and particularly their fur cloaks, in so delicate and ingenious a manner, with tin threads drawn out by themselves, as to excite astonishment.*

What Pliny says is true, that lead cannot be soldered without tin, or tin without lead. For this operation a mixture of both metals, which fuses more readily than each of them singly, is employed. Instead of oil, mentioned by Pliny, workmen use at present, in this process, colophonium or some other resin.

That vessels were made of cast tin at an early period is highly probable; but I do not remember to have seen any of them in collections of antiquities. I am acquainted only with two instances of their being found, both of which occurred in England. In the beginning of the last century some pieces of tin were discovered in Yorkshire, together with other Roman antiquities;† and in 1756 some tin vessels of Roman workmanship with Roman inscriptions were dug up in Cornwall.‡

* I. Schefferi *Lapponia*, Francof. 1673. 4to. p. 210. 261, where a figure is given of a Lapland woman drawing threads. Högstrom's *Beschreibung des Schwedischen Laplands*, Copenhagen 1748. 8vo. p. 97. Georgi *Beschreibung aller nationen des Russischen Reichs*. St. Petersburg 1776. 4to. p. 17.

† *Philos. Transact.* 1702, 1703. vol. xxiii. p. 1129.

‡ *Philos. Transact.* 1759. vol. li. p. 13, where figures of the vessels are given. *The History of Manchester*, by John Whitaker, London 1771. 4to. i. p. 306.

I shall pass over the history of the tin trade of the Phœnicians, the Greeks, the Gauls, and the Romans, respecting which only scanty and doubtful information is to be found in the works of the ancients, but in those of the moderns a greater number of hypotheses. The situation even of the Cassiterides islands cannot with certainty be determined, though it is supposed in general, and not without probability, that they were the Scilly islands, which lie at the distance of about thirty miles from the most western part of the English coast; that is, the extremity of Cornwall, or, as it is called, the Land's End. At the same time we must adopt the opinion of Ortelius, that under that appellation were included the coasts of Cornwall and Devonshire.* To those who are on the Scilly islands, Cornwall, as Borlase remarks, appears to be an island; and as it is impossible that the Scilly islands, which were called also *Silures*, could furnish tin sufficient for the ancient trade, especially as few and very small traces of old works are observed in them, it is more probable that the greater part of the metal was obtained from Cornwall. That the Phœnicians themselves worked mines there, cannot be proved; it is rather to be supposed that they procured the metal from the inhabitants by barter; but, on the other hand,

* Antiquities of Cornwall, p. 30. And in particular, *Observations on the ancient and present state of the islands of Scilly*. By Borlase, Oxford 1756, 4to. p. 18 and 57.

there is reason to believe, from various antiquities, that the Romans dug up the ore themselves from the mine, and had works for extracting the metal.

The island Ictis of Diodorus Siculus, to which the ancient Britons carried tin, and from which it was conveyed by the Gallic merchants, is generally considered as the isle of Wight; but Borlase remarks very properly,* that Ictis, according to the account of the ancients, must have been much nearer to the coast of Cornwall. He conjectures therefore, and with great probability, that this word was the general appellation of a peninsula, or bay, or a place of *depot* for merchandise.† If the Mictis of Timæus and the Vectis of Pliny are not this island Ictis, it will be difficult to find them. It is very singular that Dionysius, a later writer, and his follower Priscian, and Avienus, call the *Cassiterides* islands the *Hesperides*.‡

That the Drangians had tin mines appears to me highly improbable; Strabo is the only writer who says so, in a few words; and nothing of the kind is to be found in any other author. If Drangiana be considered as a part of Persia, to which that district belongs at present, it is stated by all modern travellers that tin is not to be found

* Natural Hist. of Cornwall. p. 177.

† In the Antiquities of Cornwall, p. 394: *Ik, yk, ick*, a common termination of creeks in Cornwall, as *Pordinik, Pradnik*.

‡ Dionysii orbis descriptio. Londini 1679. 8vo. p. 220, where Hill's observations deserve to be read.

any where in the Persian empire.* If we reckon it a part of India, Pliny asserts that no tin works were then known in that country. In his time, this metal was sent thither as an article of commerce, and was purchased with precious stones and pearls. This last circumstance has by some been considered as a proof of the high price of the metal at that period; but he says nothing farther than that tin was among the imports of India at that time, and that jewels and pearls formed a part of the exports. It may be said, that the inhabitants of the Spanish colonies in America give their silver for our linen, but we cannot thence prove that it bears a high price.

That the word *stannum*, in the time of Pliny, did not signify tin but a compounded metal, is as certain as that, in later times, it became the common name of tin. Hence arises the question: Since what time has our tin been known under the appellation of *stannum*?

This question, as far as I know, has never yet been examined; and this, I hope, will be a sufficient excuse if I should not be able to give an answer completely satisfactory. The first author in whom I find the Greek word *cassiteros* translated by *stannum* is Avienus, in the free translation of Dionysius; who, as proved by Wernsdorf, lived

* *Voyages de Chardin*. Rouen 1723. 12mo. iv. 65, where it is expressly said that Persia has no tin, but that it obtains it from India. The same thing is confirmed by Tavernier.

about the middle of the fourth century.* The next who translates the Greek word in the same manner, is Priscian; who, according to the grounds alleged by Wernsdorf, must have lived in the beginning of the sixth century.

From what I already know I suspect, that the long and improper name *plumbum candidum* began in the fourth century to be exchanged for *stannum*; and it is probable that, at that time, tin was so abundant that it banished the old *stannum*, to which it might have a resemblance. In later centuries, then, *stannum* always signified tin; and in the middle ages various words were arbitrarily formed from it, which do not occur in the Latin authors. The *stannea tecta*, or roof of the church at Agen, on the Garonne, in Guienne, described by the ecclesiastical poet Fortunatus,† about the end of the sixth century, consisted, undoubtedly, of tinned plates of copper. *Stagnare* occurs often for tinning, as *stagnator* does for a tin-founder. In the thirteenth century, Henry III of England gave as a present a *stagnarium* or a *stannuria*, a tin mine or tin work, or, as others say, *fodina stanni*. In the fourteenth century there was in England, under Edward III, a *stannaria curia*; and in the

* Where the author mentions *κασιτερος*, the translator has *metalli albertis stanni venas*, v. 753. And in the poem *Ora maritima*, v. 293: *mons argentarius* - - - *stanno plurimo nitet*.

† Fortunati *Opera*, ed. Michaelis Angeli Luchi. Romæ 1786. 4to. i. p. 14. lib. i. cap. 8: *stannea tecta dedit*.

same century, besides various other ornaments, *lunulæ stanneatæ* were forbidden to the clergy. In a catalogue of the year 1379, the following articles occur: *tria parva stanna modici valoris - - - item unum stannum parvum - - - item duo magna stanna.**

In regard to the tin trade of the Spaniards, I can unfortunately say nothing: the tin works in Spain, we are told, were abandoned under the government of the Moors. England, as is generally asserted, enjoyed an exclusive trade in this metal till the thirteenth century, when the tin mines were discovered and worked in Bohemia. But the exact time when this took place I am not able to determine. The Bohemian works, in all probability, are older than the Saxon; but it is still more certain that the account given by Hagec, that they were known so early as the year 798, is entirely void of foundation.†

When the English writers ‡ treat on the history of this metal, they seldom fail to repeat what has been said on the subject by Matthew Paris.§ This

* Proofs may be found in Dufresne.

† Wencisl. Hagec *Böhmische Chronik*. Nürnberg 1697. fol. p. 53. Möhsen, however, in *Beyträgen zur Gesch. der Wissenschaften in Brandenburg*, Berlin 1783, 4to. p. 205, has adopted this account as true.

‡ For example, Borlase in *Natur. Hist.* p. 160. *Speed's Theatre of the empire of Great Britain*, Lond. 1676. fol. *Cambden's Britannia*, Gibson's edit. Lond. 1695. fol. p. 3. Anderson in his *Hist. of Commerce*, &c.

§ *Historia major*, p. 507: Eodemque anno (1241) inventum est

Benedictine monk, who was by birth an Englishman, and died in 1259, relates, in his History of England, that a Cornish-man having fled to Germany, on account of a murder, first discovered tin there in the year 1241. He adds, that the Germans soon after furnished this metal at so cheap a rate, that they could sell it in England, on which the price there fell, very much to the loss of Richard Earl of Cornwall, so well known by his having been elected king of the Romans. Since Matthew relates this as an event which took place in his time, it would perhaps be improper to doubt it; but it still appears strange, that no mention is to be found of this circumstance in the Bohemian or German Annals. Gmelin also must not have met with any account of it, else he would have announced it. Peithner likewise is silent respecting it: on the contrary, he says that the tin mines in the neighbourhood of the town of Graup-

stannum in Alemannia primum et purissimum copiosius quam in partibus Angliæ. Quod ab initio mundi antea, nisi tantum in Cornubia aliquo loco non legitur fuisse repertum, et ideo pretium ejus in Anglia propter copiam abundantem, quam in Angliam transmisit Alemannia, fuit minoratum ac vilificatum. This metal, however, must have remained long dear; for it is remarked in the *Archæologia*, vol. iii. p. 154, from an expense-book of the Earls of Northumberland, that vessels of tin, about the year 1500, in consequence of their dearness had not become common. This is confirmed also by a regulation respecting the household of Henry VIII. printed also in the *Archæologia*, where it is said: Officers of the squillery to see all the vessels, as well silver as pewter, be kept and saved from stealing.

pen were discovered so early as the year 1146, by a peasant named Wnadec, belonging to the village of Chodicze.* Of the antiquity of the Saxon mines I can give no account: had any information on that subject existed, it would certainly have been noticed by Gmelin.†

Brusch, who was murdered by two noblemen in 1559, seems to place the discovery of the tin mines at Schlackenwalde, which he says are younger than those of Schönfeld, in the thirteenth or twelfth century.‡ Albertus Magnus, who died in 1280, says that, in his time, a great deal of tin was dug up in various parts of Germany.§ At present the principal tin works are at Geyer, Ehrenfriedersdorf and Altenberg.

The art of tinning plate-iron was invented either in Bohemia or Germany, and introduced at a later period into England, France, and other countries. But as the whole history of the German mines is very defective and uncertain, the period when this useful and highly profitable branch of business

* Peithners Versuch über die Geschichte der Böhmischen und Mährischen Bergwerke. Wien. 1780. fol. p. 85.

† J. F. Gmelin Beyträge zur Geschichte des teutschen Bergbaues. Halle 1783. 8vo. p. 121.

‡ C. Bruschi redivivi Beschreibung des Fichtelberges. Nürnberg 1683. 4to. p. 3 and 40. *Ausführliche Beschreibung des Fichtel-Berges.* Leipsic 1716. 4to. p. 34 and 194.

§ *Liber quartus mineralium*, cap. 4: Invenitur stannum duplex, scilicet durius et siccius, quod venit de Anglia sive Britannia, et mollius aliquantulum, quod in Germaniæ partibus abundantius invenitur.

was begun is not known. Yarranton, an English writer, of whom I shall speak more hereafter, relates that the first tinning of this kind was made in Bohemia; that a catholic clergyman, who embraced the Lutheran religion, brought the art, about the year 1620, to Saxony, and that since that time all Europe has been furnished with tinplate from Germany.

This much, however, is certain, that the tinning of iron is more modern than the tinning of copper. The first articles made by the bottle-makers were flasks of copper tinned, which in old times were used in war and on journeys, like the *stagnone* still employed in Spain and Portugal, in which all kinds of distilled waters are sent from Malta.*

Among the English, who formerly had a monopoly of the tin trade, and who still possess the best and richest tin mines, the introduction of this art of employing their native production did not at first succeed; and this circumstance afforded Becher a subject for raillery.† But, about the year 1670, a company sent to Saxony, at their expense, an ingenious man named Andrew Yarranton, in order to learn the process of tinning. Having acquired there the necessary knowledge, he returned to England with some German workmen, and manufactured tin plate, which met with

* See *Gegenwärtiger staat von England, Portugal, und Spanien* (by Theodore King of Corsica), ii. p. 25. *Warenkunde*, i. p. 553.

† *Narrisch Weisheit*, p. 51.

general approbation. Before the company, however, could carry on business on an extensive scale, a man of some distinction, having made himself acquainted with Yarranton's process, obtained a patent for this art; and the first undertakers were obliged to give up their enterprise, which had cost them a great deal of money, and yet no use was made of the patent which had been obtained.*

About the year 1720, which, on account of the many new schemes and the deceptive trade carried on in consequence of them, will ever be memorable in the history of English folly, among the many *bubbles*, as they were then called, was an establishment for making tin plate; and this was one of the few speculations of that period which were attended with advantage. The first manufactory of this kind was established in Monmouthshire, perhaps at the village of Pontypool, where tin plate was at any rate made so early as 1730.† At present, the English assert that their iron plate is covered with pure block tin, which in colour, splendour, and pliability, exceeds all the foreign. The first part of this assertion, however, is by foreigners doubted.‡ In France, the first

* This is related by Anderson and Watson, from a book which I have never seen, entitled, *England's improvement by sea and land*, by And. Yarranton, gent. 1698.

† Watson's chemical essays, iv. p. 203. Anderson's Hist. of Commerce.

‡ See Rinmann's *Anleitung zur Bearbeitung des Eisens*, p. 132.

experiment to introduce this branch of manufacture was made under Colbert, who procured workmen, some of whom were established at Chenesey, in Franche-Comté, and others at Beaumont-la-Ferriere in the Nivernois. But the want of skill and proper support rendered this expensive undertaking fruitless. Some manufactories, however, were brought to be productive in the last century; the oldest of which was established at Mansvaux in Alsace, in the year 1726. This was followed, in 1733, by another at Bain in Lorraine, which obtained its privilege from Duke Francis III, and this was confirmed by Stanislaus in 1745.*

* That tin, in modern times, has been brought from the East Indies to Europe is well known; but I have never been so fortunate as to discover when this trade began. It is, however, known, that at the commencement of the sixteenth cen-

* This is related by Diderot in his article *Fer-blanc* in the *Encyclopédie*. That the *Fer-blanc* of the French is tin plate every one knows; but what are we to understand by *ferrum candidum*, a hundred talents of which were given as a present to Alexander in India? No commentator has noticed this appellation. In the index, however, to Snakenburg's *Curtius*, I find the conjecture that it may mean the *ferrum Indicum*, which, lib. xvi. §7. *ff de publicanis*, or *Digest. xxxix. 4. § 16. 7*, is named among the articles liable to pay duty; but some editions in this passage have *ebenum Indicum*. The reader is referred also to Photii *Biblioth.* p. 145, where Ctesias relates a fable in regard to Indian iron. Pliny, xxxiv. 14, p. 667, mentions *ferrum Sericum*, which, in his time, was considered as the best; but still it may be asked, why is the epithet white applied in particular to the Indian iron? Compare Aristot. *de Mirab. Auscult.* p. 96 and 426.

ture a good deal of information had been obtained in Europe in regard to East Indian tin. Louis Bartheima, who was then in India, speaks of Malacca tin,* as does also F. Mendez Pinto,† who was there in 1537, and Odoard Barbosa mentions that which was carried from Caranguor to Malacca. Barbosa wrote in 1516.‡ Munster, Mercator, and other old geographers relate, that before the establishment of the Portuguese dominion in India, large tin coins were in circulation in the island of Sumatra.

The greater part of the East-Indian tin comes from Siam, Malacca, and Banca. In the last-mentioned place, which is an island near the south-east coast of Sumatra, the mines are said to have been discovered in 1711. At present, there are ten pits, which are worked by Chinese, on account of the king of Palimbang. One hundred and twenty-five pounds cost him only five rix dollars; and for this quantity he receives from the Dutch East-India company, to whose government he is subject, from thirteen to fifteen dollars. The greater part goes to China, or is used in India; but in the year 1778 the company sent 700,000 pounds to Europe, which was sold at the rate of a hundred pounds for forty-two florins. Malacca furnishes

* *Navigazioni et viaggi raccolte da Ramusio.* In Venetia 1613. fol. i. p. 166. c.

† *Algem. Hist. der Reisen*, x. p. 376.

‡ *Ramusio*, i. p. m. 317. d.

yearly about three or four hundred thousand pounds; but the principal part of it remains in India. In the year 1778 the company sold 100,000 pounds in Amsterdam. A great deal of tin is sold also in its factory at Siam.* All the tin sold by it at Amsterdam between the years 1775 and 1779 amounted to 2,421,597 pounds. †

It is, however, remarkable, that of late years English tin has been sent to India, because the Dutch cannot sell theirs so cheap. In 1790 twelve hundred tons were sent to China, and ten tons to Bombay; and by this sale the price of tin rose in Cornwall from fifty-eight to seventy-two shillings per cent. ‡

SOWING-MACHINES.

THAT under the terms sowing-machine, *semoir*, drill-plough, *macchine per seminare*, are understood implements by which the seeds of those plants cultivated on a large scale, and particularly the different species of corn, can be regularly deposited in the earth, and at any distance from each

* Beknopte beschryving der Oostindische Etablissemerten. Door Ary Huysers. Amsterd. 1793. 8vo.

† Ricard's Handbuch der Kaufleute. Greifswald, 1783. 4to. i. p. 57.

‡ Transactions' of the society for the encouragement of arts, vol. x.

other, at pleasure, is at present generally known. The principal part of the machine consists of a box, having within it a cylinder furnished with cogs, which forms the axes of two wheels, and which, as it revolves, assists the seed put into the box to escape through holes formed at a proper distance from each other in the bottom.

At first, these machines were exceedingly simple, and had only in the fore-part a ploughshare; but afterwards a harrow was applied behind, so that with such an apparatus one could plough, sow, and harrow, at the same time. It was attended, however, with the common fault of all very complex machines; it was too artificial, too expensive, and too easily deranged. The greater part, therefore, of those lately made have only a harrow behind them.

Since the beginning of the last century, so many machines of this kind have been invented, that to give a complete catalogue of them would be difficult. The invention, however, does not belong either to our period or to the English, who have hitherto paid the greatest attention to the improvement and employment of it. I have some where read, that a proposal for a machine of this kind occurs in Theophrastus; but I have not yet been able to discover the passage. I am much rather inclined, from the information I have hitherto obtained, to place this invention in the sixteenth century, and to ascribe the merit of it to the Italians.

By our oldest writers on agriculture, Heresbach, Colerus, Florinus, Hohberg, and others, it is not mentioned.

Joseph Locatelli, of whom, however, very little is known, is commonly considered as the inventor. That he was a nobleman of Carinthia, but not a count, as he is called in Iöcher's Dictionary of Learned Men, is proved by a small work consisting of two sheets in quarto, now in my possession.* It is there stated, that experiments were made with a machine of this kind by the emperor's order, at the imperial palace and market of Laxenburg, in the presence of a commissioner, named Pietro Bonaventura von Crollolanza, appointed for that purpose. These experiments succeeded so well, that a crop of sixty for one was obtained from land not manured, and subject to frequent inundation. On this account the emperor rewarded the inventor, and sent him with letters of recommendation to the king of Spain.

In this small work no date is mentioned, but on the title-page; and if that be correct, the invention must be placed in the last year of the sixteenth or the first of the seventeenth century, consequently in the reign of the emperor Rudolphus II,

* The title is, Beschreibung eines neuen Instruments mit welchem das Getraide zugleich geackert und gesäet werden kan; vormals erfunden von Locatelli, Landmann im Erz-Herzogthum Cärndten. Nunmehr aber bey diesen Schweren Zeiten - - - - mitgetheilt und zum dritten mal gedruckt. Anno 1603. Without the name of any place, printer, or publisher.

who had a great fondness for mechanical inventions. This treatise is certainly the same which, as Reinman says,* was printed in 1690 without any place being mentioned, and according to Haller,† at Jena, 1690; but the author of it cannot have been the inventor, as asserted by Iöcher, who adds, that the tract in question was printed at Vienna in the year above mentioned.

The date 1603, however, can hardly be correct; it ought rather to be 1693, and in that case the tract might have been three times printed, between that period and 1690. The date in the title-page of my copy appears properly to have in it a 9, which resembles a zero, only because the compositor used a type on which the lower part of the figure was broke. That this conjecture is true, I have, I think, sufficiently proved; though Munchausen, Haller, and others read the date 1603.

In the year 1669, John Evelyn gave to the Royal Society of London a complete description of Locatelli's invention.‡ He there says that the inventor went with his machine to Spain, where he proved the advantage of it by public experiments, and described them in a Spanish work, dedicated to

* *Historia litteraria der Teutschen*, iii. 2. p. 514.

† *Biblioth. Botan.* i. p. 400. Haller says that this Locatelli was the author also of a medical work entitled: *Teatro d'arcani medici*. Venez. 1667-8. But Haller certainly here confounds this Locatelli with Louis Locatelli, who, according to Iöcher, wrote *Theatrum Arcanorum Chymicorum*, and died in 1657.

‡ *Phil. Transactions*, vol. v. N^o 60. p. 1056.

Geronimo de Camargo, member of the *Consejo real de Castilla*, who was commissioned by the king to make known and promote the use of this machine, the sale of which was secured to the inventor at a price fixed in his patent. This Spanish work, from which Evelyn made an extract, was printed with the Austrian approbation of Crollolanza, and the date Aug. 1st, 1663. Locatelli must immediately after have gone to Spain, for it is there stated that his machines were made and sold in great abundance at Madrid, in 1664. The invention belongs, therefore, to the year 1663.

This machine was exceedingly simple. The seed-box, the cylinder of which was furnished with two small wheels, required only to be hooked or fastened, by means of ropes, to the stilt of the plough. A figure of it may be found in the before-mentioned German tract; also in the Philosophical Transactions, and thence copied into Duhamel's *Traité de la culture des Terres*.*

* Paris 1753. 12mo. i. p. 368. tab. 6. Duhamel has committed a double error. He speaks of the invention as if the first experiments were made in Spain, and as if those in Austria had been later. He says also, that the latter were made *dans le Luxembourg in Istria*. The English account also says erroneously Luxembourg, instead of Lachsenburg or Laxemburg, which is in Austria, and not in Istria. A figure, on a reduced scale, but inverted, may be found also in Leske *Abhandlungen zur Naturgesch. Physik und Oekonomie aus den Philosoph. Transact.* Leipzig 1779. 4to. i. tab. 8. The description, however, is wanting. It was to have followed in the next part, but it was never printed.



The Italians, however, dispute with Locatelli the honour of the invention. They assert that one of their countrymen, named M. Giovanni Cavallina, of Bologna, proposed such a sowing-machine a century and a half before; and they refer for a proof to the account preserved by Gio Battista Segni in his work upon Scarcity. This book I have never seen. Haller gives the title from Seguiet, and says that it was first printed at Bologna, in 1602; but Zanon calls the year 1605, and says that this Segni, who is not noticed by Iöcher, was a *canonicus regularis*.* Of Cavallina I have not been able to find any further account; not even in the large and full work of Fantuzzi. I can, therefore, give only the description of Segni as transcribed by Zanon.† From this it appears

* Of Segni an account may be found in *Notizie degli scrittori Bolognesi raccolte da Giovanni Fantuzzi. In Bologna 1784—1794.* ix. vol. 4to. vii. p. 377. Segni, who died in 1610, wrote a great many ascetic books, the names of which are there given. The work to which I allude was twice printed, and is entitled, *Trattato sopra la carestia e fame, sue cause, accidenti, provisioni e reggimenti, varie, moltiplicazioni e sorte di pane; discorsi filosofici, theologici, &c.* Ferrara, per Benedetto Mamarelli 1591, and *accresciuto dal autore in Bologna per Gio. Rossi, 1602.* The size is not given. Haller calls it a quarto.

† Dell' agricoltura, dell' arti e del commercio, Lettere di Antonio Zanon. In Venezia 1764, 8vo. vol. iii. p. 325. The passage, as quoted by Segni, is as follows: Riesce maravigliosamente utile per lo piano lo stromento ritrovato già molt' anni da M. Giovanni Cavallina da Bologna, col quale piuttosto vien piantato il fromento, che seminato, e spargna in buondato il grano in seminare. Questo è fatto come un forloncino da burattare la farina, sopra un carrivolo semplice di due ruote ed un timone: parte della cassa tienc il grano,

that the machine alluded to had also a seed-box with two wheels, and might be compared to a bolting-mill, but below each hole of the bottom board there seems to have been an iron funnel, which before was shaped like a plough-share. The machine, therefore, seems to have formed as many small furrows as it dropped grains of corn; and, as far as can be judged, there was in the bottom only one row of holes. It appears also that each grain of corn, as soon as it dropped, was covered with earth by the machine. Whether Locatelli took advantage of this invention, and gave it out, with some alteration, as his own, cannot be easily determined.

Soon after Locatelli's invention another sowing-machine was proposed at Brescia, by the Jesuit

che si ha da seminare, parte è accommodata sotto il buratto, sbusata, ed per ogni buco ha una canna di ferro verso la terra, che finisce però in taglio di coltello dalla parte dinanzi, tanto lungo, quanto basta a fare un solco nel quale subito cade per la canna il grano burattato, e si seppellisce tutto, che con ne v`a niente a male, e con un altro ferro in ultimo lo cuopre immediatamente, tirandovi sopra quel terreno, che si cavò, facendo il solco detto; sì che non può esserne mangiato un sol grano dagli uccelli o da altri animali, come sogliano fare, mentre li contadini seminano all' modo usato; lascia poi certi spatii ed intervalli, per li quali vanno al suo tempo li mietitori senza culpestare il fromento, il che suol essere di non poco danno. La raccolta è piu sicura, senza comparatione, poichè a questo modo nasce tutto il grano seminato, si radica miglio, e si nodrisce dell' altro. Vero è che la terra vuol essere mossa una volta più del solito, má questa fatica vien ricompensata dall' agevolezza nel seminarla, bastando ogni vil giumento o garzoncello a tirare detto stromento, dal cui moto si muovono insieme il furlone e il buratto a lavorare.

Lana, who seems to have had no knowledge of the preceding ones ; at least he makes no mention of them. The case with Lana was perhaps the same as with many ingenious men, who possess great powers of invention. As they never read, but only think, they are unacquainted with what others have done before them ; and, therefore, consider every idea which comes into their mind as a new one. He proposed a harrow, the spikes of which should make holes in the earth, in the same manner as gardeners do with their bean-planter, and the grains of corn were to fall into these holes from a box pierced like a sieve, and placed over the harrow.*

I do not know whether this, at present, could be called a sowing-machine ; but it is not improbable that an apparatus of this kind would facilitate the planting, or, as it is termed, setting of wheat, which in modern times has been revived in England, and particularly in Suffolk. For this purpose holes are made three inches apart, in rows, four inches distant from each other, with a bean-planter, by men and women. Each labourer is followed by three children, who throw two or three grains of seed into each hole. One labourer in a second can make four holes, and in two or three days plant an acre. For this he obtains nine shillings, one-half of which is given to the

* *Prodromo, ovvero saggio di alcune inventioni nuove, premesso all' arte maestra. In Brescia 1670, fol. p. 96, fig. 26.*

children.* By these means there is a saving of one half the seed ; and this defrays the expenses. The wheat also, when it grows up, is cleaner as well as more beautiful ; and this method, besides, affords employment to a great number of persons. ;

However minute and ridiculous this method of planting may appear to our practical farmers, it is nevertheless true that it has been found beneficial in Upper Lusatia.†

The objection‡ that corn when planted in this manner may throw out too many stems, which will not all ripen at the same time, can be true only when the grains are placed at too great a distance from each other. The German mode of farming, however, is still too remote from horticulture to admit of our attaching great value to the advantages with which this method is attended.

I shall here remark, that Sir Francis Bacon says that in his time, that is, in the beginning of the seventeenth century, attempts had been made to plant wheat, but being too laborious it was again

* See the excellent account of the agriculture in Suffolk in my *Beyträgen zur Oekonomie*, &c. i. p. 1. It was written by Mr. M. F. Wild, of Durlach, who in the year 1767 was one of my pupils, and afterwards became teacher in the Institute of Education at Colmar. But alas! I do not know whither he has now been swept by the vortex of the revolution.

† Leske Reise durch Sachsen. Leipzig 1785. 4to. p. 319.

‡ Neue Abhandlungen der Cellischen œconomischen Gesellschaft, ii. p. 79.

abandoned, though he declares it to be undoubtedly advantageous.* In the most populous districts of China almost all the corn is set, or it is first sown in forcing-beds, and then transplanted.† The English call the labour with the sowing-machine *drilling*, and the planting of wheat they name *dibbling*.

MANGANESE.

THE term glass-making announces more than the art really performs. In our glass-houses glass is no more made than starch is by those who are called starch-makers. The latter only separate the starch from those parts with which nature had combined them; and our glass-makers merely bring to a state of fusion the glass already produced by nature, and then form it into vessels of various kinds. As it is, however, not fusible by itself, it requires, before it can be fused in the fire, an addition which, in general, consists of an alkaline salt together with some calcareous earth. Glass-making, therefore, is only a reforming of natural glass; but by these means it always loses in quality. The addition, indispensably necessary, renders it more fragile and brittle, so that it often suffers from the action of the air and of acids. On

* Sylva Sylvarum, cent. 5. § 442. p. 267.

† Algem. Histor. der Reisen, vi. p. 217.

this account the windows of hot-houses and of apartments continually filled with thick vapours become at length opake, and the case is the same with glass which has lain for centuries in the earth or in the sea. That play of colours observed on the surface of glass, and which lessens its transparency, announces the commencement of efflorescence.

Hence appears the reason why polished rock crystal is so superior to the best crystal glass of our glass-houses. Even an unexperienced eye can immediately distinguish the former from the latter, by its greater brightness and transparency, as well as by its extraordinary splendor. This substance, however, may be reformed also by art, but merely by polishing, and not by fusing, which would be impossible without some addition. Glass-makers who wish to deteriorate their articles in the least degree possible, must use very little addition, and even lessen that which they have employed by exposing their glass a long time to the fire. But it then becomes so difficult of fusion, and tough, that it can no longer be treated in the usual manner. For this reason, those who prepare artificial precious stones, or the best prisms for philosophical experiments in regard to refraction, must anneal the glass, which has become quite stiff, in the furnace; then break it, and form the pieces to the proper shape by grinding them. For common green or blackish-green glass,

any kind of sand and every kind of siliceous earth, if not too impure, are sufficient; but for white glass, the purest sand or quartz, as well as the purest alkaline salts, must be selected; and even then the glass will not acquire the most beautiful white colour and brightness, unless some manganese be added to the frit.*

That the art of glass-making may have arisen from an accident, such as that mentioned by Pliny, † I am ready to admit; but by what accident were artists made acquainted with the use of manganese, a mineral the outward appearance of which seems to announce nothing that could be useful to the glass-maker? It is not found in such abun-

* Under this appellation, writers on the art of glass-making understand a mixture of sand or siliceous earth and alkaline salts, which at the German glass-houses, where the above word is seldom heard, is called *einsatz*. It appears to have been brought to us, along with the art, from Italy, where it is written at present *fritta*, and to be derived from *fritto*, which signifies something broiled or roasted. It seems to be the same word as *fretton*, which occurs in Thomas Norton's Poem, *Crede mihi sive Ordinale*, where it however signifies a particular kind of solid glass, fused together from small fragments. This Englishman lived about the year 1477. His treatise was several times printed. It is to be found also in Mangeti *Bibliotheca Chemica*, ii. p. 307, a. where the word is thus introduced:

Durior species (vitri) vocatur *fretton*,
Ex vitrorum fracturis id evenit,
'Tinetura smaltorum vitriariorum
Non penetrabit illud, ut referunt.

† Plin. xxxvi. 26. § 25. See Hambergeri *Vitri Historia*, in *Comment. Societ. Gotting.* tom. iv. anni 1754. p. 487; an extract from which may be found in *Hamburgischen Magazin*, xviii. p. 478.

dance as to allow us to suppose that it naturally presented itself; nor do we know that any older application of it may have induced the ancients to employ and examine it in such a manner that the present use of it might be accidentally discovered. In general, it resembles some kinds of iron-stone, which it was considered to be till a very late period. That iron, however, colours glass must have been very early remarked; and therefore it could occur to no one to employ manganese for depriving frit of its colour. It produces this decoloration only when it is added sparingly, and according to a determinate proportion; otherwise it gives to the glass a violet colour, something similar to that of the amethyst.

The application of manganese was certainly taught by accident, and not by theory. But in regard to the question, why it frees glass from its dirty colour, it must be admitted, if we readily acknowledge the truth, that we can offer only hypotheses; as the old chemists called in the aid of phlogiston, and the new that of oxygen. Did a false hypothesis, then, conduct to this discovery? That this was the case, has been asserted by old as well as more modern writers, and is no doubt possible. Thus Kepler, from an erroneous hypothesis in regard to the revolution of the planets, discovered the ratio of their motion, according to their distance from the sun; and such instances may be adduced in favour of hypotheses which have

done more harm than good. But, in my opinion, in examining the origin of the ancient arts, we ought not to give credit to any cause assigned for an invention until no other can be found. In regard to the art in question, I think I can mention one which, at any rate, has probability in its favour, and which I shall here submit to the reader's decision.

That it was observed at an early period that metallic calces, and particularly that of iron, which most frequently occurs, communicate various colours to glass, has been already proved.* It needs, therefore, excite no wonder that men should be induced to make experiments on colouring glass with various minerals, and especially such as contained iron. Now since manganese, as already said, has a great resemblance to iron-stone, it was also occasionally employed; and it was soon found that this supposed species of iron-stone, according as it is used in greater or less quantity, gives to glass many beautiful shades of a violet, red, and dark brown colour. As it was necessary that the artist should weigh the manganese, in order to proportion it to the vitreous mass, according to the required colour, it is possible that the glass, when a very small quantity had been added, was found to be colourless. This observation must have been made with the greater satisfaction, and more readily turned to advantage,

* See the history of Ruby-glass in vol. i. p. 195.

the higher colourless glass, which approached nearest to rock crystal, was at that time esteemed.*

The period, however, when this great improvement in one of the most useful arts was fortunately introduced, cannot with certainty be determined; but it is very probable that it was practised in the time of Pliny. Were not this the case, what should have induced him, more than once, to remark that the magnet was employed in glass? Under this name the ancients certainly comprehended manganese; which, in general, had a resemblance to the magnet, and was considered as such by Agricola, † Kircher, ‡ and others, at a more modern period. Pliny, § in one passage, speaks of

* Plin. xxxvi. 26. p. 759: *Maximus tamen honos in candido translucentibus, quam proxima crystalli similitudine.* And lib. xxxvii. cap. 6. p. 769; he says that artists could make glass vessels nearly similar to those of rock crystal; but he remarks that the latter had nevertheless risen in price. *Mire ad similitudinem (crystalli) accessere vitrea, sed prodigii modo, ut suum pretium auxerint crystalli non diminuerint.* That is, as already said, natural glass, when fused, never equals in goodness the unfused, and therefore cannot depreciate the latter.

† De Re metallica, lib. xii. p. 471.

‡ Mundus subterraneus, ii. p. 451.

§ Plin. xxxvii. 24. § 66. p. 758. Alluding to the invention of glass, he says: *Mox ut est astuta et ingeniosa solertia, non fuit contenta nitrum miscuisse; coeptus addi et magnes lapis, quoniam in se liquorem vitri quoque, ut ferrum, trahere creditur.* Lib. xxxiv. 14. § 42. p. 667, he again says, speaking of the magnet: *Lapis hic et in Cantabria nascitur, non ille magnes verus caute continua, sed sparsa bullatione, ita appellant; nescio an vitro fundendo perinde utilis;*

a kind of magnet which was found in Cantabria, not in veins, but interspersed or in nuclei; and he adds that he did not know whether it was useful in glass-making, because no one had ever tried it. This use of manganese then must, at that time, have been very common, since it occurred so readily to a writer in speaking of a supposed magnet.

Another passage of Pliny has been supposed to allude to manganese, but in my opinion with much less probability. It is that where he says *Alabandicus* flows in the fire, and is fused at the glass-houses.* But by that term he seems to understand a kind of marble, according to the opinion of Isidorus, by whom the word is repeated.† As a calcareous earth it was perhaps added to

nondum enim expertus est quisquam. Ferrum utique inficit eadem vi. The words, *non ille magnes verus*, show that a difference had even then been observed between the real magnet and the supposed one, manganese. The author, however, adds “that stone is certainly a magnet, for one can make iron magnetic by it as well as by any other magnet.” But this certainly must never have been tried, otherwise the contrary would have been found to be the case. In the old editions of Pliny stands the word *lubbatione*; but it is shown by that of 1507, and by Hermolaus Barbarus, that many manuscripts have *bullatione*. Which of these was the real term of art cannot be discovered; but the meaning is clear, and seems to agree not badly with a derivation from *bullæ*.

* Plin. xxxvi. 8. § 13. p. 735. Niger est Alabandicus terræ suæ nomine, quamquam et Miletæ nascens, ad purpuram tamen magis adspectu declinante. Idemque liquatur igni ac funditur ad usum vitri.

† Orig. xvi. cap. 5.

promote the fusion of the sand. Camillus Leonardus, however, considered the *Alabandicus* as manganese.*

It is not improbable that the ancients employed manganese, if not for glazing, at any rate for painting their pottery or earthen-ware, as soon as they became acquainted at the glass-houses with its susceptibility of being converted into a coloured vitreous mass.

But this is far from being proved, though Count Caylus,† Genssane ‡ and others positively assert, that the so called Etruscan vases and lamps were painted with the same manganese that we use for our earthen-ware.

* *Speculum lapidum*, Parisiis 1610. 8. p. 71. It may not be superfluous here to remark, that this *Alabandicus* of Pliny must not, as is often the case, be confounded with the precious stone to which he gives the same name, lib. xxxvii. cap. 8. p. 779. The name properly denotes only a stone from Alabanda in Caria. It occurs, but much corrupted, as the name of a costly stone, in writings of the middle ages. See in Du Cange *Alamandine* *Alavandine*, *Almandine*; and even in our period so fertile in names, a stone which is sometimes classed with the ruby and sometimes with the garnet, and which is sometimes said to have an affinity to the topase and hyacinth, is called *Alamandine* and *Alabandiken*. See Brückman on Precious Stones, who in the second continuation, p. 64, deduces the word from *Allemands*, without recollecting the proper derivation, which he gives himself, i. p. 89 according to Pliny.

† *Recueil d'Antiquités*, i. p. 86. Cette couverte étoit faite avec une terre bolaire tres-martiale; la même que celle que nous employons dans notre faïance, connue sous le nom de Manganese ou magnesia vitriariorum. This betrays very little mineralogical knowledge.

‡ *Traité de la Fonte des mines par le feu du Charbon de Terre*, Paris 1770. 2 vol. 4to. i. p. xv.

Those who attempt to trace out the history of the arts must be very cautious not to admit, without sufficient proof, that what the ancients accomplished was effected by the same means as those employed by us for the same purpose. This, in some cases, may be true; but in many others false. Thus, they made a beautiful kind of blue and red glass, without being acquainted with our cobalt and mineral purple; and they performed very long sea voyages without our compass. It is the duty of the historian either to point out the means which the ancients employed, whether they were the same or not as those used at present, or to acknowledge that their processes are unknown to us. Those who invariably follow this rule will sometimes discover that, in ancient times, men were able to accomplish the same objects and to produce the same effects, by means totally different from those used at present; and then the question will sometimes arise, Which of the means, the old or the new, are the cheapest, the most convenient, and the surest? This leads to technological problems, the solution of which, notwithstanding the great superiority we possess in those auxiliaries of the arts, natural history, chemistry, &c. is impossible. I have indulged in these observations, in mentioning the celebrated Caylus, because I well know that he has often erred in not attending to them. I acknowledge and respect the service of this eminent man; but I am convinced that

by the boldness of his assertions he acquired greater confidence and more celebrity than he deserved.

The colours on the Etruscan vases have a resemblance indeed to those on our stone-ware, but it is also true that they might be produced by calx of iron.

The substances used by the ancient potters can be determined only by the testimony of the ancients or by experiments; but the former is not to be found; and the latter have never been made, though they would not be difficult to any chemist who might choose to sacrifice a few vessels of that kind.

The question how the use of manganese was first found out, occurred even to Pliny; and his opinion on that subject deserves to be quoted, especially as it was long considered as true by Albertus Magnus, Caneparius, and many later writers. To understand it one must know that it was, at first, believed that the magnet, as it attracts iron, could attract other bodies also; and it was conjectured that other minerals might possess a similar property. Some imagined that they had found magnets for gold and silver.* In the oldest times

* Wallerius entertained a hope of this kind. See his *Elementa Metallurgiæ*, Holmiæ 1768. 8vo. p. 60, or in the German translation p. 59. Albertus Magnus says, in his Treatise *de mirabilibus mundi*, which was printed at Amsterdam, 1702—12, along with the Book *de secretis mulierum, et de virtutibus herbarum, lapidum, et ani-*

men had so erroneous an opinion of the art of glass-making, that they conceived that glass was obtained from sand, as metal from its ore ; and Pliny thinks that they then conjectured that a magnet could attract glass as well as it does iron. Now as manganese, on account of its similarity, was considered to be a magnet, it was consequently subjected to experiments, which gave rise to the beneficial discovery that it renders glass colourless.

This use of it then has been retained through every age to the present time, and it is mentioned by all those authors who have written on glass-making. Avicenna* makes so complete a distinction between it and the magnet, that he treats of each in a particular section, though he says nothing of its employment in the glass-houses ; but indeed as a physician he had no opportunity of doing so. Albertus Magnus,† however, who lived a century

malium, p. 175: Magnes trahit ferrum, carabe trahit paleam, et quidam alius lapis trahit vitrum. He certainly here alludes to manganese, which in another part he expressly mentions. Compare Caneparius *de Atramentis*, Roterodami 1718. 4to. p. 20 and 24.

* Canon Medicinæ, lib. ii. tract. 2. cap. 470, de magnete ; and cap. 472, de magnesia. In the edition, Venetiis apud Iuntas 1608. fol. i. p. 356 and 357.

† In his Book *de mineralibus*, lib. ii. tract. 2. cap. 11, in the second part of all the works of this multifarious writer, Lugduni 1651. fol. p. 234 : Magnesia, quem quidam magnosiam vocant, lapis est niger, quo frequenter utuntur vitrarii ; hic lapis distillat et fluit in magno et forti igne, et non aliter ; et tunc immixtus vitro ad puritatem vitri deducit substantiam. See the passage quoted in the last note but one.

later, Roger Bacon,* Basilius Valentine,† Camillus Leonardus,‡ Biringoccio, Mercati,§ Neri, and many others || have spoken in the plainest terms of this application.

* *De alchemia*, in Manget's *Biblioth. Chemica*, p. 614.

† In his last Testament, ii. p. 133.

‡ *Speculum lapidum*, lib. i. cap. 9. p. 31: Quidam lapis, ex quo nostri vitrarii vasa dealbant. Lib. ii. cap. 7. p. 71: Alabandicus niger in purpureum vergens lapis est a loco nomen sumens suæ primæ inventionis; ab igne colliquatur ac funditur more metalli; utilis ad vitrariam artem cum vitrum clarificet et albefacit. Reperitur in multis Italiæ locis, et a vitrariis Mangadesum dicitur. Page 132: Magnasia sive Magnosia ex nigro colore in commoditate ad vitrariam artem. Idem quod Alabandicum.

§ *Metallotheca*, p. 148: Manganensis eum veteribus ignotus fuerit, modo notissimus et quotidiano usu existit. Manganese a figulis nominatur ab effectu, corrupto quidem nomine, quod scilicet vasa magnonizet. Sydereæ quibusdam dicitur, quod scintillas habeat instar ferri nitentes, quæ, dum frangitur, conspiciuntur. Punicosus est et friabilis, colore fuseo aut ferrugineo; cum figulis tum vitrarii usum præbet; nam vitrum tingit purpureo colore ipsumque depurat, adeo ut si viride vel flavum suapte natura sit, eius mistione albescat, puriusque efficiatur. Reperitur in Germania et in Hetruria in montibus Viterbiensibus.

|| Hier. Cardanus de subtil. lib. v. p. 294: Sydereæ, quam Manganensem Itali vocant, terra est repurgando vitro aptissima, illudque tingens colore caeruleo. - - - He says, page 303, that glass consists of *arena, sale, kali, et siderea*. Alluding to this passage Scaliger says, *de subtil. exercit.* 104, 23: Magnesium non novi; ceterum in MS. codice de conflandis vitris Panthei civis Veneti (some extracts from which may be seen in *Theatrum Chemicum*) scriptum erat vitrum a magnesia colore purpureo infeci. Memini cum puer essem, et Ladroni viverem, effossum in montibus, ni fallor, Solodonianis, et Venetiæ delatum, neseio quid, quo ipso vitrum usque adeo candidum purumque fieri prohibebant, ut crystalli nomen assumeret. Ferri colorem

It is seen by the words quoted from different authors, that the name, which as far as I know occurs first in Albertus Magnus, was written in a great many different ways: *magnesia*, *magnosia*, *magnasia*, *manganensis*, *mangadesum*, and in French *magalaise*, *meganaise*, *magnese*. One might imagine that it is derived from magnet, partly on account of the similarity of the two substances, and partly on account of its supposed power to attract glass. Besides, its other name, *sidera*,* seems to have a reference to the Greek word for iron. Mercati, however, deduces the term from *mango-nizare*, because potters besmear their wares with this mineral; but I suspect that the name was common before that use of the substance was known. It is to be observed that to this word various other significations have been given. Sometimes it seems to denote common iron-stone, and sometimes pyrites. What the gold-makers understood by it will be best discovered by consulting the works of their followers. † *Braunstein*

mihi retulisse videtur. Præceptor meus Secundus docebat me, vitrum admistione ferrei coloris albicare, utriusque rei substantia adeo arte unita, ut compositis earum partibus ipsi etiam colores alii alios invaderent; et magnesian ferreæ cujusdam substantiæ et ignis impatientem exhalare, auferendo secum sordes vitri, haud aliter atque lixivium quo linæ vestes mundantur.

* Σιδηρος ferrum, σιδηριτις λιθος magnes.

† Henkels Kiess-Historie Leipzig 1725. 8. p. 87. Compare the section *de magnesiaphilosophica*, in the work of Caneparius *de Atramētis*, i. 5. p. 27.

also, the German name, the earliest mention of which occurs perhaps in the writings of Basilius Valentine, denoted at first every kind of ferruginous earth employed by the potters for painting. Thus Schwenkfeld gave the name of *Braunstein* and *Braunfarbe* to a kind of bloodstone.*

For a long time the manganese imported from Piedmont was in Germany accounted the best; and therefore was much sought after by the artists of Nuremberg. Afterwards, a kind brought from Perigord, a place in Guyenne, and named *ierre de Perigueux*, or *lapis petracorius*, was highly esteemed. Wallerius gives this as a peculiar species; and in my opinion he is right.† Its distinguishing characters are, that it resembles a burnt coal or cinder; has a somewhat shining surface, and on the fracture appears to be finely striped and a little coloured. A piece which I have in my possession exhibits all these marks. This species has been mentioned by very few of the new mineralogists. Germany, however, for some centuries past has employed its own manganese, which even

* *Stirpium et fossilium Silesiae catalogus*, Lipsiae 1600. 4. p. 381. In Albinus's *Meissnischer Chronik*, 1589. fol. ii. p. 151, the following words occur: Die Glassköpf von der Platten geben sonderlich den Töpfern eine gute kesselbraune Farbe, daher ich achte, dass sie von etlichen auch Farbesteine genennet werden.

† *Systema mineralog.* i. p. 330. Compare Pomet's *Materialist*, Leipsig 1717. fol. p. 752. Lemery *Materialien-Lex.* Leipz. 1721. fol. p. 611.

in the time of Biringoccio was sent, as an article of commerce, to Italy.*

That in our times a peculiar metal called *magnesium*, or *regulus magnesi*, has been found in manganese, is too well known to require much notice. I shall however remark, that Ignatius Gottfried Kaim, in his Dissertation *de metallis dubiis*, printed at Vienna, in 1770, first mentioned this regulus, which was afterwards proved in a fuller manner by J. Gottlob Gahn, Bergman, and Ilseman. A Frenchman named de la Peirouse is said to have also found it, in a native state, in an iron-mine in the county of Foix.†



PRINCE RUPERT'S DROPS. LACRYMÆ VITREÆ.

It is more than probable that these drops, and the singular property which they possess, have been known at the glass-houses since time immemorial. All glass, when suddenly cooled, becomes brittle, and breaks on the least agitation. On this account, as far back as the history of the art can be traced, a cooling furnace was always constructed

* Pirotechnia, 1550. 4to. p. 36. b.

† See Leonhardi's additions to Macquers chemischen Wörterbuche, 1788. i. p. 572.

close to the fusing furnace. A drop of fused glass falling into water* might easily have given rise to the invention of these drops; at any rate this might have been the case in rubbing off what is called the navel.† It is, however, certain that they were not known to experimental philosophers till the middle of the seventeenth century. Their withstanding great force applied at the thick end, and even blows; and on the other hand, bursting into the finest dust when the smallest fragment is broken off from the thin end, are properties so peculiar that they must excite the curiosity of philosophers, and induce them to examine these effects, especially at a time when mankind, in general, exert themselves with the greatest zeal to become better acquainted with the phænomena of natural bodies. On this account they have been noticed in almost every introduction to experimental philosophy. To determine the time then in which they were first made known, seems to be attended with little difficulty, but it still remains doubtful by whom and in what country.

* It is not always necessary that the water should be cold: these drops will be formed also in warm water, as well as in every other fluid, and even in melted wax. See Redi's experiments in *Miscellan. naturae curios. anni secundi*, 1671. p. 426. They succeed best with green glass, yet I have in my possession some of white glass, which in friability are not inferior to those of green.

† The navel, in German *nabel*, is that piece of glass which remains adhering to the pipe when any article has been blown, and which the workman must rub off. These navels, however, are seldom in so fluid a state as to form drops.

It appears certain that the first experiments were made by philosophers with these drops, in the year 1656. Monconys,* who travelled at that period, was present when such experiments were made at Paris, before a learned society, who assembled at the house of Mommor, the well-known patron of Gassendi; and the same year he saw similar experiments made by several philosophical persons at London. He tells us expressly that Chanut, the Swedish resident, procured glass drops for the first Parisian experiments; and that these drops were brought from Holland.

It appears, therefore, that the first glass drops were made in Holland; yet Montanari,† who was professor of mathematics at Bologna, says that the first were not made by the Dutch but by the Swedes. The grounds, however, on which he rests his assertion are exceedingly weak. Because a Swedish resident procured those used for the first experiments, it does not follow that they were made at Swedish glass-houses, especially as it is positively said that they were brought from Holland. It was indeed stated so early as 1661, by Henry Regius‡ or Van Roy, professor at Utrecht, that

* *Journal des voyages de M. Moneonys*, Lyon 1666. 4to. ii. p. 162. *J'ai appris - - que M. Chanut resident de Suede avoit fait voir des larmes de verre vert toutes solides venuës de Hollande.*

† *Speculazioni fisiche del dot Geminiano Montanari Modanese, sopra gli effetti di que' vetri temprati, che rotti in una parte si risolvono in polvere.* In Bologna 1671, 11 sheets 4to. p. 41.

‡ *H. Regii Philosophia naturalis, Amstelodami 1661.* 4to. p. 515: *Adferuntur huc ad nos e Suecia globuli vitrei caudati - - -* In the

these glass drops came from Sweden; but may not this have been a lapse of memory, occasioned by the circumstance that the first drops used by the natural philosophers of Paris were procured by a Swedish resident.

Monconys, whose relation indeed bears evident marks of great haste as well as credulity, calls Chanut *Resident de Suede*, and seems to have considered him as a Swedish resident at the French court; an opinion in which he has been followed by many literary men.* But Pierre Chanut was French resident at Stockholm, and at that time so well known that Monconys could hardly be unacquainted with his quality. He was resident from the year 1645 to 1649; and he was afterwards envoy for adjusting the disputes between Sweden and Poland, which were to be settled at Lubec. He

Amsterdam edition, by Elzvir, 1654, 4to, which in the title is called the second, these glass drops are not mentioned.

* In the German translation of Monconys' Travels Chanut is styled resident of his Swedish majesty. In the *Miscellanea Naturae Curios.* already quoted, where the account of Monconys is translated into Latin, it is said: Intellexi, quod Chanut Residens regni Sueciae vidisset parari lacrymas ex vitro viridi penitus solidas, ex Hollandia advectas. Here then there is a double mistake. Montanari says, p. 41: Primi vetri temprati erano state partecipate da M. Chanut Residente di Suezia in quella corte, consequently at the French court. J. G. Baier, in his Dissertation *de lacrymis seu guttis vitreis*, Altorfi 1708, 4to, p. 5, says: Anno 1656, Parisiis capta sunt de lacrimis vitreis experimenta, suppeditante eas D. Chanut in aula Regis Galliarum Residente, allatas e Belgio.

is often mentioned in Puffendorf's book *de rebus Suecicis*; and the printed account of his missions and negociations* contain important materials towards a history of queen Christina, with whom he was a great favourite. He superintended the funeral of Descartes, † who was interred with great honour. He was born in 1601; but with the time of his death I am unacquainted. He was celebrated as a man of great learning, and particularly an able mathematician; and it is neither improbable nor even impossible that he may have sent the first glass drops to Paris from Sweden; but why does Monconys add that they were brought from Holland?

It deserves to be mentioned that about fifteen years before, that is, in 1641, the first glass-houses were established in Sweden, ‡ and in all probability by Germans. It is possible that when the blowing of glass was first seen, glass drops may have

* *Memoires de ee qui s'est passé en Suede, depuis l'année 1649, jusques en l'année 1652. Tirez des depeches de Mons. Chanut, ambassadeur pour le roy en Suede. Par Linage de Vauciennes. A Cologne 1677. 3 vol. 12mo.*

† But not the transmission of the almost withered body to France, as is asserted in Gundling's *Histor. der Gelehrtheit*. iii. p. 3226. In regard to sending home the body, which was done in the year 1666, some curious circumstances may be seen in Dunkel's *Nachrichten von Gelehrten*, ii. 1. p. 38. No. 1040, where however there are two errors, namely Chanat instead of Chanut, and 1690 for 1666.

‡ This is stated by John Clason in his oration *Om Sweriges handels omskiften*, delivered at Stockholm before the Academy in 1751.

excited an attention which they had not met with in Germany, where no one expected any thing new in glass-houses, which were there common and had long been established. It can nevertheless be proved that they were known to our glass-blowers at a much earlier period.

In 1695 John Christian Schulenburg,* subrector of the cathedral school of Bremen, published there a German Dissertation on glass drops and their properties, in which he says that he was informed by glass-makers, worthy of credit, that these drops had been made more than seventy years before at the Mecklenburg glass-houses, that is to say, about the year 1625.

Samuel Reyher, professor at Kiel, says that Henry Sievers, teacher of mathematics in the gymnasium of Hamburgh, had assured him that such glass drops were given to his father by a glass-maker, so early as the year 1637; and that his father had exhibited them in a company of friends, who were much astonished at their effects. Reyher adds that he himself had seen at Leyden, in 1656, the first of these glass drops, which had been made at Amsterdam, where he afterwards purchased some of the same kind; but in 1666 he procured for a very small sum a great many of them from the glass-houses in the neighbourhood

* Springgläser samt ihren Eigenschaften, four and a half sheets quarto.

of Kiel.* It is worthy of remark that Huet,† who paid considerable attention to the history of inventions, says, that the first glass drops, which he had seen also in the society held at the house of Mommor, were brought to France from Germany. According to Anthony Le Grand they came from Prussia. ‡

The first glass drops were brought to England by the well-known prince Rupert, third son of the elector Palatine, Frederic V, and the princess Elizabeth daughter of James I; and experiments, described by Rupert Moray, were made with them, in 1661, by command of his majesty. This is expressly stated by Merret;§ and therefore what some English writers have supposed, that Prince Rupert himself was the inventor, is entirely erroneous. || The services which he rendered to

* In his Dissertation *de aere*, of which some account may be seen in the first volume of this work, and also in the edition Kiliae 1714, and Hamburgi 1725. In the oldest editions, Kiliae 1670, 4to. and 1673, this circumstance is not mentioned.

† Commentarius de rebus ad eum pertinentibus, Lipsiae 1719. 4to. p. 68.

‡ Historia naturalis. Edit. secunda, Londini 1680. 4to. p. 37.

§ In his Observations on Neri *ars vitraria*, Amstel. 1668. 12mo. p. 421; or in Kunkel's Translation, Nürnberg 1743. 4to. p. 291. This piece is printed also in the before-quoted *Miscellanæ naturæ curiosæ*.

|| This is said, for example, by Grainger in his Biographical History of England. London 1769. vol. ii. P. 2. p. 407.

the useful arts were too great and too numerous to be either lessened or increased by such trifles.

I shall take this opportunity of remarking, that those small glasses, hermetically sealed, and containing a drop of water, which when placed on hot coals burst with a loud report, and therefore are called in German *knalgläser*, fulminating glasses, were known before 1665. Hooke speaks of them in his *Micrographia*,* printed in that year, and they were mentioned by Reyher in 1669, in his Dissertation already quoted. In Germany they are made chiefly by Nuremberg artists; one of the most celebrated of whom was Michael Sigismund Hack. He learnt the art of glass-blowing in England, and in 1672 returned to Nuremberg where he had been born in 1643.†

FIRE-ENGINES.

THE invention of pumps I shall leave to those who undertake to write the history of hydraulics, and here only remark that, on the testimony of Vitruvius,‡ it is in general ascribed to Ctesibius, on

* This book was only once printed, but the title-page has the date 1667. See *Biographia Britannica*, iv. p. 2654.

† *Doppelmayr Nachrichten von Nürnbergischen Künstlern*, p. 276.

‡ Lib. x. cap. 12. p. 347. Compare lib. ix. cap. 9. p. 321.

which account they are called *machinæ Ctesibicæ*; and that Ctesibius lived at Alexandria in the time of Ptolemy Philadelphus and Ptolemy Euergetes I, consequently two centuries before the Christian æra. My present object extends no further than to state what I know in regard to the question, At what time were these machines first employed for extinguishing fires?

For this purpose, however, it was necessary that the pump-work employed at first only for raising water, should undergo some alteration. To use it for extinguishing fires, it was requisite that the water should be speedily driven from the upper aperture as high as possible; whereas for the first purpose, it is enough if the water be thrown out in sufficient quantity to be conveyed to the place of its destination. More additional parts necessary for extinguishing fires would then be an imperfection; as the power which gives the water a needless velocity might be employed with more advantage to raise a greater quantity of it.

In my opinion, it is highly probable that Ctesibius had an idea of converting his pump into a fire-engine, for his scholar, Hero of Alexandria, speaks expressly of this use, and describes the construction of a forcing-pump with two cylinders;* but it is very doubtful whether this appli-

* In that book entitled Πνευματικά or *Spiritalia*. It may be found Greek and Latin in *Veterum mathematicorum opera*, Parisiis 1693. fol. p. 180: οἱ δὲ σιφῶνες οἷς χρῶνται εἰς τοὺς ἐμπρησμοὺς κατασκευάζονται

cation of it soon became general, and whether this advantageous machine was known to the ancient Romans. What I have been able to learn on the subject is as follows.

Pliny the younger, after telling the emperor

σῖφως: Siphones, quibus utuntur ad incendias hoc modo construuntur. The accompanying figure represents a forcing-pump with two cylinders. Respecting the other editions of this work, see Fabricii *Biblioth. Græca*, ii. p. 593, where one of the Latin translations, which I have in my possession, has been omitted. It is entitled: *Heronis Alexandrini Spirituum liber. A Federico Commandino Urbinate, ex Græco nuper in Latinum conversus*. Parisiis apud Aeg Gorbinum 1583. 4to. This edition ends with the words: et magis continuata conversio fiat,—which in the Parisian are in page 230. The end also of the Parisian edition is wanting from the words: Quomodo animal dividatur et bibat—to: et tunc oblato poculo bibet. More information in regard to Hero may be found in *Heronis Ctesibii Belopoeica, hoc est telifactiva, Bernardino Baldo Urbinate Guastallæ abbate illustratore et interprete. Item Heronis vita eodem auctore, Augustæ Vindel. 1616. 4to. seventy-six pages*. In the library of our university is the following work by this Baldus: *Chronica de mathematici overo epitome dell' istoria delle vite loro, opera di monsignor Bernardino Baldi*. In Urbino 1707. 4to. This book, which seems to be very little known, is a meagre chronological account of all the mathematicians, ending with Guido Baldi del Monte, 1596. The preface states that it lay above a hundred years in manuscript, so that Baldus must have died in 1617; and also that the author left behind him a larger work, containing all the mathematicians, in two volumes, an edition of which is promised by the editor. Iöcher speaks of it, but I do not any where find that it was ever printed. Baldus is the first person who wrote the lives of the mathematicians, and on that account his name deserves to be mentioned with respect. To this subject belongs the following dissertation: *Heronis Alexandrini vita, scripta et quædam inventa, præside R. Ch. Wagnero, auctore J. A. Schmidt. Helmstadii 1714. 4to.*

Trajan, in one of his letters, that the town of Nicomedia, in Bithynia, had been almost entirely destroyed by a fire, adds, that the devastation had been increased by a violent storm which took place at the time; by the laziness of the inhabitants, and by the want of machines or apparatus proper for extinguishing the flames.* The word *sipho*, which the author here uses, was certainly the fire-engine of Ctesibius; though some under this term understand only aqueducts, canals, and pipes for distributing water throughout the city. I will not deny that this word may have signified such pipes, particularly on account of a passage in Strabo,† where he speaks of the subterranean conduits of Rome, and says, that almost all the houses had cisterns, *siphones*, or water-pipes, and running streams. But Pliny, at the same time, mentions water-buckets, which may be considered as an appen-

* Incendium latius sparsum, primum violentia venti, deinde inertia hominum, quod satis constat, otiosos et immobiles tanti mali spectatores perstitisse, et alioqui nullus unquam in publico siphos, nulla hama, nullum denique instrumentum ad incendia compescenda, et hæc quidem ut jam præeipi, parabantur. *Epist.* 42. lib. x.

† Lib. v. edit. Almel. p. 360: τοσούτον δ' ἐστὶ τὸ εἰσαγωγίμον ὕδωρ ἐκ τῶν ὑδραγωγείων, ὥστε ποταμούς δια τῆς πόλεως καὶ τῶν ὑπνομῶν ῥεῖν, ἀπασαν δὲ οἰκίαν σχεδὸν δεξιμεγας, καὶ σιφῶνας, καὶ κρουνοὺς εἶχει ἀφθονοὺς. Tantum aquæ per aqueductus in urbem derivatur, et flumina per urbem et cloacam labantur, et quælibet propemodum domus cisternas, tubulos, ac canales habeat copiosos. Compare Lipsius *de magnitudine Romana*. Antverp. 1598. fol. lib. iii. cap. 11. p. 181.

dage absolutely necessary to a fire-engine. It is also hardly possible to believe that a town, immediately situated on an arm of the sea, should be destitute of water.*

I can however produce from a cotemporary writer, a strong proof that Pliny alluded here to a fire-engine, and I do not find that the passage has been before quoted. Apollodorus, the architect, who was employed by the emperor Trajan in constructing the celebrated bridge over the Danube, and erecting some large works at Rome, and who was put to death by his successor Adrian, out of revenge for a jeering answer which he received from him, as we are told by Dio Cassius, describes in the fragment of his book on warlike machines, how assistance may be given when the upper part of a building is on fire, and the machine called *sipho* is not at hand. In this case leathern bags, filled with water, are to be fastened to long pipes in such a manner, that by pressing the bags the water may be forced through the pipes to the place which is in flames.† The *Sipho*, therefore, was a

* Plin. Lib. v. cap. ult. Est in intimo sinu, (astaceno) Nicomedia Bithyniæ præclara.

† Κάν που ακρωτηριον καιηται δυσεπιβατον, μη η δε οργανον ο καλειται σιφων καλαμοι παλιν τετρημμενοι ωσπερ οι των ιξευτων, αρμοζονται, επου δει φερειν αυτους υδωρ, ασκι τε πληρεις πιεζομενοι εκθλιβωσι δι' αυτων επι τον καιομενο: τοπον. Si forte extremitas aliqua, ad quam difficilis sit adscensus, ardeat, nec præsto sit instrumentum illud quod vocatur *sipho*, arundines rursus perforatæ, cujusmodi sunt aucupum, aptantur in iis locis quo aquam ferre eas oportet, et utres aqua pleni pressi aquam

machine by which water might be easily projected to a considerable height, to extinguish a place on fire that could not be reached by any other means.

That in the fourth century, at least, a fire-engine, properly so called, was understood under the term *sipho*, is fully proved by Hesychius,* and also by Isidorus, who lived in the beginning of the seventh century.† As the latter remarks that such engines were employed in the East for extinguishing fires, there is reason to conclude that they were not then used in the west.

The question still remains, at what time this apparatus for extinguishing fires was introduced at Rome. From the numerous ordinances for preventing accidents by fire, and in regard to extinguishing fires, which occur in the Roman laws,‡

ejaculantur in locum qui igni consumitur. Poliorceticà, p. 32, in Veterum mathematic. Opera.

* Σιφων οργανον τι εις προεσιν υδατων εν τοις εμπρησμοις. Instrumentum ad ejaculandas aquas adversus incendia.

† Originis, xx. 6. Siphon vas appellatum, quod aquis sufflando fundat; utuntur enim hoc orientales. Nam ubi senserint domum ardere, currunt cum siphonis plenis aquis et extinguunt incendia, sed et cum aras expressis ad superiora aquis emundant. Fire-engines are used in many towns, in the same manner, to wash the windows in the upper stories, which cannot be taken out.

‡ See Digest. i. tit. 15, where all persons are ordered to have water always ready in their houses: ut aquam unus quisque in cœnaculo (the upper story?) habeat, jubetur admonere. Also Digest. 47. tit. 9. Many things relating to this subject may be found in L. A. Hambergeri *Opuscula*, Jenæ et Lips. 1740. 8vo. p. 12; in the Dissertation de *incendiis*. Further information respecting the police

there is reason to conjecture that this capital was not unprovided with those useful implements and machines, of the want of which in a provincial town Pliny complains, and which he himself had supplied. This conjecture, however, I am not able to prove; and instances both in ancient and modern times show, that the good police establishments of small towns are not always to be found in capitals. Antioch and several other towns were provided with lanterns, which were wanting even in the proud Rome.* But what excites some doubt is, that fire-engines are never mentioned in the numerous accounts given of the fires which took place in that city. At present, it is impossible to speak of a misfortune of this kind without stating whether a sufficient number of engines were assembled, and what they effected, as Pliny has not failed to do in his short account of the fire at Nicomedia.

One passage, however, in Ulpian is commonly quoted as a proof that, in his time, there were fire-engines at Rome. Where he enumerates those things which ought to belong to a house when sold, he mentions, besides other articles used for

establishment of the Romans in regard to fires, is contained in two dissertations, which however I have not seen, entitled G. C. Marquarti *de cura Romanorum circa incendia*. Lips. 1689. 4to. And Ev. Ottonis *dissertat. de officio præfecti vigilum circa incendia*. Ultrajecti 1733.

* See what has been already said, vol. iii. p. 377.

extinguishing fires, *siphones*.* But if this word means here fire-engines, the passage seems to prove too much; for it must then be admitted that each house had a fire-engine of its own. These implements therefore must have been small hand-engines, such as are kept in many houses at present; and in that case the passage cannot be adduced as a proof of public engines, such as Pliny regrets the want of at Nicomedia. But it is much more probable that Ulpian alludes only to those *siphones* which, according to the account of Strabo, were to be found in every house at Rome; that is, pipes which conveyed water to it for domestic purposes.

From the total want of fire-engines, or the imperfect manner in which they were constructed, what Seneca says must have been true, namely, that the height of the houses at Rome rendered it impossible to extinguish them when on fire.†

* Digest. xxxiii. 7. 18: *Acetum quoque quod extinguendi incendii causa paratur, item centones, siphones, perticæ quoque et scalæ, et formiones et spongiæ et hamas et seopas contineri, plerique et Pegasus aiunt. Alexander ab Alexandro, whose opinion however forms no proof, understands here fire-engines. Dier. genial. v. 24. p. 342. Siphones vero, fistulas follibus junctas seu máquinas hydraulicas, quibus agitatis, ad superiora ædium exhauriunt aquam, qui etiam organa pneumatica dicti. These *fistulæ follibus junctæ*, which no commentator has explained, were those tubes or pipes proposed by Apollodorus.*

† *Ædes quas in tantum extruxere, ut domus ad usum et munimentum paratæ, sint nunc periculo, non præsidio; tanta altitudo*

That the buildings there were exceedingly high, and the lanes, the bridges and even the principal streets remarkably narrow, is well known.* It is supposed by Archenholz† and others, that the houses at Rome were built of such a height on account of the great heat in that warm climate; but the chief reason was undoubtedly that assigned by Vitruvius, ‡ which still produces a like effect. For want of room on the earth, the buildings were extended towards the heavens; so that at last the greatest height of an edifice was fixed by law at seventy, and afterwards at sixty feet. In Hamburgh, at present, where ground is dear and daily becoming more valuable, the greater part of the houses are little less than sixty feet in height; a few even are seventy; and that it is thereby rendered difficult if not impossible, not-

ædificiorum est, tantæque viarum angustia, ut neque adversus ignem præsidium, neque ex ruinis ullam in partem effugium sit. Controvers. 9. libri ii. p. 153.

* In Germany also the roads and the distance between the ruts made by cart-wheels were, in old times, very narrow. Some years ago, when the new tile-kiln was built before the Geismar gate at Gottingen, there was found at a great depth, a proof of its antiquity, a street or road which had formerly proceeded to the city with so small a space marked out by carriage-wheels, that one like it is not to be seen in Germany.

† England und Italien. Leipsic 1785. 8vo. ii. p. 216.

‡ Lib. ii. cap. 8. p. 68: In ea majestate urbis et civium infinita frequentia, innumcrabiles habitationes opus fuit explicare. Ergo cum recipere non posset area plana tantam multitudinem ad habitandum in urbe, ad auxilium altitudinis ædificiorum res ipsa coegit devenire.

withstanding the perfection of the German engines, to extinguish fires, is proved by the melancholy instance of Gera, where the houses are now built lower. With Neubert's engine, which was tried at Hamburgh in 1769, eight fire-men threw eleven and a half cubic feet of water to the height of sixty-two or sixty-three feet.

In the East, engines were employed not only to extinguish but to produce fires. The Greek fire, invented by Callinicus, an architect of Heliopolis, a city afterwards named Balbec, in the year 678, the use of which was continued in the East till 1291,* and which was certainly liquid,† was employed in many different ways; but, chiefly, on board ship, being thrown from large fire-engines on the ships of the enemy. Sometimes this fire was kindled in particular vessels, which might be called fire-ships, and which were introduced among a hostile fleet; ‡ sometimes it was put into jars and other vessels, which were thrown at the enemy by means of projectile machines, § and sometimes it

* Hanovii disquisitiones. Gedani 1750. 4to. p. 65. A translation of the dissertation here alluded to may be found in the *Hamburgischen magazin*, xii. p. 297.

† Annæ Comnenæ Alexiad. lib. xvi. p. 385: πύρ ὑγρόν. The same expression occurs also in Theophanes, *Chronographia*, p. 352.

‡ Theophanes, p. 294 and 352.

§ A projectile machine of this kind is mentioned by Joinville in *Histoire de S. Louis IX.* Paris 1668. fol. p. 39: ung engin qu'ils appelloient la Parriere, par lequel engin is nous gettoient le feu Gregois à planté. Does not the following passage in *Leonis tactica*, Lugd. Bat. 1612. 4to. p. 347, allude also to the Greek fire, though

was squirted by the soldiers from hand-engines; or, as appears, blown through pipes. But the machines with which this fire was discharged from the fore-part of ships, could not have been either hand-engines or such blow-pipes. They were constructed of copper and iron, and the extremity of them sometimes resembled the open mouth and jaws of a lion or other animal; they were painted and even gilded, and it appears that they were capable of projecting the fire to a great distance.* These machines, by ancient writers, are expressly called spouting-engines. John Cameniata, speaking of the siege of his native city, Thessalonica, which was taken by the Saracens in the year 904, says, that the enemy threw fire into the wooden works of the besieged, which was blown into them by means of tubes, and thrown from other vessels.† This passage, which I do not find quoted in any of the works that treat on the Greek fire, proves that the Greeks, in the beginning of the tenth century, were

Meursius speaks of unslaked lime, which however could not have produced the same effects: *Χυτρας και αλλ' όυς ασθεστου πληρες, αν ριπτομενων και συντριβομενων, ό του ασθεστου ατμος συμπνιγει και σκοτιζει τους πολεμιους, και μεγα εμποδιον γινεται: Ollas calce viva plenas. alii injiciunt, quibus constractis, calcis vivæ pulvis dissipatus suffocat et strangulat hostes, et magno ad præliandum impedimento est.*

* See the passage of Anna Comnena quoted by Hanov. p. 335.

† In Leonis Allatii *συμμικτα*. Coloniae Agrip. 1653. 8vo. p. 239: *πυρ τε δια των σιφωνων τη αερι φυσησαντες και τινα αλλα σκευη—ignem siphonibus effiantes, et alia vasa, flammæ plena, in murum conjicientes.*

no longer the only people acquainted with the art of preparing this fire, the precursor of our gun-powder. The emperor Leo, who about the same period wrote his art of war, recommends such engines, with a metal covering, to be constructed in the fore-part of ships,* and he twice afterwards mentions engines for throwing out Greek fire.† In the East one may easily have conceived the idea of loading some kind of pump with the Greek fire; as the use of a forcing-pump for extinguishing fires was long known there before the invention of Callinicus.

At what time the towns in Germany were first furnished with fire-engines I am not able to determine. In my opinion, they had regulations in regard to fires much earlier than engines; and the former do not seem to be older than the first half of the sixteenth century. The oldest respecting the city of Franckfort on the Mayn, with which I

* Cap. 19. § 6. p. 322: Εχετω δε παντως τον σιφωνα κατα την πρωραν εμπροσθεν χαλκη εμπιεσμενον, ως εθος, δι' ου το εσκευασμενον πυρ κατα των εναντιων ακουτισει. According to the reading given in Fabricii *Bibliotheca Græca*, vi. p. 373: In prora siphonem ære obtectum de more habeas ad ignem in hostes cjaculandum, et celse supra siphonem pseudopatum ex asscribus confectum et asscribus circumtectum, in quo viri ad bellandum instructi sint.

† Pag. 344: Interdum frontem classis directam instrues, ut ubi usus ferat in hostium proras irruat, et siphonibus ignem ejiicientibus naves illorum incendat. δια του πυρος των σιφωνων. Pag. 346: Multæ molitiones excogitatae sunt; ejus generis sunt, ignis cum tonitru et fumo ignito per siphones emissus, et incendens naves: Οιον τοτε εσκευασμενον πυρ μετα βροντης και καπνου προπυρου δια των σιφωνων πεμπομενον.

am acquainted, is of the year 1460.* The first general ordinance respecting fires in Saxony was issued by Duke George, in 1521.† The first for the city of Dresden, which extended also to the whole country, was dated 1529.‡ In many towns, the first regulations made by public authority for preventing fires will no doubt be found in the general regulations in regard to building, which seem to be somewhat older than the particular ordinances concerning fires. At Augsburg an express regulation, in regard to building, was drawn up and made publicly known, so early as 1447.§ In turning over old chronicles, it is remarked, that great fires began to occur less frequently in the sixteenth century; and this is undoubtedly to be ascribed to the improved mode of building,|| the precautions enjoined by governments to prevent fires, and the introduction of apparatus for extinguishing them. But by the invention of fire-

* A passage from it is quoted in *Orths Anmerkungen über die erneuerte Reformation der stadt Frankfurt*. 1751. 4to. iii. 404.

† It is entitled *Begreyff der feuer Ordnunge*, four sheets folio. It is wanting in the *Codex Augusteus*, but the substance of it is found in Canzler and Meisner *für ältere Litteratur und neuere Lectüre*. Leipsic 1785. 8vo. iii. p. 97. A Nuremberg fire ordinance without any date, and a renewed one of 1593, are mentioned in Göking's *Journal von und für Teutschland*. 1784. Part x. p. 259.

‡ Weckens *Beschreibung und Vorstellung der Residenz Dresden*, p. 482. According to the index this was the first fire ordinance at that place.

§ Von Stetten *Kunstgeschichte der stadt Augsburg*, i. p. 87.

|| Thus in the year 1466 straw thatch, and in 1474 the use of shingles were forbidden at Franckfort. *Lersner*, ii. p. 22.

engines, every thing in this respect was so much changed, that a complete revision of the regulations in regard to the extinguishing of fires became necessary; and therefore the first mention of town fire-engines will in all probability be found in the new fire ordinances of the sixteenth and following century.

It has been remarked by Mr. von Stetten, that in the building accounts of the city of Augsburg, fire-engines are first mentioned in the year 1518. They are called there *instruments for fires, water syringes* useful at fires;* and these names seem to announce that the machine was then in its infancy. At that time they were made by a goldsmith at Friedberg, named Anthony Blatner, who the same year became a citizen of Augsburg. From the account added,—that the wheels and levers were constructed by a wheel-wright, and from the greatness of the expense,—there is reason to conclude that these were not small, simple hand-engines, but large and complex machines. In that respectable dictionary entitled *Maaler's Teutschsprach*, Zurich 1561, I find fire-hooks and fire-ladders, but no instrument similar to a fire-engine.

In the year 1657, the well-known jesuit Caspar Schott was struck with admiration on seeing at Nuremberg a fire-engine, which had been made there by John Hautsch. It stood on a sledge, ten

* *Instrumente zu Brunsten, Wassersprützen zum feuer dienlich.* Kunstgeschichte der stad Augsburg, ii. p. 112.

feet long and four feet broad. The water-cistern was eight feet in length, four in height, and two in width. It was moved by twenty-eight men, and forced a stream of water an inch in diameter to the height of eighty feet; consequently over the houses. The machine was drawn by two horses. Hautsch distributed throughout Germany an engraving of it; with an offer of constructing similar ones at a moderate price, and teaching the use of them; but he refused to show the internal construction of it to Schott, who however readily conjectured it. From what he says of it, one may easily perceive that the cylinders did not stand in a perpendicular direction, but lay horizontally in a box, so that the pistons moved horizontally, and not vertically, as at present. Upright cylinders, therefore, seem to belong to the more modern improvements. Schott adds, that this was not a new invention, as there were such engines in other towns, and he himself forty years before, and consequently in 1617, had seen one, but much smaller, in his native city.* He was born, as is well known, in 1608, at Königshofen, not far from Würzburg. George Hautsch also, son of the above artist, constructed similar engines, and

* *Magia Universalis*, pars iii. lib. vi. p. 510; and thence copied into Paschii *Inventa nov-antiqua*. Lips. 1700, 4to. p. 668. The *Magia universalis* was printed in 1657. See also Doppelmayr, p. 301, who says that the water was driven to the height of a hundred feet.

perhaps with improvements, for Wagenseil* and others have ascribed to him the invention.

The first regulations at Paris respecting fires, as far as is known, were made to restrain incendiaries, who in the fourteenth century, under the name of *Boutefour*, occasioned great devastation not only in the capital, but in the provinces. † This city appears to have obtained fire-engines for the first time in the year 1699; at any rate the king at that period gave an exclusive right to Dummerier Duperrier to construct those machines called *pompes portatives*; and he was engaged at a certain salary to keep in repair seventeen of them, purchased for Paris, and to procure and to pay the necessary workmen. In the year 1722 the number of these engines was increased to thirty, which were distributed in different quarters of the city; and at that time the contractors received annually 20,000 livres. The city, however, besides these thirty royal engines, had a great many others which belonged to the *Hôtel de Ville*, and with which the Sieur Duperrier had nothing to do. ‡

In the middle of the seventeenth century fire-engines indeed were still very imperfect. They had neither an air-chamber nor buckets, and re-

* De civitate Noribergensi, p. 153. Marpergers *geöffnetes Manufaktur haus*. Hamburg 1707. 12mo. p. 210. *Doppelmayr*, p. 303.

† Continuation du traité de la police, par De la Mare. Paris 1738. fol. p. 137.

‡ Ibid. p. 157.

quired a great many men to work them. They consisted merely of a sucking-pump and forcing-pump united, which projected the water only in spurts, and with continual interruption. Such machines, on each movement of the lever, experience a stoppage, during which no water is thrown out; and because the pipe is fixed, it cannot convey water to remote places, though it may reach a fire at no great distance, where there are doors and windows to afford it a passage. At the same time the workmen are exposed to danger from the falling of the houses on fire, and must remove from them to a greater distance. Hautsch, however, had adapted to his engine a flexible pipe, which could be turned to any side as might be necessary, but certainly not an air-chamber, otherwise Schott would have mentioned it. In the time of Belidor there were no other engines in France, and the same kind alone were used in England in 1760. Professor Busch, at least, concludes so,* from the account then given by Ferguson, who called Newsham's engine, which threw the water out in a continued stream, a new invention. In Germany, the oldest engines are of this kind.

Who first conceived the idea of applying to the fire-engine an air-chamber, in which the included air, by compressing the water, forces it out in a

* Versuch einer Mathematik zum Nutzen und Vergnügen. Hamburg 1791. 8vo. p. 396.

continued stream, is not known. According to a conjecture of Perrault, Vitruvius seems to speak of a similar construction; but Perrault himself acknowledges that the obscure passage in question* might be explained in another manner. The air-chamber in its action has a similarity to Hero's fountain, in which the air compressed by the water obliges the latter to ascend.†

I can find no older fire-engine constructed with an air-chamber than that of which Perrault has given a figure and description. He says it was kept in the king's library at Paris, and during fires could project water to a great height; that it had only one cylinder, and yet threw out the water in one continued jet. He mentions neither its age nor the inventor; and I can only add that his book was printed in 1684.‡ The principle of this machine, however, seems to have been mentioned before by Marriotte, who on this account is by some considered as the inventor, but he does not appear to have had any idea of a fire-engine, at least he does not mention it.§

* Lib. x. cap. 12.

† Spiritalia, 36. p. 85.

‡ I possess only the second enlarged edition of his *Architecture de Vitruve*, where the account may be found, p. 318. Whether it stands in the first edition of 1673 I do not know. Daniel Bernoulli has given the description and figure in his *Hydrodynamica*. Argent. 1738. 4to. p. 172. fig. 51.

§ The passage may be found in *Traité du mouvement des eaux*, p. 4. dis. 1. and in *Oeuvres de Mariotte*. Leide 1717. 2 vol. 4to. i.

It is certain that the air-chamber, at least in Germany, came into common use after it was applied by Leupold to fire-engines, a great number of which he manufactured and sold. He gave an account of it in a small work, consisting of four sheets quarto, which was published in 1720, but at first he kept the construction a secret. The engines which he sold consisted of a strong copper box closely shut and well soldered. They weighed no more than sixteen pounds, occupied little room, had only one cylinder; and a man with one of them could force up the water without interruption to the height of from twenty to thirty feet.* About 1725 Du Fay saw one of Leupold's engines at Strassburgh, and discovered by conjecture the construction of it, which he made known in the Transactions of the Academy of Sciences at Paris, for that year.† It is very singular that, on this occasion, Du Fay says nothing of Mariotte, or of the engine in the king's library. Leupold, however, had some time before, that is in 1724, given a description and figure in his *Theatrum machinarum*

p. 445. fig. 89. In my opinion the first edition of this work was published at Paris in 1686, 12mo. A German translation by J. C. Meinig was printed at Leipsic 1723, 8vo. The passage occurs there, p. 314.

* An extract from his work may be found in the *Breslauer Sammlungen. Versuch*, 6. p. 2035, and *vers.* 7. p. 374.

† *Physische Abhandlungen der Pariser Akademie, übersetzt durch von Steinwehr*, vii. p. 539.

hydraulicarum,* with which undoubtedly Du Fay was not acquainted.

Another improvement, no less useful, is the leather hose added to the engine, which can be lengthened or shortened as necessary, and to which the fire-pipe is applied, so that the person who directs the jet of water can approach the fire with less danger. This invention, it is well known, belongs to two Dutchmen, both named Jan van der Heide,† who were inspectors of the apparatus for extinguishing fires at Amsterdam. The first public experiments made with it took place in 1672; and were attended with so much success, that at a fire, next year, the old engines were used for the last time, and the new ones introduced in their stead. In 1677 the inventor obtained an exclusive privilege to make these engines during the period of twenty-five years. In 1682 engines on this construction were distributed in sufficient number throughout the whole city, and the old ones were entirely laid aside. In 1695 there were in Amsterdam sixty of these engines, the nearest six of which were to be employed at every fire. In the course of a few years they were common throughout all the towns in the Netherlands.

* Vol. i. p. 120. tab. 45. fig. 2.

† In the patent, however, they were named *Jan ende Nicolaas van der Heyden*.

All these circumstances have been related by the inventor in a particular work; which, on account of the excellent engravings it contains, is exceedingly valuable.* Of these the first seven represent dangerous conflagrations at which the old engines were used, but produced very little effect. One of them is the fire which took place in the stadthouse of Amsterdam, in the year 1652. The twelve following plates represent fires which were extinguished by means of the new engines, and exhibit, at the same time, the various ways in which the engines may be employed with advantage. According to an annexed calculation, the city of Amsterdam lost by ten fires, when the old apparatus was in use, 1,024,130 florins; but in the following five years, after the introduction of the new engines, the loss occasioned by forty fires

* Beschryving der nieuwlijks uitgevonden en geotrojeerde Slang-Brand-Spuiten, en haare wijze van Brand-Blussen, tegenwoordig binnen Amsterdam in gebruik zijnde.—Door der zelve Inventeur Jan van der Heide en Jan van der Heide de jonge, generaale Brandmeesters der stad Amsterdam. Amst. 1690. Two sheets and fifty pages in folio. To this subject belongs the following work, a copy of which also is in the library of our university: *Beschryving der Brand-orders, en wijze van Brandblussen, tegenwoordig binnen Amsterdam in gebruik zijnde door Jan van der Heide, en Jan van der Heide de Jonge, generale Brandmeesters der zelve Steede.* Amst. 1695. one sheet and a half quarto, with four copper-plates and explanations. One of the descriptions translated may be seen in the *Leipziger feuer-ordnung vom Jahre, 1789.* 4to. p. 74, where it may have been inserted for the first time, on the introduction of the improved engines made with hose.

amounted only to 18,355 florins; so that the yearly saving was ninety-eight per cent. Of the internal construction of these engines no description or plates have been given; nor do I remember to have read a passage in any author from which it can be concluded that they were furnished with an air-chamber, though in the patents they were always called *spouting-engines*, which threw up one continued jet of water.* The account given even of the nature of the pipe or hose is short and defective, probably with a view to render it more difficult to be imitated. It is only said that it was made of leather in a particular manner; and that besides being thick, it was capable of resisting the force of the water.†

The conveyer or bringer was invented also about the same time by these two Dutchmen. This name is given at present to a box which has on the one side a sucking-pump, and on the other a forcing-pump. The former serves to raise the water from a stream, well, or other reservoir, by means

* Slang-Brand-Spuyten, bestaande in een geduirrig stralende Brand-Spuit, met een buygelijke buys daar aan, om haar gedaante een Slang genaamd, die men kan verlangen naar eysch end welgevallen.

† Page 6. Slang, of Spuit-Slangen van leer gemaakt, dat op een byzondere wyze bereid en zaamen gevoegt word om dicht, bestendig en tegen't geweld van't water bestand te zyn. In the French explanation of the plates these new engines are called *pompes à boyaux*.

of a stiff leathern pipe, having at the extremity a metal strainer, pierced with holes, to prevent the admission of dirt, and which is kept suspended above the mud by a round piece of cork. The forcing-pump drives the water thus drawn up through a leathern pipe into the engine, and renders the laborious conveyance of water by buckets unnecessary.

At first, indeed, this machine was exceedingly simple. It consisted only of a leathern pipe screwed to the engine, the end of which widened into a bag supported near the reservoir, and kept open by means of a frame, while the labourers poured water into it from buckets. A pump, however, to answer this purpose was soon constructed by the Van der Heides, who named it a *snake-pump*. By its means they were able to convey the water from the distance of a thousand feet; but I can find no account of the manner in which it was made. From the figure, I am inclined to think that they used only one cylinder with a lever. Sometimes also they placed a portable pump in the water, which was thus drawn into a leathern hose connected with it, and conveyed to the engine. Every pipe or hose for conveying water in this manner they called a *wasserschlange*, water-snake, and this was not made of leather, like the hose furnished with a fire-pipe, but of sail-cloth. They announced, however, that it required a particular preparation, which consisted in making it

water-tight by means of a proper cement.* The pipe also, through which the water is drawn up, must be stiffened and distended by means of metal rings, otherwise the external air, on the first stroke of the pump, would compress the pipe, so that it could admit no water. It is here seen that pipes made of sail-cloth are not so new an invention as many have supposed. That our present apparatus for conveying water to the fire-engine is much more ingenious, as well as convenient, must be allowed; but I would strongly recommend that in all cities there should be pumps, or running wells of water, to the spout of which, pipes having one end screwed to a fire-engine might be affixed. The van der Heides, among the advantages of their invention, stated, that this apparatus rendered it unnecessary to have leathern buckets, which are expensive, or at any rate lessened their number, as well as that of the workmen.

From this account, the truth of which cannot be doubted, one may readily believe that engines with leathern hose, were certainly not invented by Gottfried Fuchs, director of the fire apparatus at Copenhagen, in the year 1697, as publicly announced in 1717, with the addition, that this invention was soon employed both in Holland and at Hamburgh. †

* Page 5. Water-Slang, zynde een lange en buiggelyke buis, van zeker soort van doek hier toe besonderlyk bereid, gemaakt.

† Breslauer Sammlung 1717. Erster versuch Sept. p. 108. Paschii *Inventa nov-antiqua*, p. 668. W. G. Hesse *Abhandlung zu verbesserung der Feuersprützen*. Gotha 1778, 8vo. p. 7.

Fuchs seems only to have made known the Dutch invention in Denmark, on occasion of the great fire which took place on the 19th of April 1689, at the Opera-house of Amalienburg, when the beautiful palace of that name, and more than three hundred and fifty persons, were consumed. At any rate, we are told in history that, in consequence of this calamity, an improvement was made in the fire-establishment by new regulations, issued on the 23d of July 1689, and that engines on the Dutch construction, which had been used more than twelve years at Amsterdam, were introduced.*

Hose or pipes of this kind for conveying water were however not entirely unknown to the ancients. At least the architect Apollodorus says, in the passage already quoted, that to convey water to high places exposed to fiery darts, the gut of an ox, having a bag filled with water affixed to it, might be employed; for on compressing the bag, the water would be forced up through the gut to the place of its destination.† This was a conveyer of the simplest kind.

Among the latest proposals for improving the hose is that of weaving one without a seam. In

* *Algemeine Welthistorie*, vol. xxxiii. p. 631.

† *Poliorcet.* pag. 32: Κατα δε τα προκειμενα τοις πυροβολοις μερη, αντι σωληνων, βωων εντερα παραφεροντα υδωρ εις υψος. τουτων ασκοι πληρεις υδατος παρατιθενται και θλιβομενοι αναφερουσι. *In partibus autem quæ expositæ sunt telis incendiariis, pro tubis, boum intestina habere oportet, quæ aquam in sublime deferant. Ante hæc intestina utres aqua pleni collocantur, qui pressi aquam sursum emittunt.*

1720, some of this kind were made of hemp at Leipsic, by Beck, a lace-weaver, as we are told by Leupold, in his before-mentioned work on fire-engines, which was printed the same year. After this they were made by Erke, a linen-weaver of Weimar; and at a later period they were made of linen at Dresden, and also in Silesia.* In England, Hegner and Ehrliholzer have a manufactory at Bethnal Green, near London; where they make water-tight hose without seams.† Some of the same kind are made by Mr. Mögling on his estate near Stutgard, on a loom of his own invention, and are now used in many towns of the duchy of Wirtemberg.‡ I shall here remark, that Braun had a loom on which shirts could be wove without a seam, like those curious works of art, sometimes brought from the East Indies, and of which he has given a full description with an engraving.§

In the last place, I shall observe that, notwithstanding the belief of the Turks in predestination,

* Leipziger Intelligenzblatt, 1775, p. 345; and 1767, p. 69. Teutscher Merkur, 1783.

† The environs of London, by Daniel Lysons. Lond. 1792—1796. Four parts, 4to.

‡ W. G. Rappolt über die Stärke rund gewebter seile, Tübingen 1795. 8vo. Physikal. Œkon. Bibliothek, xix. p. 258.

§ Vestitus sacerdotum Hebræorum. Amstel. 1701. 4to. i. p. 273. Much useful information in regard to various improvements in the apparatus for extinguishing fires may be found in Aug. Niemann *Uebersicht der Sicherungsmittel gegen Feuersgefahren*. Hamburg und Kiel, 1796. 8vo. See *Physikal. Œkonom. Bibliothek*, xix. p. 412.

the use of fire-engines has been lately introduced at Constantinople, by Ibrahim Effendi.*

INDIGO.

IT is more than probable that indigo, so early as the time of Dioscorides and Pliny, was brought to Europe, and employed there in dyeing and painting. This I shall endeavour to show; but under that name must be understood every kind of blue pigment, separated from plants by fermentation, and converted into a friable substance by desiccation; for those who should maintain that real indigo must be made from those plants named in the botanical system *Indigofera tinctoria*, would confine the subject within too narrow limits; as the substance which our merchants and dyers consider as real indigo is prepared, in different countries, from so great a number of plants, that they are not even varieties of the same species.†

Before the American colonies were established, all the indigo employed in Europe came from the East Indies; and till the discovery of a passage round the Cape of Good Hope, it was conveyed, like other Indian productions, partly through the

* Busching's *Erdbeschreibung*, vol. ii. p. 673.

† For the preparation I must refer to my *Vorbereitung zur Waarenkunde*, Part iv. N° 4.

Persian Gulf, and partly by land to Babylon, or through Arabia and up the Red Sea to Egypt, from which it was transported to Europe. Considering this long carriage, as the article was not obtained, according to the Italian expression, *a drittura*, that is, in a direct manner, it needs excite no surprise that our knowledge, in regard to its real country and the manner of preparing it, should be exceedingly uncertain and imperfect. Is it astonishing that articles, always obtained through Arabia, should be considered as productions of that country; and that many commodities which were the work of art, should be given out to be productions of nature? For more than a hundred years the Dutch purchased from the Saxons cobalt, and smalt made from it, and sold them again in India; and the Indians knew as little where and in what manner the Dutch obtained them, as the Saxons did the people who were the ultimate purchasers and consumers. The real nature of indigo was not generally known in Europe till the Europeans procured it from the first hand; yet long after that period, and even in the letters-patent obtained on the 23d of December 1705, by the proprietors of the mines in the principality of Halberstadt and the county of Reinstein, indigo was classed among minerals on account of which works were suffered to be erected; but this only proves the individual ignorance of the undertakers, and also of their superiors, when they read what

they had written, and confirms the justness of Ovid's advice,

Disce bonas artes, moneo, Germana juvenus ;
Non tantum trepidos ut tueare reos.

What Dioscorides calls *indicon*, and Pliny and Vitruvius *indicum*, I am strongly inclined to believe to have been our indigo.* It was a blue pigment brought from India, and used both in painting and in dyeing. When pounded, it gave a black powder; and when diluted in water it produced an agreeable mixture of blue and purple. It belonged to the costly dye-stuffs, and was often adulterated by the addition of earth. On this account, that which was soft without any roughness, and which resembled an inspissated juice, was esteemed the best. Pliny thinks † that pure indigo may be di-

* Dioscor. lib. v. cap. 107. p. 366. Περὶ Ἰνδικου. Του δε λεγομενου Ἰνδικου, το μεν αυτοματως γινεται οιονει εκθρασμα ὄν των Ἰνδικων καλαμων. το δε βαφικον εστιν, επανθισμος πορφυρους επαιωρουμενος τοις χαλκειοις ὄν αποσυραντες ξηραινουσιν ὁι τεχνιται· ἀριστον δε ἡγητεον εἶναι το κυανοειδες τε και εγγχυλον, λειον. Εστι δε των στυφοντων ελαφρως και ῥεσσοντων φλεγμονας και οιδηματα· ανακαθιρει δε και καταστελλει ἑλλη. Ex Indici generibus unum sponte naturae provenit, veluti spuma marisve ejectamentum, Indicis arundinibus adhaerescens; alterum dant infectorum officinae, estque purpureus, quasi flos aereis innatans cortinis, quem derasum artifices siccant. Optimum porro censendum quod caerulei speciem praebet, atque etiam succosum est ac laeve. Inter medicamenta est, quae leviter adstringunt et inflammationes ac oedemata rumpunt. Ulcera quoque purgat et reprimit.

† Plin. lib. xxxv. cap. 6. § 27. p. 688. Ab hoc maxima auctoritas Indico. Ex India venit arundinum spumæ adherescente limo; cum teritur, nigrum; at in diluendo mixturam purpuræ caeruleique mirabilem reddit. Alterum genus ejus est in purpurariis officinis innatans cortinis, et est purpuræ spuma. Qui adulterant, vero In-

stinguished from that which is adulterated by burning it, as the former gives an exceedingly beautiful purple flame, and emits a smell similar to that of sea-water. Both he and Dioscorides speak of two kinds, one of which adheres to reeds, in the form of slime or scum thrown up by the sea. The other, as Dioscorides says, was scraped from the sides of the dye-pans in the form of a purple-coloured scum; and Pliny expressly remarks, that it was collected in this manner in the establishments for dyeing purple. The former relates also, that *indicum* belonged to the astringent medicines; that it was used for ulcers and inflammations, and that it cleansed and healed wounds.

This is all, as far as I know, that is to be found in the works of the ancients respecting *indicum*. I have given it at full length, as accurately as possible, and I have added, in order that the reader may be better able to compare and judge, the original words of the authors. *Indicon*, it is true, occurs in other passages; but it was certainly different from the one already mentioned. I allude, for example, to the black *indicon* of Arrian, and the *indicon* of Hippocrates. Of the former I shall

dico tingunt stercora columbinā, aut cretam Selinusiam, vel annulariam vitro inficiunt. Probatum carbone. Reddit enim, quod sincerum est, flammam excellentis purpuræ; et dum fumat, odorem maris. Ob id quidam e scopulis id colligi putant. Pretium Indico xx in libras. In medicina Indicum rigores et impetus sedat, siccaturque ulcera. The same account almost is given in Isidori *Origin.* lib. xix. cap. 7. p. 464.

treat in particular hereafter; and in regard to the latter, I refer to the author quoted in the note below.* It is not at all surprising that these names should be applied to more Indian commodities, since at present we give to many kinds of fruit, flowers, fowls, and other things, the appellation of Indian. The ancients, indeed, were not so careful as to distinguish always, by a proper addition, the many articles to which they gave the name of *indica*; and they had reason to expect that their cotemporaries would readily comprehend, by the connexion, the kind that was properly meant. Their commentators, however, in later times have, for the most part, thought only of one species or thing, and by these means they have fallen into mistakes which I shall here endeavour to rectify.

Every thing said by the ancients of *indicum* seems to agree perfectly with our indigo. The proper country of this production is India; that is to say, Gudscharat or Gutscherad, and Cambaye or Cambaya, from which it seems to have been brought to Europe since the earliest periods. It is found mentioned, from time to time, in every century; it is never spoken of as a new article, and it has always retained its old name; which seems to be a proof that it has been used and employed in commerce without interruption.

It is true, as the ancients say, that good indigo

* Foesii Oeconomia Hippocratis. Francof. 1588. fol. p. 281.

when pulverised is of a blackish colour. The tincture, however, is partly blue and partly purple; but under the latter term we must understand an agreeable violet, and not, as is often the case, our scarlet. It is true also that good indigo is soft or smooth to the touch* when pounded; it floats on water, and, at present, as in the time of Pliny, is adulterated and rendered heavier by the admixture of some earth, which, in general, as appears, is fine pounded slate.† It is further true, that the purity

* *Εγγυλον* means also juicy, or something that has a taste. Neither of these significations is applicable here, where the subject relates to a substance which is dry and insipid, or at any rate which can possess only a small degree of astringency. It must in this place denote an inspissated or dried juice; but I can find no other passage to support this meaning. Dioscorides, v. 172. p. 390, calls the best Samian earth *την εγγυλον και μαλακην και ευθρυβη, pinguem, mollem, friabilem*. *Εγγυλον* then may be the same as *λειον*, which some one seems to have added here by way of explanation.

† In Pliny's time people coloured a white earth with indigo, or only with woad, *vitrum*, in the same manner as coarse lakes and crayons are made at present, and sold it for indigo. One of them he calls *annularia*, and this was one of the sealing earths, of which I have already spoken in the first volume. In my opinion it is the same white pigment which Pliny immediately after calls *annulare*: *Annulare quod vocant, candidum est, quo muliebres picturæ illuminantur*. These words I find no where explained, and therefore I shall hazard a conjecture. Pliny, I think, meant to say, that "this was the beautiful white with which the ladies painted or ornamented themselves." But the meaning of the lines which immediately follow I have not been able to discover. May it not be an interpolation by some one who was unable to comprehend how an earth could be coloured with *vitrum*? The interpolation, however, must have been made at an early period, since it is to be found transcribed by Isidorus, *Origin*. xix. 7.

of it can be discovered by burning it. Indigo free from all foreign bodies becomes entirely consumed, leaving only ashes, while that which is impure, leaves a large quantity of earth. Pliny, perhaps, did not rightly understand this test by fire, and added, from conjecture, what he says in regard to the colour of the flame and the smell of the smoke, that this proof might not remain without an explanation. It is, however, possible that those who considered indigo to be sea slime, imagined that they perceived in it a smell of sea-water. A naturalist of modern times, who refers petrifications to Noah's flood, believed that he could smell sea-water in them after the lapse of so many thousand years.*

Indicum, on account of its long carriage by land, must have been dear; and therefore it was one of those pigments which the ancient painters, who were often poor slaves, were not accustomed to keep in any quantity by them, and with which it was necessary they should be supplied by those for whom they executed paintings.† Our indigo was also exceedingly dear, till it was cultivated in

* See my *Physikalische Œkonomische Bibliothek*, i. p. 587.

† Plin. lib. xxxv. § 12. p. 684: *Floridi colores sunt, quos dominus pingenti præstat: minium, Armenium - - - Indicum.* Vitruv. lib. vii. cap. 14. p. 248. *Item propter inopiam coloris Indici, creatam Selinusiam, aut annulariam, vitro, quod Græci isatin appellant, inficientes imitationem faciunt Indici coloris.* That the passage must be read in this manner has been already shown by Turnebus, *Adversar.* vi. 17. p. 109 (180).

the West Indies, where the value of it decreased as long as good land was plenty, and the price of labour was lessened by the slave-trade; but at present, since the land is become exhausted, it is rising to the ancient price.

That indigo, which at present is used only by dyers, should have been employed also for painting, needs excite no surprise. It was applied to this purpose till the invention of painting in oil, and the discovery of Prussian blue, smalt, and other pigments of a superior quality. It is even still used by landscape-painters to produce a pale gray; but it will not harmonise with oil.* As to the medical properties of indigo, I can, at any rate, show that the experiments made with it at the end of the seventeenth and the beginning of the eighteenth century fully confirm the high encomium bestowed by Dioscorides upon his *indicum*. There was a time when the former was much prescribed and recommended.† At present our physicians are acquainted with purer and more powerful remedies than indigo, the internal use of which, as the fermented mass is prepared in copper vessels, must be attended with suspicion.

* Praktisches Handbuch für Künstler, translated from the English. Dresden 1792. 8vo. i. p. 91.

† Ephemer. Nat. Cur. Dec. 2. an. i. p. 282. *Raii Hist. Plant.* i. p. 927. *Lister de fontib. medic. Angliæ. Exercitat.* 2. *Pharmacop. Württemberg.* i. p. 12. *Linnæi Mater. med.*

That the author, so often mentioned already, was not acquainted with the preparation of indigo, cannot be denied. It would, indeed, have been extraordinary had the account of it reached the Greeks and the Romans undisguised by fables, added either to answer the purposes of the interested merchant, or accidentally in the course of its long journey, in passing through so many countries and languages. It appears to me, however, that through these it may still be discovered; and in all probability we should be better able to form some idea of it were the oldest method of making indigo still known. In the slime deposited on the reeds, I think I can remark the first degree of fermentation, or commencement of putrefaction, without which the pigment could not be separated. Who knows whether the indigo plants in the earliest times were not deposited in pits or in stagnant water, in the same manner as our flax and hemp? Who knows whether after putrefaction they were not taken out, and the colouring parts adhering to them washed off and collected? The quantity indeed obtained by this process would not be great; and at present a much better method is employed; but the improvements made in every art have been gradual. The old inhabitants of the Canary islands scratched their land with the horns of oxen, because they were not acquainted with the spade, and far less with the plough. The above conjecture will appear much more pro-

bable, when it is known that in many parts of India the plants were formerly placed in large pits; and in Malta, where indigo was still cultivated in the seventeenth century, they were put into reservoirs or basons in order to ferment.* If this was usual in the oldest times, it may be easily seen how fabulous accounts might arise. Indigo was a slime attracted from the water by a reed, which the indigo plant, stripped of its bark, was considered to be.

Dioscorides speaks of another kind of indigo, which was the dried purple-coloured scum of the dye-pans. My predecessors, considering this account as an error, which might have arisen either from conjecture or misconception, or which was purposely occasioned by merchants, did not think

* Tavernier Reisen, ii. p. 112.

We are told so in *Malta vetus et nova* a Burchardo Niederstedt *adornata*. Helmstedtii 1659. fol. lib. iv. cap. 6. p. 23: a work inserted in Grævii *Thesaurus Ital.* vi. p. 3007: Plantam conjiciunt in oblongam cisternam ad id paratam. De Beauvais Raseau, a French writer in *l'Art de l'indigotier*, 1770. fol. p. 8, calls the author Burchard, and in this he has been followed by Krünitz and one of the compilers of the *Teutsche Encyclopædie*; but Burchard was his Christian name. His true name was Niderstedt, or, as he subscribed himself, Niederstedt. This man brought home with him to Germany, after his travels, a great many Persian manuscripts, which were purchased for the king's library at Berlin, as stated by Oclrich in his *History of that library*, Berlin, 1752. 8vo. p. 3. Niederstedt, however, is not the only person who speaks of indigo being cultivated in Malta. Bartholin *Epist. med.* cent. i. ep. 53. p. 224, says *Planta glasto, Melitensibus Ennir, hic quoque copiose provenit, ex cujus aqua fit color dictus Indago.*

it worthy of further examination. I cannot, however, refrain from remarking that a blue pigment, and even a very fine one, if the proper preparations had been made for that purpose, might have been obtained in this manner. It was not indeed indigo, in the proper sense of the word, but a pigment of a similar nature. That fine high-priced powder sold, at present, under the name of blue carmine, the preparation of which, as far as I know, has never yet been publicly described, is made from the separated scum of a dye-liquor, in which the finest colouring particles remain suspended. The scum or flower of a blue pan* which floats on the surface exhibits a play of many colours; and as among these the ancient purple is frequently observed, it may therefore very properly be said to have a purple colour.† In my opinion, there is no reason to disbelieve Dioscorides, when he says, that, in his time, a blue pigment named indigo was made in this manner, especially as it can be proved that the woad-dyers, at

* It is entirely different from the molybdate of tin, the laborious preparation of which is described by J. B. Richter, in his book, *Über die neuern Gegenstände der Chemie*, part ii. p. 97.

† Πορφυρεος οἱ πορφυρους, which Salmasius (in Solinum, p. 186. b) changes, in my opinion without necessity, into πορφυρας. It deserves to be remarked that the Greek dyers, speaking of a fermenting dye-pan covered with scum, used to say, like our dyers, that it had its flower, επαυθισμον. In Hippocrates the words επαυθισμα αφρωδες denote a scum which arises on the surface. Galen explains it by ανθος ανωθεν επικειμενον. See Foesii *Œconom. Hippocratis*, p. 222. Among the Latins *flos* in this sense is very common.

the end of the sixteenth century, separated from their pans a colouring substance, which they sold instead of indigo, an article at that time exceedingly dear.* Besides, we read that in the establishments for dyeing black, the scum was, in like manner, collected in old times in the form of a black pigment, and this practice, as appears, was usual in all the dye-houses in general. Pliny, who says that this indigo was made in the purple dye-houses, seems either to have misunderstood Dioscorides, or to have been too precipitate; but it is certain that the scum in the purple dye-houses may have been collected and dried into a purple-coloured carmine.

As the Europeans did not become acquainted with the nature of indigo till modern times, it needs excite no astonishment that the old commentators should have erred in explaining the passages to which I here allude; and their opinion can, therefore, be of little weight in opposition to mine. Those who have approached nearest to the truth, Sarazen, Mathioli, Salmasius, &c. speak as if indigo were made from our woad, which however does not grow in India. Dioscorides speaks also of woad in a particular section. Marcellus† Ver-

* Caneparius de Atramentis. Roterodami 1718. 4to. v. 2. 17. Von Hohlberg *Georgica curiosa*, B. 7. 64. ii. p. 87. *Valentini Museum museor.* i. p. 225. *Pomet Materialist*, i. p. 192.

† ΠΕΡΙ ΙΝΔΙΚΟΥ ΛΙΘΟΥ. See his edition of Dioscorides. Coloniae 1529. fol. p. 667.

gilius says, that Dioscorides meant indigo is certain; and this article is so generally known that it is not worth while to mention it. But he himself seems not to have been acquainted with it, else he would have amended the erroneous passage which speaks of *Indian stone*.* This arose from the ignorance of the old transcribers, who being unacquainted with *Indicum* thought only of *gemma Indica*, mentioned by Pliny.† But Vergilius was right in this, that the purple lake, spoken of by Pliny, and not by Dioscorides as he believes, can no longer be produced, as establishments for dyeing purple do not now exist.

I have long made it a rule, and prescribed it to others,‡ in explaining any object mentioned by the ancients, never to admit, without the strongest proofs, that the same article is denoted by different appellations. This, it is true, has been often done. By these means the small knowledge we possess of a thing that occurs under one name only may be increased. A wider field may thus be opened for conjecture, and more latitude may be given to the imagination; but at the same time one may fall into groundless explanations, and hazard assertions, which, with whatever caution and

* In his edition of Dioscorides, Coloniae 1529. fol. p. 667.

† Plin. lib. xxxvii. 10. sect. 61. p. 791.

‡ I shall venture for once to refer to my book *de Historia naturali veterum*, Gottingae 1766. 8vo. p. 204; which, notwithstanding all the faults of youthful precipitancy, and its many typographical errors, has been favourably received by competent judges.

learning proposed, will, on closer examination, be found either false or highly improbable. According to this rule, I have carefully endeavoured not to suffer myself to be so far misled by the respectability of my predecessors, as to consider the *Indicum* and *Indicum nigrum** of the ancients to be the same substance. On further research I find that the latter not only appears by the epithet to be different from indigo, but that it is China, or, as the Dutch call it, Indian ink. To prove this, I must quote the whole passage of Pliny † on which my assertion is founded; and perhaps the short illustrations added will render this minuteness less tedious to those who are fond of such dis-

* Το μελαν ινδικον.

† Lib. xxxv. cap. 6. Atramentum quoque inter factitios (colores) erit, quamquam est et terra, geminæ originis; aut enim salsuginis modo emanat, aut terra ipsa sulphurei coloris ad hoc probatur. Inveni sunt pictores, qui e sepulcris carbonis infectos effodient, sed importuna hæc omnia ac novitia; fit enim ex fuligine pluribus modis, resina vel pice exustis, propter quod officinas etiam ædificaverunt, fumum eum non emittentes; laudatissimum eodem modo fit e tedis; adulteratur fornacum balinearumque fuligine, quo ad volumina scribenda utuntur. Sunt qui et vini sæcem siccata excoquant, affirmantque, si ex bono vino facta fuerit, *Indici* speciem id atramentum præbere. Polygnotus et Mycon celeberrimi pictores Athenis, e vinaceis fecere, trigynon appellant. Apelles commentus est ex ebore combusto facere, quod elephantinum vocant; apportatur et *Indicum* ex India, inexplorata adhuc inventionis mihi. Fit etiam apud infectores ex flore nigro, qui adhærescit æreis cortinis; fit et e tedis ligno combusto, tritisque in mortario carbonibus. Mira in hoc sepiarum natura, sed ex his non fit. Omne autem atramentum sole perficitur, librarium gummi, tectorium glutino admisto, quod autem aceto liquefactum est ægre eluitur.

quisitions. Pliny here enumerates all the materials which, in his time, were used for black ink. He, therefore, mentions two vitriolic substances, a slime or sediment (*salsugo*), and a yellow vitriolic earth (called also *misy*). Such minerals continued in use as long as men were unacquainted with the art of lixiviating the salt, and causing it to crystallize; or, in other words, as long as they had no vitriol-manufactories. He speaks also of lamp-black being made in huts built for the purpose, which are described by Vitruvius, and from which the smoke of burning pine-wood was conveyed into a close apartment. The article was certainly adulterated when soot, taken from the baths and other places where an open fire was maintained with wood of all kinds, was intermixed with it. It is very remarkable that black from burnt refuse of grapes, *noir de vigne*, which at present our artists, and particularly our copper-plate printers, consider as the most beautiful black, was made even at that period. Germany hitherto has obtained the greater part of this article from Mentz, through Franckfort, and on that account it is called Franckfort black. Some is made also at Kitsingen, Markbreit, and Munich. For this purpose the refuse of the grapes is charred in a close fire, and being then finely pounded is packed into casks. Pliny observes, that it was asserted that from this substance one could obtain a black

which might be substituted for indigo. Another pigment was bone black, or burnt ivory, which is highly esteemed even at present.* Besides these, continues he, there is obtained from India what is called *Indicum*, the preparation of which I have not yet been able to learn; but a similar pigment is made from the black scum of the dye-pans, in places for dyeing black, and another kind is obtained from charred fir-wood finely pulverised. The cuttle-fish (*sepia*) likewise gives a black; but that however has nothing to do with the present question. He remarks, in the last place, that every kind of black pigment is improved, or rather the preparation of it completed, by exposure to the sun;† that is to say, after gum has been added to that intended for writing, and size to that destined for painting. But that which was made with vinegar was more durable, and could not be easily effaced by washing. All this is very true. Our ink acquires a superior quality when exposed to the light of the sun in flat vessels. That vinegar renders black colours faster, is well known to our calico-printers; and those who wish to have good ink must employ in making it the brightest

* Vorbereitung zur Waarenkunde, i. p. 327. 349.

† *Perfici* is a term of art which is often used to express the finishing or last labour bestowed upon any article: *Vasa sole perficiuntur*. When vessels of earthen-ware have been formed, they must be suffered to dry and become hard in the sun. See Hardouin's index.

vinegar of beer. It is equally true, that every black pigment mixed up with gum or size can be sooner and easier washed out again with water.*

A considerable part of what has hitherto been quoted from Pliny, may be found also in Vitruvius.† The latter, in like manner, mentions huts for making lamp-black; he speaks also of ivory-black, and says expressly, that when it is properly made it not only forms a good colour and excellent ink, but approaches very near to *Indicum*.

* Gum and gummy substances of every kind used to make ink thicker and give it more body, were called *ferrumen*. See Petronius, cap. 102, 15, according to Burmann's edit. i. p. 721; and ii. p. 195.

† Vitruv. vii. 10. p. 246. Primum exponam de atramento, cujus usus in operibus magnas habet necessitates, ut sint notæ, quemadmodum præparentur certis nationibus artificiorum ad id temperaturæ. Namque ædificatur locus uti laconicum, et expolitur marmore subtiliter et lævigatur. Antè id sit fornacula habens in laconicum nares, et ejus præfurnium magna diligentia comprimitur, ne flamma extra dissipetur; in fornace resina collocatur. Hanc autem ignis potestas urendo cogit emittere per nares inter laconicum fuliginem, quæ circa parietem et cameræ curvaturam adhærescit, inde collecta passim componitur ex gummi subacto ad usum atramenti librarii, reliqua tectores glutinum admiscentes in parietibus utuntur. Sin autem cæ copiæ non fuerint paratæ, ita necessitatibus erit administrandum, ne expectatione moræ res retineatur. Samenta aut tedæ schidiæ comburantur, cum erunt carbones, extinguantur. Deinde in mortario cum glutino tereantur, ita erit atramentum tectoribus non invenustum. Non minus si fæx vini arefacta, et cocta in fornace fuerit, et ea contrita cum glutino in opere inducetur, per quam atramenti suavem efficiet colorem, et quo magis ex meliore vino parabitur, non modo atramenti, sed etiam *Indici* colorem dabit imitari.

Now I might here ask, whether it is at all probable that the learned Pliny and the practical connoisseur of painting, the architect Vitruvius, could consider and describe our blue indigo as a pigment which, like lamp-black, could be employed as a black colour and as ink? Is it credible that Pliny, if he meant blue indigo in the before-mentioned passage, would have said that he was not able to learn the preparation of it, when he expressly describes it, as he believed it to be, in the course of a few lines further? Would Pliny and Vitruvius, had they been acquainted with black indigo only, remark immediately after, that, when costly indigo could not be obtained, earth saturated with woad, consequently a blue earth, might be used in its stead? Is not allusion here made to a blue pigment, as was before to a black one? Is it not therefore evident, that the name of *indicum* was given to a black and also to a blue pigment brought from India? And if this be the case, is it not highly probable that the black *indicum* was what we at present call Indian ink, which approaches so near to the finest ivory-black, and black of wine lees, that it is often counterfeited by these substances, a preparation of which is frequently sold as Indian ink to unwary purchasers?*

In India all artificial productions are

* Waarenkunde, i. p. 136.

of very great antiquity ; and therefore I will venture to say, that it is not probable that Indian ink is a new invention in India, although it may probably have been improved, and particularly by the Chinese.

To confound the two substances, however, called indigo (*indicum*) at that period was not possible, as every painter and dealer in colours would know that there were two kinds, a blue and a black. It has, nevertheless, occurred to me, that in the works of the ancients obscurity may have sometimes been avoided by the addition of an epithet ; and I once thought I had found in Pliny an instance of this foresight ; that is, where he names all kinds of colours—*purpurissum*, *Indicum ceruleum*, *melinum*, *auripigmentum*, *cerussa*.* I conceived that in this passage our indigo was distinguished from the black *indicum* by the epithet *ceruleum*. But my joy at this discovery was soon damped by Hardouin, who places between *Indicum* and *ceruleum* a comma, which is not to be found in many of the oldest and best editions.† I cannot, therefore, get rid of this comma ; for it is beyond all dispute

* Lib. xxxv. cap. 7.

† For example, the Elzvir edition of 1635, 12mo; though it occurs in some of the older ones, such as that of 1507, fol. which is the next classical edition to that of Hermolaus Barbarus ; also in the Basle edit. of 1535, fol. which properly is the fourth Basle edition, though by Fabricius it is called the second, and by Hardouin the first. Compare Rezzonico *Disquisitiones Pliniana*, ii. p. 327.

that *ceruleum* was the common appellation of blue copper ochre, that is, mountain blue. I shall now proceed to examine whether my observation be true, that the Greeks frequently used the term black *indicum*, when they meant to denote the black, and not the blue.

The term *nigrum Indicum* occurs in Arrian, Galen, Paulus Ægineta, and perhaps in the works of other Greek physicians; and as the Latin writers were acquainted with an *Indicum* which dyed black, there is reason to conjecture that this was the *Indicum nigrum** of the Greeks, though I should rather be inclined to translate this appellation by the words Indian black, in the same manner as we may say Berlin blue, Roman red, Naples yellow, Brunswick green, Spanish brown, &c.; or I should as readily translate it Indian ink.† Arrian introduces it along with other Indian wares.‡ I do not indeed find that he makes any mention of indigo properly so called; but a complete catalogue of merchandise is not to be expected from him. *Indicum*, however, occurs once more in this author; but in the passage

* *Ινδικον μελαν.*

† For *μελαν* without any addition, or *μελαν ω γραφομεν*, or *μελαν γραφικον*, were the terms used to express black ink. Galen *de simplic. med. facultat.* ix. p. 143. ed. Basil. p. 126. *Dioscor.* v. 183. p. 393; and *Parabil.* i. 178. p. 48. In the *Hippiatr.* p. 294, black ink is called *μελαν καλλιγραφικον.*

‡ *Periplus maris Erythræi*, p. 12, edit. Stukii, Genève 1577. fol.

where it is found it is only an epithet to another article. Speaking of cinnabar, he adds, that he means that kind called Indian, which is obtained from a tree in the same manner as gum. I am inclined to think that he alludes to dragon's blood, which on account of its colour was at that time called cinnabar.*

Some have conjectured† that what in Arrian is named *laccos chromatinos*‡ was our indigo, which indeed might be classed among the lakes, according to the present meaning of that word. Others, however, understand by it gum lac.§ But I am

* Pag. 10. Γίνεται και εν αυτη και κινναβαρι, το λεγομενον ινδικον, απο των δενδρων ως δακρυ συναγομενον

† In particular the learned Dr. William van Ranouw, who lived at Amsterdam, and died in the year 1723 or 1724. I shall always respect his memory, because he recommended the study of technology. He was the author of a work entitled *Kabinet der natuurlyke historien, wetenschappen, konsten en handwerken*, of which eight parts, small octavo, were printed at Amsterdam, between the years 1719 and 1727. Many of the parts have been several times reprinted. The eighth, published by an anonymous writer after the author's death, concludes with a piece which has for title, *Slot van het kabinet der nat hist.* In 1732, a good index was published to the whole work, *Register tot alle de deelen von het kabinet - - - door P. van der Meersch*, which forms the ninth volume; but in my copy, purchased at the sale of the library of the ornithologist G. G. Möhring, it is wanting. In the seventh part there is a dissertation, of considerable length, but well worth reading, on the history, preparation, and use of indigo.

‡ Periplus maris Erythr. p. 3: λακκος χρωματινος.

§ Exercitat. Plin. p. 816. b. And in the annotations in *Flavium Vopiscum*, p. 398, according to the edit. *Historiæ Augustæ*, Parisiis 1620. fol.

unacquainted with any proofs that gum lac was known at so early a period. I much doubt whether this meaning of the word lac be so old; and I must confess that the opinion of Salmasius appears to me highly probable, namely, that Arrian alluded to a kind of party-coloured garment. For, besides the grounds adduced by Salmasius, it deserves to be remarked, that in the passage in question different kinds of clothes, and no other articles, are mentioned. Besides, the epithet *chromatinos** is applied by the same writer, in the same sense, to other kinds of clothing. It cannot, therefore, be said that Arrian mentions our gum lac, the origin of which word Salmasius endeavours to discover.

In the works of Galen, which have not yet been sufficiently illustrated, I have found *Indicum nigrum* only four times. In a place where he speaks of diseases of the eyes, † he extols it on account of its cleansing quality; and says it can be used for wounds, when there is no inflammation. In another place, ‡ it occurs in three prescriptions for

* Pag. 2: αβολοι νοθοι χρωματινοι.

† De Composit. pharmac. secundum locos, lib. iv. cap. 4, in the edition of Basle 1538, ii. p. 207. 'Ρυπτικον δε τι και το καλουμενον αρμενιον εχει, καθαπερ και το καλουμενον ινδικον μελαν, και δια τουτου τοις αφλεγμαντοις ελκεισιν αλυπως σμιλει. Habet autem et quod armenium vocatur, extergendi vim, quemadmodum et atramentum Indicum appellatum, et ob id sane ulceribus inflammatione carentibus citra molestiam adhibetur. *Edit. Gesn. Class. v. p. 304.*

‡ Lib. iv. cap. 7. ed. Basil. p. 218: ed. Gesn. p. 314.

eye-salves. I have however endeavoured, but without success, to find in this excellent writer an explanation of what he calls *Indicum*; though he has explained almost all the different articles then used in the materia medica. It appears, therefore, that the Greeks gave the name of *Indicum* to our indigo, and also to Indian black or Indian ink.

It, however, cannot be denied that, in opposition to this opinion, considerable doubts arise. Many who think that the black indigo (*nigrum Indicum*) of Pliny and Vitruvius was not ink, but our indigo, remark, that things of a dark blue or dark violet colour were by the Greeks and the Romans frequently named black; and, therefore, that the blue indigo might in this manner be called black.* But the examples adduced as proofs are epithets,† applied by the poets to dark-coloured flowers. Because nature produces no black flowers, the poets, who are fond of every thing uncommon, extraordinary, and hyperbolic, call flowers black, when they are of so dark a tint as to approach nearly to black. Thus clear and deep water is called black.‡ It is, however, hardly credible that painters and dyers, who must esta-

* Salmasii Exercitat. Plin. p. 908. a.

† Such as *ιον μελαν*. Theocrit. Idyl. x. 28; *σακινθος μελαινη, κρινου μελαγ, θυμον μελαν*, &c. Nec tamen, ut testes mos est audire poetas, Ovid.

‡ See vol. iii. p. 230.

blish an accurate distinction between colours, should have spoken in so vague a manner. Salmasius suspects that *Nil* and *Nir*, the Arabic names of Indigo, have arisen from the Latin word *niger*.

The objection, that Paulus Ægineta, the physician, in a passage where he refers to Dioscorides for the medical virtues of *Indicum*, applies to it the epithet black, seems to have more weight.* It may be added also, that the virtues, in general, which Galen ascribes to the *Indicum nigrum*, appear to be similar to those ascribed by Dioscorides to *Indicum*; and the latter in one place,† where he speaks of the healing of wounds, uses only the expression *Indicum*, and not *Indicum nigrum*. It is particularly worthy of remark that Zosimus, the chemist, declares the hyacinth colour of the ancients, that of woad, and the *Indicum nigrum*, to be the same‡ or similar. But to those who know

* Pauli Æginetæ libri vii. Basilæ 1538, fol. p. 246. lib. vii. *Μελαν ινδικον, ως φησι Διοσκοριδης, των ψυχοντων ελαφρως εστι και ρησσουντων φλεγμονας και οιδηματα, ελκη τε αναπαθαιρευτων.* Pauli Ægin. *Pharmaca simplicia*, Othone Brunfelsio interprete, Argentorati 1531. 8. p. 45, a. *Melan indicum, ut inquit Dioscorides, ex facillime refrigerantibus est, phlegmonasque et œdemata rumpentibus ulcera remouentibus.*

† *Parabillum*, lib. i. 161. p. 43.

‡ Salmasius in *Homonymis Hyl.* Iatr. p. 177, a; and in *Exercitat.* Plin. p. 810, b; and p. 936, b; has quoted these words: *Επι υακινθου δε ποαν υακινθου και μελαν ινδικον και ισατιδος ριζαν.* In regard to the manuscripts of the work of Zosimus, which is commonly called *Panopolita*, see Fabricii *Bibl. Græca*, vol. vi. p. 612, 613; and vol. xii. p. 748. 761. I wish I may be so fortunate as to outlive the

on how slight grounds the ancient physicians ascribed medicinal qualities to many substances, it will not perhaps appear strange, that, in consequence of the same name, they should ascribe the same qualities to two different things. It is not improbable that in cases of external injury, for which the *Indicum nigrum* was recommended, indigo and Indian ink might produce as much or as little effect. I should consider of far greater importance the opinion of the chemist Zosimus; but unfortunately his writings have not yet been printed. The period in which he lived is still uncertain, and it is not known whether all the chemical manuscripts which bear that name were written by the same author.

From what has been said, I think it may, at any rate, be inferred, that in the time of Vitruvius and Pliny indigo, as well as Indian ink, was procured from India, and that both were named *Indicum*. It is less certain that the Greeks called indigo *Indicum*, and Indian ink *Indian black*.

publication of it; it will certainly throw much light on the history of the arts. I cannot help calling the reader's attention to another passage of Zosimus, which is quoted by Saumaise, p. 810. b: Οὕτω γὰρ δεκτικά γίνεταί των χρωμάτων, ὡσπερ καὶ χροοποιηθεὶς ὁ ἐστὶ λαχίον, ὁ καλοῦσι λαχχαν οἱ λαχῶται, τούτεστιν Ἰνδικοβαφοὶ λοιπὸν εὐμορφῶς, δια νιτροῦ καὶ θερμου ὄλου ἀφιησιν εαυτοῦ τὸ εἶδος τὸ αἰμῶπου. In this passage λαχχας appears to be actually the same as Ἰνδικον, and perhaps we are to understand by it that kind of indigo obtained from the scum or flower of the dyepans. It is also remarkable that Zosimus calls indigo-dyers λαχῶται and Ἰνδικοβαφοὶ, in order perhaps to distinguish them from the dyers with woad. The distinction, therefore, between indigo-dyers and those who dyed with woad must be very old.

Nay it appears that indigo, on account of the very dark blue colour which it exhibits both when dry and in the state of a saturated tincture, was often named Indian black. In my opinion, it is proved also that, in the old dye-houses, the workmen collected the scum thrown up by the dye-pans, and dried it into a kind of lake or carmine.

I shall now prove, what I have already asserted, that indigo was at all times used, and continued without interruption to be imported from India. I shall quote mention made of it in various centuries; but I am convinced that attentive readers may find instances where it occurs in many other writers.

The Arabian physicians, it is probable, all speak of indigo; but it is unfortunate that, in this point, we must depend upon very incorrect Latin translations. It appears also that they often repeat the information of the Greeks, in regard to articles of the materia medica, without having been acquainted with them themselves. Rhases, who lived at the end of the tenth century,* mentions, *Nil, alias Indicum*. Avicenna, who died in 1036, often speaks of indigo; † but in the margin of the

* In the edition of some Arabian physicians, published by Brunfels, at Strasburgh, 1531, fol.

† Avicennæ Canon medicinæ - - - Venetiis apud Juntas, 1608, fol. ii. p. 237. lib. iv. fin. 7. tract. i. cap. 10: Indicum quidem Indum bonum est, velocioris tincturæ, sed est vehementius, faciens colorem pavonis et flavitatem. Et Indicum Carmenum est minus

wretched translation it is remarked, that under the term *indicum*, alum (or much rather vitriol) is to be understood: In a passage, however, where he speaks of dyeing the hair black, he certainly alludes to indigo, which, according to the translation, produced *colorem pavonaceum*, or a violet colour. In the Latin we find *Indicum indum bonum*, and this awkward expression Salmasius* explains by remarking, that the words in the Arabic are *Alusma Alhendia*, that is, Indian woad. In the same place he mentions *Indicum carmenum*, a kind of indigo which did not dye so much a violet colour as a black, that is to say with the addition of vitriol. *Carmania*, indeed, bordered on *Gedrosia*, which is the proper country of indigo, where the best is still prepared at Guzurat. In the explanation of some Arabic words, † printed in my copy of Avicenna, *indicum* is translated *granum Nil. Serapion*, about the end of the eleventh century, ‡ mixed together, as appears, every thing that the Greeks have said in regard to indigo and woad. Averroës, in the middle of the twelfth century, mentions the medicinal qualities of indigo as given by the Greeks, § and adds, that it was much used for dyeing.

tingens et tardius, verum ejus tinctura est declivis ad nigredinem, et non est multitudo coloris pavonis in ea.

* De Homon. hyles iatricæ, cap. 107. p. 178. b.

† Pag. 432.

‡ In Brunfels Collection, already quoted, p. 61.

§ Ibid. p. 348.

Muratori gives a treaty, written in Latin, of the year 1193, between the citizens of Bologna and Ferrara, which contains a list of those articles subject to pay duty. Among these occurs *indigum*.* In the thirteenth century the celebrated Marco Polo, who spent twenty-six years in travelling through Asia, and even some parts of China, relates that he saw indigo, which the dyers used, made in the kingdom of *Coulan* or *Coilum*; and he describes the process for preparing it.† Much curious information in regard to the trade with this article, in the middle of the fourteenth century, is contained in the valuable work of Francesco Balducci Pegolotti.‡ We there find the names of different kinds, such as *Indaco di Baldacca detto buccaddeo*, in all probability from Bagdad, a city which in many old books of travels is called Baldach or Baldac;§ also *Indaco del Golfo*,|| *Indaco di Cipri*,¶ *Indaco Rifanti*.** In-

* Antiquitates Italiæ mediæ ævi, ii. p. 894.

† Lib. iii. cap. 31. p. 150. Crescit etiam ibi herba quædam, unde fit color, quo tinctorum utuntur, vulgo Endici dictus; quæ primum in vasis aqua repletis humectatur, et deinde in sole torrefacta in minutas dividitur partes, quales ad nos inferri solet.

‡ In the third part of the work, entitled *Della decima e di varie altre gravezze imposte di Firenze*. Lisbona e Lucca, 1766. 4to. Through an error of the press, the name in Sprengel's *Geschichte der geographischen Entdeckungen* is always spelt *Pegoletti*, and this error has been copied into Fischer's *Geschichte des Teutschen Handels*.

§ P. 65, 73, 296, 371.

|| P. 113, 296.

¶ P. 65, 296.

** P. 296.

digo, at that time, was imported in hides (*cuojo*),* or in leather bags (*otre*),† and also in boxes (*casse*).‡ What this traveller says in regard to the signs by which its goodness may be known, is very remarkable. § Nicolo Conti, who travelled through India before the year 1444, mentions *endego* among the merchandise of Camboja. || That the expression *color indicus* was used in the middle ages to denote blue mixed with violet, is proved by Du Cange. It appears to me, therefore, highly improbable that indigo should not be known to Rosetti, as Professor Bischof supposes. ¶ In that

* P. 15.

† P. 57, 73.

‡ P. 315.

§ P. 371. *Indaco di Balducca* detto *baccadeo* vuol' essere in piccioli pezzolini nè troppo grossi, nè troppo piccioli in questo modo †, e quando rompi gli suoi pezzolini, la sua pasta dentro vuol' esser sottilissima e fissa, e che penda alquanto in colore violetto; e se tiene del coronato, vale tanto meglio: e il coronato si è, che quando l'uomo rompe il pezzolino dell' Indaco, ed e' mostra nella sua rottura, poichè è rotto, intra l'uno pezzo e l'altro nelle facce della sua rottura a modo d'una gentile, e sottile meffa, e quello che mostra in questo modo s'appella coronato, e non è però in ciascuno pezzo d'indaco, ma pare, che ne trovi del cosie fatto, e i pezzi dell' indaco vae tra esso de' pine grandi, e de pine piccoli, che non sono quelli, che qui di sopra t'ho mostrato, ma questi si mostrano par assempro.

Indaco di Cipri si è grassa cosa, e vale intorno d'uno quarto di ciò che vale il buono indaco di Baccaddeo, ed è fatto in panellini piani di sotto, e acuti di sopra in questo modo Δ, et rattorto in poco; e quanto è più leggiere e più in colore d'indaco, e netto di foglie, e di pattume, che alcuna volta ene appastato con csse, tanto è migliore.

|| Ramusio Viaggi, 1613, i. p. 342. A.

¶ Versuch einer Gesschichte der Farberkunst. Stendal 1780, 8vo. p. 69.

important work on dyeing, however, which I mentioned long ago,* it occurs several times, and always under the name *endego*.†

I shall here make one observation, which is of some importance in the history of dyeing. It is found that, in the middle ages, the Jews maintained in the Levant a great many establishments for dyeing, and were the principal people who carried on this branch of business. Benjamin the Jew, who died in 1173, says in his travels, in speaking of some places, that “a Jew lived there who was a dyer;” or he remarks, in regard to others, that “most of the Jews followed the occupation of dyeing.” A scarlet-dyer lived at Tarento, and a purple-dyer at Thebes. At that period the Jews at Jerusalem had hired from the king a place particularly well fitted for dyeing, on the express condition, that no person, besides themselves,

* *Anleitung zur Technologie*, fourth edit. p. 123. I can now add that Roso, in *Memorie della Societa Italiana*, Verona 1794, 4to. vii. p. 251, quotes also the edition *per Francesco Rampazetto*, 1540, 4to. In Aldrovandi *Dendrologiu*, Francofurti, fol. (1671) p. 432, the book is quoted under the name of *Plicto*.

† As the edition of 1548, which I have now before me from the library of our university, is not paged, I shall quote the title of the section: A tener la sede de cavallo azure. A far una pelle o piu de color azurro. A far pelle azure. In the book of ancient documents (*Urkundenbuche*) which the archbishop Testa von Montreale added to his work *De rebus Friderici II*, there is one document in which the emperor gave great immunities to the Sicilians, and which contains good information in regard to dyeing with indigo; but this work I have not been able to procure.

should be suffered to carry on there the same business.* I am fully aware that well founded doubts have been entertained in regard to the credit which ought to be given to Benjamin's narration, and Jewish vanity is every where well known; but I do not see why he ought not to be believed in regard to this point; for it may very naturally be asked, why he should have falsely ascribed this occupation to his countrymen and no other? He speaks only once of a Jew glass-maker, a woollen- and a silk-weaver. To this may be added, that it is frequently stated in various authors, that the business of dyeing was carried on in Italy by the Jews. Thus, in the eleventh century, among the branches of revenue arising to the popes from Benevento, mention is made of the taxes paid by the Jews on account of their dye-houses.† In the middle ages princes seem to have maintained dye-houses on their own account. Instances occur of their giving away, as presents, such establishments with all their apparatus.‡ A place of this kind was called *tincta*, *tingta*, or *tintoria*. This

* Itinerarium Benjaminis cum notis Const. L'Empereur. Lugd. Batav. 1633. 8vo. p. 18, 20, 38, 41, 48, 50, 51, 52, 58.

† Cajetani Cenni Monumenta dominationis Pontificiæ. Romæ 1761. 2 vol. 4to. ii. p. 180: *Tingta Judæorum*.

‡ Du Cange quotes a diploma of the emperor Frederick II, dated 1210: *Donamus totam tinctam nostram ipsius civitatis nostræ Pa-normitanæ, quæ sit et fieri potuerit in futuro, cum fundico et omni jure et libertate sua - - - Omnia jura ipsorum Judæorum et redditus ipsius tinctæ*. Similar expressions are quoted by Du Cange, under the word *Tintoria*, from a diploma of Charles II. king of Sicily.

dye regale is to be deduced perhaps from the old establishments for dyeing purple, which could be formed only by sovereigns, and not by private individuals. Along with these *tinctoræ* the Jews are often mentioned, so that it appears probable they were employed there as workmen.

There is reason therefore to conjecture, that the Jews learned this art in the East, where it was carried in many things to a degree of perfection which the moderns, with all the aid of chemistry, have not been able to attain; and that they employed in Italy the same pigments as were used in the dye-houses of the Levant. It is not improbable also, that in the room of woad, which was then cultivated in Italy, they introduced indigo, a substance richer in colouring matter, or, at any rate, rendered it more common. The Italians were the first people in Europe who brought this art to a greater degree of perfection, as they did many others; and it can be proved that the knowledge of it was thence diffused to other countries. In the same proportion as this took place, indigo, in my opinion, banished the native woad, which was neither so advantageous, nor communicated so beautiful a colour as the Italians were able to dye with the former. The use of it became more extended when the productions of the East Indies were brought to Europe by sea, and particularly after it could be obtained from America, at a much cheaper rate.

The first Portuguese ship, that commanded by Vasco de Gama, returned from the East Indies in the year 1499, and was soon followed by several more, all laden with the most valuable merchandise of the East. I have never yet been able to find any invoice of the cargoes of these vessels; and, unfortunately, we have no account of the early trade carried on by the Portuguese with Indian productions. I have no means, therefore, of proving that indigo was among the commodities first imported. Spices, which in consequence of the general prevalence of luxury sold at that time exceedingly dear, together with precious stones, formed, no doubt, the first articles of trade; but it is not improbable that they were soon followed by indigo, for all the travellers who about that period visited India, speak of it as one of the most current articles.

Barbosa, a Portuguese, who collected there in 1516 valuable information in regard to geography and trade; who afterwards accompanied Magelhaens on his voyage round the world, and perished with him at the island of Zebu, has given a price-current of the merchandise at Calecut, in which the value of good indigo at that time is stated.*

* Ramusio, i. p. 323. c: Endego vero et buono val la farazuelo, fanoes xxx. *Farazuola*, or, as Ramusio sometimes writes it, *farazola*, is the common weight at Calicut, and in our dictionaries is spelt *farcell*, *farezella*, *faratella*. By *fanoes* is to be understood that coin called in our dictionaries *fanos*, *fanon*, *fano*. Those who wish to understand the price will find assistance from the explana-

Corsali also, in his letters written from India in 1516, mentions indigo among the wares of Camboya. Louis Guicciardini, who wrote first in 1563, and died in 1589, speaking of the merchandise obtained by Antwerp from Portugal, mentions *Anil* among that of the East Indies.*

It is however certain, that the trading company established in the Netherlands in 1602, who learned at an early period the art of rendering indispensably necessary to the Europeans cottons, tea, sago, and other things of which they could always hope to find a sufficient supply in India, carried on the greatest trade with these articles. The first German writers who complain of indigenous woad being banished by indigo, and those sovereigns who, by public orders, endeavoured to prevent this change, ascribe the fault to the Netherlanders. Niska, † who wrote in 1630, says, indigo had been introduced into Germany only thirty years; and an order of the emperor Ferdinand III, dated 1654, says, that it had been imported into Germany from Holland some years before that period.

tion given by Barbosa to the first article of his catalogue. The words in brackets were added by Ramusio: *Lacca di Martabani, che sia buona, val la farazuola, che è libre xxii et sei oncie, et mezzo di Portogallo d'oncie 16 la libra [che sono circa lire xl alla sottile di Venetia] xvi fanoes, [che sono xviii marcelli d'argento, per che un fanoes vale un marcello d'argento in circa.]*

* *Totius Belgii Descript.* Amstel. 1660. 12mo. i. p. 242: *Color Indicus, quem Lusitani dicunt anil.*

† Schreber's *Beschreibung des Waidtes.* Halle 1752. 4to. p. 105.

That the importation, at this time, was very great, is proved by the cargoes of the ships which arrived in Holland from the East Indies in 1631. The first had 13,539 pounds of Sirches indigo; the second 82,734 pounds of Guzerat indigo; the third 66,996 pounds of the same; the fourth 50,795 pounds of Bajano indigo; the fifth 32,251 pounds of Chirches indigo; the sixth 59,698 pounds of Bejana indigo; and the seventh 27,532 pounds of Chirches. I have mentioned these so particularly, as one may thence see the different kinds, and the places where made. These seven vessels, therefore, brought to Europe 333,545 pounds, which, at a low valuation, were worth five tons of gold, or 500,000 dollars. In the month of April, 1633, three ships brought home 4092 *kartel* of indigo, which were worth 2,046,000 rix-dollars.*

The profit attending this trade induced people, soon after the discovery of America, to manufacture indigo in that country; and they were the more encouraged to do so by observing that the native Americans, before they had the misfortune to become known to the Christians, tinged their bodies and faces of a blue violet colour, by means of indigenous plants, which resembled the indigo-plant of Asia.

Whether the two plants are of the same genus,

* Schreber ut supra, p. 114 and 115 in the Appendix.

or whether the American is different from that used in the other quarters of the globe, has not yet, as far as I can find, been with certainty determined. It is however proved, that the assertion of Raynal and others, that this plant was first conveyed to the new world from Asia by the Europeans, is entirely erroneous. It is mentioned by Francis Colon, in the Life of his father,* among the valuable productions of the island of Hispaniola or St. Domingo. Francis Hernandes reckons it among the natural plants of Mexico, and says, that the Americans used it for dyeing their hair black. He adds, that they made from it a pigment which they named *Mohuitli* and *Tleu-huilli*, the same as the Latins named *cœruleum*, and he describes also the method of preparing it.†

* This work was twice printed in Italian and once in French. These editions I have never seen. Compare *Meusel Biblioth. Histor.* 3. 1. p. 261. It was, however, afterwards printed in *Barcia Historiadores primitivos de las Indias Occidentales*. Madrid 1749. fol. vol. i. In the last section, p. 61, we find among the productions of the above island, *minas de cobre, anil, ambar, &c.* An English translation of this Life may be seen in Churchhill's Collection of Voyages and Travels, ii. p. 621. But these words are there translated in the following manner: *mines of copper, azure, and amber.*

† *Rerum medicarum Novæ Hispaniæ Thesaurus*. Romæ 1651. fol. lib. iv. 12. p. 102. We find the same thing stated, in the same words, in Nierenbergii *Hist. Naturæ*. Antverpiæ 1635. fol. p. 339. Compare Joh. de Laet *Novus Orbis*. Lugd. Bat. 1635. fol. p. 330.

I shall here beg leave to answer the following question, which was once proposed to me: How could Nierenberg transcribe from Hernandes, whose work was printed sixteen years later? Hernandes had in manuscript 24 books, and 11 volumes of drawings. The

This is confirmed by Clavigero, who has published the newest account of Mexico.*

This plant, therefore, must be reckoned among the few which are indigenous in three quarters of the globe. It is, however, highly probable that the Europeans, in the course of time, introduced a better species or variety into America, where several kinds are actually cultivated at present.

In the history of the American indigo, I must here leave a considerable hiatus, which perhaps

work appeared to Philip II too large, and he commissioned his physician Nardo Anton. Recchi, a Neapolitan, to make an extract from it. This extract was translated into Spanish by Francis Ximenes, a Dominican, who caused it to be printed in Mexico, in quarto, in 1615, and in 1651 it was printed in Latin at Rome. The jesuit Nieremberg, who was born of German parents at Madrid, and became there professor of history, had thus an opportunity of consulting the manuscripts of Hernandez, preserved at that time in the library of the Escorial, but since unfortunately burnt, and he indeed quotes them, lib. i. cap. 15. p. 10. See Clavigero in *Storia del Messico*, ii p. 211. What Joh. de Laet took from Hernandez was extracted, as he says himself, from the Spanish translation of Ximenes. This information may serve to improve or enlarge what Haller says, *Bibliotheca Botan.* i. p. 419. u. 452.

* *Storia antica del Messico.* In Cesena, 1780. 4 parts, 4to. ii. p. 189. Sig. Raynal afferma, che questa pianta fu transpiantata dall' India orientale nell' America, e che avendone fatta sperienza in parecchi paesi, si stabilì la coltura della medesima nella Carolina, nella Spagnuola, e nel Messico. Ma questo è uno de' molti abbagli di quel filosofo. Si consta per la testimonianza di Don Ferd. Colombo, che una delle piante proprie della isola Spagnuola era quella dell' Indaco. Sappiamo ancora per la testimonianza degli storici del Messico, e singolarmente del Doct. Hernandez, che gli antichi Messicani si servivano dell' Indaco. Tra tanti storici del Messico da me vedut. non ho trovato nè anche uno che abbia creduta straniera quella pianta.

may be one day filled up from books of travels and topography. All that I know at present is, that the first indigo brought to Europe was procured from Guatimala, consequently from Mexico, and that this article was supplied at first, and for a long time, by none of the West India islands but St. Domingo alone.

Krunitz says,* but on what authority I do not know, that Lopez de Gomes relates that, in his time, a very fine sky-blue colour was prepared in Hispaniola. If the person here alluded to be Lopez de Gomara, who accompanied Ferdinand Cortez as chaplain,† this would be the oldest testimony that could be expected, and would correspond with the account given by Labat. But I shall leave the further investigation of this subject to others, and observe, that the cultivation of indigo was begun in Carolina in 1747, and according to Anderson was encouraged the year following by premiums. ‡

This article, therefore, was brought from both the Indies to Europe, and recommended itself so much by the superiority and richness of its dye, by the facility with which it could be used, and the advantages attending it, that it suddenly ba-

* Encyclop. vol. xxix. p. 548. The same thing is said in the *Teutsche Encycloped.* vol. xvii. p. 338.

† His works, which are scarce, may be found in Barcia's Collection, vol. ii.

‡ Hist. of Commerce, German transl. vol. vii. p. 390.

nished from all dye-houses the European woad, which was cultivated, in particular, in Thuringia in Germany, in Languedoc in France, and in the neighbourhood of Rieti in the dominions of the church. At first, a small quantity of indigo only was added to the woad, by which the latter was improved; more was afterwards gradually used, and at last the quantity became so large, that the small admixture of woad served only to revive the fermentation of the indigo, but was not capable itself of communicating any colour. It was soon observed, that every yard of cloth could be dyed somewhat cheaper when indigo was used along with woad, than when the latter was employed alone according to the ancient method. Germany then lost a production by which farmers, merchants, carriers, and others, acquired great riches.

In the sixteenth century people began, in many countries, to make considerable improvements in dyeing. For this purpose, new dye-stuffs, both indigenous and foreign, were subjected to experiment, and trials were made with salts which had never before been employed. In this manner dyers sometimes obtained colours which pleased by their novelty and beauty; but it needs excite no surprise that many new methods of dyeing did not produce the desired effect. Many communicated colours which were agreeable to the eye but they soon faded; and some rendered the dyed

cloth so tender, that it soon rotted on the shopkeepers' shelves. Governments conceiving it then necessary to do something for the security of the purchaser, considered the imperfection of the art as a premeditated deception; and as it was, at that time, supposed that some pigments could give durable and genuine colours, and others fading or false ones; and also that the pernicious effects of salts could not be prevented or moderated, they, in general, prohibited the use of all new materials from which hurtful consequences had been observed to arise.

Legislators are neither almighty, omniscient, nor infallible. With the best views, and a firm determination to discharge their duty, they may recommend things hurtful, and prohibit others that might be attended with advantage. Were their commands and prohibitions inviolable, insuperable, and irresistible, they would often confine the progress of the arts and sciences, and render useful inventions impossible. But the people, when they have not entirely become machines, know how to elude, even at great personal hazard, faulty regulations, and by prohibited ways to obtain greater advantages than those which formed the object of the orders issued by their government. This was the case in regard to the art of dyeing in the sixteenth century.

A recess of the diet held in 1577 prohibited,

under the severest penalties, the newly-invented pernicious, deceitful, eating, and corrosive dye called the *devil's dye*, for which vitriol and other eating substances were used instead of woad. This prohibition, the identical words of which I have retained, was renewed in 1594 and 1603, with the addition of this remark, that, in consequence of the weight of the bad dyes, a pound of undyed silk for sewing or embroidery, would produce two or three pounds of dyed.*

Allusion seems to be made here to black, which at that time was the colour of the higher orders. It appears that at this period astringent juices and martial vitriol began to be used more than they had been formerly, and cloth when too long boiled with these substances, becomes exceedingly tender: black cloth is even sometimes spoilt, in this manner, at present. It is also true, that cloth receives the greatest addition in weight when dyed black, and the next greatest when dyed blue. I am not acquainted with accurate experiments in regard to the weight which cloth acquires by dyeing; but one may safely assert, that it is stated far too high in the recess of the diet. Fifteen ounces of raw silk lose by that kind of scouring, which the French call *decrument*, four ounces; consequently, white silk weighs eleven ounces, but after it is

* All these prohibitions may be found in *Schreber's Beschreibung des Waidtes*. Halle 1752. 4to. in the Appendix, p. 1, 2.

dyed black its weight is increased to thirteen ounces. In general, a black dye increases the weight of cloth a fifth more than bright dyes.*

As indigo, after this, soon became common, and the sale of woad was injured, the first prohibition against the former was issued by Saxony, in the year 1650; † and because government well knew how much depends on a name, when one wishes to render an object odious or estimable, the prohibition was couched in terms which seemed to show that indigo was included among those eating substances, termed in the recess already mentioned *devil's dyes*. In the year 1652 Duke Ernest, the pious, caused a proposal to be made to the diet by his envoy, Dr. Hœnnen, that indigo should be entirely banished from the empire, and that an exclusive privilege should be granted to those who dyed with woad. ‡ This was followed by an imperial prohibition on the 21st of April 1654, § in which every thing ordered in regard to the *devil's dyes* is repeated, with this addition, that great care should be taken to prevent the private introduction of indigo, by which the trade in woad was lessened, dyed articles injured, and money carried out of the country. The elector took the earliest op-

* Observations sur la Physique, par Rozier, iii. 1774. p. 183.

† Schreber ut supra, p. 9.

‡ Schreber. Hauptst. v. p. 122.

§ Ibid. p. 3.

portunity, the same year, to make known and enforce this prohibition with great severity in his dominions.*

The people of Nuremberg, who at that time cultivated woad, went still further. They made a law that their dyers should annually take an oath not to use indigo; and at present they are obliged to do the same thing,† though indigo is as necessary to them as to others; a most indecent disregard to religion, which, however, is not without example. In the French monarchy, where all offices were purchased and sold, every counsellor of parliament, on his entrance, was obliged to swear that he had not obtained his place by money, until, at length, some one had the courage to refuse taking a false oath. Thus also, in Germany, many placemen must swear that they will observe all the orders of government, yet many of them are daily violated, and indeed cannot be observed, or, at any rate, not without great mischief and confusion.

What was done in Germany in regard to Thuringia, was done in France in regard to Languedoc. In consequence of an urgent representation by the states of that province, the use of indigo was forbidden in 1598;‡ and this prohibition was af-

* Schreber ut supra, p. 11.

† Gatterer's Technologisches Magazin, i. 2. p. 256.

‡ Le Guide du commerce de l'Amerique par le port de Marseille. A Avignon 1777. 4to. i. p. 366.

terwards repeated several times. But in the well-known edict of 1669, in which Colbert separated the fine from the common dyers, it was stated, that indigo should be used without woad; and in 1737, dyers were left at liberty to use indigo alone, or to employ a mixture of indigo and woad.*

In England, where, I believe, woad was not at that time cultivated, the first mention of indigo in the laws occurs in the year 1581, under the reign of Elizabeth, not, however, on account of a blue but a black dye. No woollen articles were to be dyed black with the gall-nut, madder, or other materials, till they had received the first ground, or been rendered blue by woad, or woad and indigo together.† In like manner, it was long believed, that no durable black could be produced unless the article were first dyed in a blue pan. Hats also were not considered to be properly dyed unless traces of a blue tint could be discovered on the place where they were cut.‡ At present, our dyers can communicate a durable black without a blue ground, as well as dye a fixed blue without woad; and in every part of Europe foreign indigo will continue to be the most common material for dye-

* See Hellot's *Abhandlung*, from *Memoires de l'Acad. à Paris, année 1740*, in *Hamburg. Magaz.* i. 5. p. 42.

† The Statutes at large, vol. ii. Lond. 1735. p. 250—except the same (the woollen article) be first grounded with woad only, or with woad and a Nele, alias blue Inde.

‡ Marperger's *Beschreibung des Hutmacher-handwerks*. Altenburg. 1719. 8vo. p. 85.

ing, till its high price render it necessary to obtain a similar pigment from indigenous plants.

VANES. WEATHERCOCKS.

IF the poet Seneca was well informed, mankind, in the infancy of navigation, had no particular names for distinguishing the principal winds.* This is not at all incredible; because with their rafts and floats, which were the first vessels, they for a long time ventured out to sea only so far that they could easily return to the shore; and, therefore, while navigation continued in this state, they had little reason to trouble themselves about the direction of the winds. It is more certain that those nations respecting whom we have the oldest information, distinguished by names the four principal winds only. This is generally proved by a passage in Homer, where he intends to mention all the winds, and names only four;† but this proof is of little weight; for what poet at present would, with the like view, think of boxing the compass, or of introducing into a poem the names of all the thirty-two points? Would he not rather

* Medea, ver. 316: *Nondum Boreas, nondum Zephyrus nomen habebant.*

† *Odys. v. 295: Una vero Eurisque Notisque ruit, Zephyrusque vehemens et Boreas serenus.*

be satisfied with the names of the four chief winds alone? If more names, therefore, were usual in Homer's time, he would not consider it necessary to name them. In another passage he names only two winds;* and from these some have endeavoured to prove that no more were then known; but this assertion indeed is completely refuted by the passage first quoted. It can, however, be easily proved, that for a long time names were given to the four principal winds only.

One may easily see also what at first gave rise to this distinction. The sun at noon stands always over one point of the horizon, which appears to the observer as a circle, having the place where he himself is as its centre. This point is called the meridian or south, and the one opposite to it the north. If the observer turns his face towards the north, he will have on his right hand the east, and on his left the west. The space between these principal winds contains ninety degrees, or a right angle.† The number, however, must soon have

* Iliad, ix. 5. Sicut autem venti duo pontum commovent piscosum, Boreas et Zephyrus. It almost appears that Seneca also considered these two names as the oldest. Homer, however, Iliad, xxi 334, where he speaks only of two, names the *Zephyrus* and *Notus*. Strabo, i. p. 51. (29): Εἰσι δὲ τινες οἱ φασὶ δύο τοὺς κυριωτάτους εἶναι ἀνεμούς, Βορέαν καὶ Νότον: Sunt qui duos præcipuos ventos faciunt, Boream et Austrum.

† Favorinus in *Aulus Gellius*, ii. 22, says: Exortus et occasus mobilia et varia sunt; meridies septemtrionesque statu perpetuo stant et manent. *Plin.* ii. 47. p. 96: Veteres quatuor omnino servavere,

been raised to eight, and this division was usual in the time of Aristotle.* Afterwards twelve points in the heavens were adopted, also as many winds; and in the time of Vitruvius men had distinguished and given names to twenty-four, though this division was very little used. To determine the names, however, employed in the last two divisions is attended with some difficulties; and it almost appears as if writers did not always apply to them the same meaning.†

The Greeks considered Æolus as the first person who made navigators acquainted with the winds. He is said to have ruled over the Volcanic islands, afterwards named the Æolian; and if this be true, he would certainly have a good opportunity of observing the weather, and marking the winds by the smoke continually rising up there from burning volcanoes. This celebrated personage, who received Ulysses on his return from the Trojan war, by the knowledge thus obtained may

per totidem mundi partes, ideo nec Homerus plures nominat; hebeti, ut mox indicatum est, ratione.

* Aristot. Meteorol. ii. cap. 5 et 6. On this account, as Salmasius remarks, the book *de Mundo* cannot belong to Aristotle, as mention is made in it of twelve winds.

† Those who wish to examine further into this subject may consult Salmasius *ad Solin.* p. 880. *Cellarii Notit. orbis antiqui*, i. p. 32. *Riccioli Almagestum*, i. p. 75, and the writers there quoted. Compare also *Berghaus Geschichte der Schifffartskunde*, Leipsic 1792, 8vo. i. p. 272.

have assisted navigators, who afterwards made known the services which he rendered to them.*

The antiquity of the division into thirty-two points, used at present, I am not able to determine. Riccioli thinks that they have been employed since the time of Charles the Great, but I do not know whether this can be proved. That assertion perhaps is founded only on the opinion, that this emperor gave German names to the winds and the quarters of the world. This indeed is stated by his historian Eginhart, who mentions the names, which I shall here insert, together with the Latin names added by Eginhart, and those usual at present.†

Subsolanus . . .	<i>Ostroniwind</i>	EAST.
Eurus	<i>Ostsundroni</i>	East-south-east.
Euroauster . . .	<i>Sundostroni</i>	South-east.
Auster	<i>Sundroni</i>	SOUTH.
Austroafricus .	<i>Sundwestroni</i>	South-south-west.

* Plin. vii. sect. 57. p. 416: Ventorum rationem Æolus Hellenis filius docuit. *Diodor. Sic.* v. 7. p. 336 (291). Æolum velorum usum docuisse rei nauticæ studiosos memorant. Ex ignis quoque prodigiis diligenter observatis, qui venti ingruituri essent, indigenis certo prædixisse. *Servius ad Æneid.* i. 56. *Plin.* iii. 9. p. 164: Strongyle, in qua regnavit Æolus, quæ a Lipara liquidiore flamma tantum differt; e ejus fumo, quinam flaturi sint venti, in triduum prædicere incolæ traduntur. *Strabo*, vi. p. 423. (276). Compare *Baniers Götterlehre*, iii. p. 578, and *Riccii Dissertat. Homer.* iii. p. 100.

† Eginhartus *de Vita et Gestis Caroli Magni*, curante Schminke. Traject. ad Rhen. 1711. 4to. p. 132, 133.

Africus	<i>Westundroni</i>	South-west.
Zephyrus	<i>Westroni</i>	WEST.
Corus	<i>Westnordroni</i>	West-north-west.
Circius	<i>Nordwestroni</i>	North-west.
Septemtrio . . .	<i>Nordroni</i>	NORTH.
Aquilo	<i>Nordostroni</i>	North-north-east.
Vulturnus	<i>Ostnordroni</i>	North-east.

It has, however, been long since remarked, that these names are much older than Charles the Great;* and it is highly probable that they were only more accurately defined, or publicly confirmed by this prince, or that in his time they came into general use. How often have early inventions been ascribed to sovereigns, though they were only made in their reign? Even whole nations have been said to be descended from those princes under whom they first became known to foreigners; as, for example, the Poles from Lech, and the Bohemians from Zech.

Charles, however, did not give names to thirty-two, but to twelve winds. Nor was he the first who added to the four cardinal points eight others, for the same thing is asserted of many. But it deserves to be remarked, that in Charles's names one can discover traces of that ingenious mode of denoting all the winds with four words; that is to say, by different combinations of East, West, South, and North. It is certain that the names of the different points and winds used by all the

* Adelung's Wörterbuch, under the word *East*.

European nations, the Italians only excepted, are of German origin, as well as the greater part of the terms of art employed in navigation and naval architecture.*

It appears to me not improbable, that the division used at present was introduced soon after the invention of the magnetic needle; at least Honorius, surnamed *Augustodunensis*,† who must have flourished before the year 1125, speaks only of twelve winds; as do also Gervasius in 1211, and Vincent de Beauvais in the middle of the thirteenth century, who gives from Isidorus, who lived about the year 636, the twelve Latin names used by Eginhart.‡

It can scarcely be doubted that means for indicating the winds were invented at a very early period. I here allude to vanes, flags, and every other apparatus by which the direction of the wind can be conveniently and accurately discovered, and

* See an explanation in *Sturmii Physica electiva*, Norimbergæ 1722. 4to. ii. p. 458.

† Of the writings of this monk, whom I shall again have occasion to quote, separate editions are scarce. They are, however, to be found in *Maxima Bibliotheca Patrum*, tom. xx. where he says, p. 973, in the book *de Mundi origine*, i. cap. 54: *Ventus in duodecim dividitur, et quisque proprium vocabulum sortitur: de quibus quatuor sunt cardinales, reliqui illorum collaterales.* Compare also p. 1012, *de Philosophia Mundi*, lib. iv. cap. 15.

‡ *Speculum Natur.* iv. 34. p. 254. *Gervasii Otia imperialia*, cap. 9. in *Leibnitii scriptores Brunsvic. Hanoveræ* 1707. fol. i. p. 890.

similar to those erected at present, on many private houses, on most of our church steeples, and on board ships. I must, however, confess that I have hitherto scarcely observed any trace of them among the Greeks and the Romans. I can find no account of them in works where all the parts of edifices are named; where ships and every thing belonging to them are expressly described; nothing in Pollux, and nothing in any of the poets. I am unacquainted also with any old Greek or Latin word that can be applied to an apparatus for pointing out the wind. In the edition of Kirsch's German and Latin Dictionary printed in 1754, we find *Wetterhahn* (a weathercock) *petalum, triton*; but the latter term is borrowed from the tower of Andronicus, of which I shall have occasion to speak hereafter; and neither this word nor *petulum*, or *petulæ, arum*, which Kirsch gives also, occurs in this sense in any ancient author, and the case is the same with *pinna-cella, ventilogium, aurologium*, and other names which are to be found in some dictionaries.

I am acquainted with no older information in regard to an apparatus for observing the winds, than what is given by Vitruvius respecting the tower built at Athens by Andronicus Cyrrhestes, that is, of Cyrrhus, a town in Syria. This tower, which was built of marble, in an octagonal form, had on each side a representation of that wind opposite to which it was placed. Its summit termi-

nated in a small spire, on which was a copper triton, made to turn in such a manner as to present its front to the wind, and to point with a rod held in its right hand to the image of the wind blowing at the time.* This tower is still standing; and a description and figure of it may be seen in the travels of Spon and Wheeler,† and in those also of Pocock.‡ The figures representing the winds, which are larger than the life, are executed in basso relievo, and correspond to the seasons at which they generally blow. At the top of each side, under the architrave, the name of the wind is inscribed in Greek characters. Boreas, the North wind, holds in his hand a muscle-shell, which seems to denote his peculiar power over the sea. The Zephyr has its bosom full of flowers, because it prevails in March, at the time when the flowers

* Vitruv. i. 6. p. 41. Qui diligentius perquisiverunt, tradiderunt ventos esse octo, maxime quidem Andronicus Cyrrhestes. Qui etiam exemplum collocavit Athenis turrim marmoream octogonon, et in singulis lateribus octogoni, singulorum ventorum imagines excultas, contra suos eujusque flatus designavit, supraque eam turrim marmoream metam perfecit, et insuper Tritonem æreum collocavit dextra manu virgam porrigentem, et ita est machinatus, uti vento circumageretur, et semper contra flatum consisteret, supraque imaginem flantis venti indicem virgam teneret.

† Spon and Wheeler's Travels, German translation, Nurnberg 1690. fol. ii. p. 34.

‡ Pococke Beschreibung des Morgenlandes. Erlangen 1755. 4to. iii. p. 246. *The Antiquities of Athens by Stuart and Revett.* i. 3. tab. i—xix. *Les Ruines des plus beaux Monumens de la Grèce, par M. Le Roy, Paris 1770, ii. p. 7. tab. 3. p. 50. 51. tab. 25.*

chiefly blow in Greece : and similar attributes are assigned to the rest.

Varro had an apparatus of the same kind at his farm.* Within the building was a circle, in which the eight winds were represented, and an index, like that of a clock, pointed to that wind which was blowing at the time. Nothing, therefore, was necessary but to look at the ceiling to know from what quarter the wind came. I have seen an apparatus of the same kind on some exchange, either at Lubec or Rotterdam. Varro calls the tower of Andronicus *horologium*, a word which Salmasius wishes to change into *aurologium*. But it contained also a sun-dial, as we are assured by Pocock, who observed the necessary hour lines ;

* Varro de re rust. iii. 5. 17 : In eodem hæmispærío medio circum cardinem est orbis ventorum octo, ut Athenis in horologio, quod fecit Cyrrhestes ; ibique eminens radius a cardine ad orbem ita movetur, ut eum tangat ventum qui flet, ut intus scire possis. Segner has illustrated Varro's apparatus by means of an engraving, which may be seen in Gesner's edition of the *Scriptores rei rusticæ*, published in 1773. Those who may wish to construct an apparatus of this kind, will find sufficient instructions for that purpose in *Bion's Mathematischer Werkschule*, Nurnberg 1741. 4to. i. p. 422. T. 28. fig 7, and still better in *Leupold's Theat. Stat. universale*, part iii. p. 299. Our common weathercocks and vanes, when well made, and preserved from rust, show the point from which the wind proceeds, but do not tell their names. By the vanes on church steeples, one knows that our churches stand in a direction from east to west, and that the altar is placed in the eastern end. On other buildings, an arrow, which points to the north, is placed under the vane.

and therefore it is not improbable that the people, who through the want of clocks would oftener look to the dial than to the weathercock, gave to the tower a name alluding to the former rather than to the latter.*

Du Cange says, that a triton, by way of weathercock, was placed on the temple of Androgeus at Rome; but I am unacquainted with the source from which he derived this information, and of that temple I have not been able to obtain any account.† Whether the tritons placed on the temple of Saturn at Rome were indicators of the wind, or whether they had a learned signification,

* Gervasius also, whom I have already quoted, gives the following information, which belongs to this subject, though it may be hardly worth examination, cap. 13. p. 964: In confinio civitatis Neapolitanæ Virgilius hortum plantaverat. Ibi erat imago ænea bucinnam ad os tenens, quam quoties auster ex objecto subintrabat, statim ipsius venti flatus convertebatur. Quid autem conversio ista noti commodi portabat, audite. Est in confinio civitatis Neapol. mons excelsus - - - hic fumum teterrimum eructat, et ligna exusta in carbonis colorem. - - - Flante ergo noto pulvis calidus segetes omnesque fructus exurit, sicque terra feracissima ad sterilitatem ducitur. Ob hoc tanto regionis illius damno consulens Virgilius in opposito monte statuam, ut diximus, cum tuba erexit, ut ad primum ventilati cornu sonitum, et in ipsa tuba flatus subiurantis impulsus notus repulsus vi Mathesis quassaretur. Unde fit quod statua illa vel ætate consumta vel invidorum malitia demolita, sæpe pristina damna reparantur. Leupold also proposes a wind index which emits a tone.

† Du Cange refers to *Anonymus de arte architectonica*, cap. 2: Tritonem æreum, ventorum indicem, Romæ fuisse ad templum Androgei Cyrenensis.

as Macrobius asserts, I will not venture to determine.* It is probable that the pillar, some remains of which were found at Gaeta, (*Cajeta*), in the kingdom of Naples, and on which the names of the winds were cut out in Greek and Latin, served as a wind indicator also.†

But it is more than probable that an apparatus for pointing out the wind, similar to that at Athens, was erected also at Constantinople. At least I consider as such what was called by some *anemodulium*, and by others *anemoderium*; the information respecting which has not, as I conceive, been hitherto understood, not even by Banduri. In my opinion, it was not a building or tower, but a column, furnished with a vane, somewhat similar to what is still seen in many places on the sea coast, where a high pole is erected with a flag. This pillar, if I may be allowed the expression, consisted entirely of copper; it was square, and in height not inferior to the loftiest columns in the city. Its summit formed a pyramid, and, as I conjecture, an octagonal one, upon which stood a female figure,

* Saturn. i. 8. p. 223. Illud non omiserim, Tritonas cum buccinis, fastigio Saturni ædis superpositos; quoniam ab ejus commemoratione ad nostram ætatem historia clara et quasi vocalis est, ante vero muta et obscura et incognita, quod testantur caudæ Tritonum humi mersæ et absconditæ.

† Neapolitana Historia, a I. C. Capacio conscripta. Neapoli 1607. 4to. lib. ii. p. 596. The author says the following words were inscribed on it: λιψ, λιθανοτος, νοτος, ευρος; Africus, Austro-Africus, Auster, Eurus, Subsolanus.

that turned round with every wind, and consequently was a vane, only not a triton, as at Athens. Below it, on each side of the pyramid, were seen a great many figures, which I will venture to assert were attributes or images of the winds, to which the female figure pointed. Nicetas says, that there were observed among them birds, agricultural implements, the sea with shipping, fishing-boats, and naked cupids sporting with apples, which, in my opinion, denoted the different seasons in which each wind was accustomed to blow.*

* Being desirous of convincing the reader that I am right in my opinion, and as the books which contain this information are to be found only in the best libraries, and as it would be troublesome to search through them and give quotations in the usual manner, I shall here transcribe or point out all the passages with which I am acquainted. The passage of Nicetas may be found in *Fabricii Biblioth. Græca*, vi. p. 407, and in *Banduri Imperium Orientale*, Parisiis 1711. fol. tom. i. lib. vi. p. 108. Nicetas speaks of it again in *lib. ii. de Andronico*, according to the Venetian edition, 1729. fol. p. 175. He there says, that the emperor was desirous of placing his image on the *anemodulium*, where the cupids stood. Another writer, *Anonymus de antiquitatibus Constantin.* in *Banduri Imper. Orient.* i. p. iii. lib. i. p. 17, says expressly, that the twelve winds were represented on it, and that it was erected with much astronomical knowledge by Heliodorus, in the time of Leo Isauricus: *μετα πολλης επιστημης και αστρονομιας εποιει τουτο.* In the same work, lib. v. p. 89, it is said, that a statue of the consort of Leo the Great was erected on the *anemodulium*. *Georgii Codini Excerpta de Antiquitat. Constant.* Paris. fol. p. 54, calls Heliodorus, the artist, an astronomer. *Cedreni Compendium Hist.* Paris, 1647. fol. i. p. 323: *το τετρασκελες τεχνασμα ο Δηριον λεγουσιν ανεμων, ηγειρεν ο μεγας Θεοδοσιος πυραμιδος σχημα ζωγραφουν, και ζωοις πλαστοις κεκοσμημενον, βλαστοις τε και καρποις και ροϊσκοις. γυμνοι τε ερωτες Ιστανται προσγελωντες αλληλοις ημερωις, και τοις κατω περωσιν εμπαιζοντες· ολλοι δε εποχλαζοντες εμπροσθιν νεοι, σαλπιγξι χαλκαις εμψωσαντες*

It is not improbable that the whole pillar was constructed of different pieces of copper, cast singly and then joined together; and it appears that neither Nicetas, nor Cedrenus, nor the Latins, who in the thirteenth century pulled down and melted the numerous objects of art, plundered from various cities by the emperor Constantine to ornament his capital, were acquainted with the purpose for which this pillar was originally destined, or the meaning of the emblematical figures represented upon it. Nay, there is even reason to think that the Greeks themselves, at this time, were so ignorant as to believe such objects to be the productions of magic. According to Cedrenus, this costly wind indicator was erected by Theodosius the Great, and according to others by Leo Isauricus. Were the first assertion true, it would belong to the fourth century, and in the second case to the eighth; but I cannot help suspecting that it was constructed before the time of Theodosius. The female figure, which indicated the wind, was, according to Nicetas, called *ane-*

ανεμουσ. χαλκου δε βρετας υψοτεν πετομενυ πνοας λιγειας δεικνυει των ανεμων
 Quatuor pedibus suffultum opus, quod Contentionem ventorum vocant. Theodosius M. erexit, pyramidis formam depingens, et fictilibus exornans germinibus, fructibus, atque malis Punicis. Stant et nudi amores invicem sibi blande arridentes, et infra transeuntibus illudentes. Rursum alii adolescentes subsidentes æreis tubis ventos inflant, et imago ærea in sublimi volans, auctos flatus ventorum denotat. All the authors here quoted belong to the *Historici Byzantini*.

modoulon, but according to Cedrenus *anemoderion*. The former denotes a person who belongs to the wind; the latter, one who contends with the wind;* and both these appellations are well suited to a vane or wind indicator. If my explanation be correct, this work of art at Constantinople had nothing in common with the statue of Jupiter constructed by Lysippus at Tarentum.† The latter was forty cubits in height; and what excited great astonishment was, that though it would shake when pushed with the hand, it withstood the force of the most violent storms. I should rather compare the statue of Lysippus to those moveable masses of rock which are mentioned by various authors, both ancient and modern. ‡

It is not improbable that there may have been wind indicators of this kind in other places, and that more passages alluding to them, not hitherto remarked, may be found in different authors. Professor Michaelis, who was desirous to assist me in my researches, pointed out to me an account, undoubtedly written before the year 1151, §

* *Δηρις των ανεμων.*

† Plin. Hist. nat. xxxiv. 7. sect. 18. p. 647: Talis (Jupiter) factus a Lysippo XL cubitorum. Mirum in eo, quod manu, ut ferunt, mobilis, (ea ratio libramenti est,) nullis convellatur procellis. Id quidem providisse et artifex dicitur, modico intervallo, unde maxime flatum opus erat frangi, opposita columna.

‡ These I have quoted in *Aristot. auscult. mirabil.* cap. 102, and in *Antigoni Carystii Hist. mirab.* p. 238, to which may be added, *Lebeuf Dissertations sur l'hist. eccles. et civile*, 8. 2. p. 188.

§ *Geographia Nubiensis.* Parisiis 1619. 4to. p. 118: Est etiam

in which it is stated, that there was at Hems, in Syria, formerly called Emessa, a high tower, on the summit of which was a copper statue of a horseman that turned with every wind. It is worthy of remark, that under the vane there were figures, among which was that of a scorpion; in all probability the emblem of some season.

In Europe, the custom of placing vanes on the summits of the church-steeple is very old; and as these vanes were made in the figure of a cock, they have thence been denominated *weathercocks*. In the Latin, therefore, of the middle ages, we meet with the words *gallus* and *ventilogium*. The latter is used by Radulphus, who wrote about the year 1270.* Mention of weathercocks occurs in the ninth, † eleventh, ‡ twelfth, § and thir-

in eadem urbe Heins super excelsam testudinem in medio urbis erectam, statua ænea equitis formam referens, quæ pro vario ventorum circumductu varie circumvolvitur. In ejus testudinis pariete est lapis infixus, in quo scorpium figura est incisa, et cum quis morsus sive punctus fuerit, quod secum defert lutum ei lapidi applicat ac morsui admovet, statimque sanatur.

* Radulphus in *Vitu S. Richardi Cicesterensis episcopi*, num. 60. Sicut præeminet ventilogium toti fabricæ, quod quidem quanto altius erigitur, tanto plus tempestatibus irruentibus fronte opponitur. More passages of this kind may be seen in Du Cange.

† In Ughelli *Italia sacra*, Romæ 1652, fol. iv. p. 735, we find the following inscription on a weathercock then existing at Brixen: *Dominus Rampertus episc. gallum hunc fieri præcepit an. 820.*

‡ Eckehard, a monk in the convent of St. Galle, in *Casibus monasterii S. Galli*, cap. 5: duo ex illis ascendunt campanarium, cujus cacuminis gallum aureum putantes.

§ Honorius, whom I have already mentioned, in *Maxima Biblioth. Patrum*, xx. p. 1066, de antiquo ritu missarum, i. 144: Non

teenth* centuries. There is no doubt that the cock was intended as an emblem of clerical vigilance. In the ages of ignorance, the clergy frequently styled themselves the cocks of the Almighty, whose duty it was, like the cock which roused Peter, to call the people to repentance, or at any rate to church. † The English, therefore, are mistaken, when they suppose that the figure of a cock was first made choice of for vanes in the fourteenth century, under the reign of Edward III, in order to ridicule the French, with whom they were then at war; and that the custom of *cock-throwing*, that is to say, of throwing sticks at a cock exposed with his wings tied, as still practised, took its rise at the same time. ‡

In France, in the twelfth century, none but noblemen were allowed to have vanes on their houses; nay, at one time, this was the privilege of those who, at the storming of a town, first planted their standards on the ramparts. § These

sine causa gallus super campanarium ponitur. Gallus enim dormientes excitat, et per hoc admonetur presbyter gallus dei, ut per campanam dormientes ad matutinas excitet.

* *Durantes Rationale divinor. officior. i. cap. i. n. 22. Raynerus contra Valdenses, cap. 5: gallus super campanile significat doctorem.*

† *Ambrosius, v. cap. 24. Vossius de Idolat. iii. cap. 86. p. 598. I. Pierii Valeriani Hieroglyphica. Francof. ad M. 1678. 4to. p. 288. Schmid Fastelabends Sammlung. Rostock, 4to. p. 27.*

‡ *G. W. Alberti Briefe über den zustand der Rel. und Wissench. in Grossbritan. Hannover 1752. 8vo. i. p. 302.*

§ *Saintfoix Versuche in der Geschichte der Stadt Paris. Kopenhagen 1765, 8vo. v. p. 27.*

vanes were painted with the knights' arms, or the arms were cut out in them, and in that case they were called *panonceaux*.*

Flags or vanes on ships occur very early, but they are always mentioned on account of their use in making signals. They were of various forms and colours; were sometimes drawn up, and sometimes taken down; placed sometimes on the right and sometimes on the left side of the ship, and were changed in various other ways, directions for which may be seen in the *Tactics* of the emperor Leo. They were named *vexilla*, *flammulæ*, also *flammula* and *banda*, and the last two appellations occur in the works of the younger Greek writers.†

But though the oldest writers on the art of naval warfare, such as Vegetius, ‡ recommend a knowledge of the winds, I have not yet met with any certain account of apparatus for determining the direction of them on board a ship. Before the discovery of the magnetic needle, such accuracy as is necessary at present would have been superfluous; yet naval commanders must long before have had some means of distinguishing, at least, the twelve winds then defined, though no traces

* Dictionnaire à Trevoux, 1704. fol. article *Girouette*.

† Hirtius de Bello Alexand. cap. 45: vexillo sublato, quo pugnandi dabat signum. - - Tacit. *Annal.* v. 22: prætoria navis vexillo insignis. Livius, lib. xxxvii. cap. 24: signo sublato in prætoria nave. *Leonis Tactica*, cap. 19. § 40, 42. p. 342, 343. edit. Meursii. Lugd. Bat. 1612. 4to.

‡ Vegetius de Re milit. lib. v. cap. 8. p. 97.

of them are to be found in the works which have been accidentally preserved to us.

Scheffer,* who, as is well known, collected from the works of the ancients all the terms of art applicable to navigation, thinks that the band, *tænia*, affixed to a pole at the stern of the ship † did not serve so much for an ornament as to indicate the course of the wind. He is, however, able to produce no other authority for this opinion than a passage in one of Cicero's letters, which has been changed and amended, till it at length seems to say that Cicero had resolved to embark, because the vanes had announced a favourable wind. ‡

I must acknowledge that, at present, I can produce no older information in regard to vanes used on board ship, to indicate the course of the wind, than of the eleventh century, taken from the life of Emma, the consort of Canute the Great, king of Denmark, Norway, and England, the author of which was an eye-witness of what he relates. Describing the magnificent Norman fleet sent to England in the year 1013, he says that

* De milit. navali. Upsaliæ 1654. 4to. ii. 4. p. 157, and p. 52. fig. 1. R.

† Pollux, i. 9. § 90. p. 61: Inter aphlasta vel aplaustria rectum infixum est lignum, quod stelida vocant, è cujus medio linteum dependens fascia appellatur: ου το εκ μεσου κρεμαμενον βληος ταινια ονομαζεται.

‡ Epist. ad Atticum, v. 12: Erat in animo nihil festinare, Delo nec me movere, nisi omnia ακρωτηριων σφια vidissem. Ernesti, in his *Clavis*, says: ακρωτηριων σφια, signa secundæ tempestatis ex vexillis in fastigiis navium et domorum.

birds, which turned round with the wind, were placed on the top of the masts.*

At that time, therefore, instead of the flags used at present, a vane, shaped like a bird, was placed at the summit of the mast; perhaps also the figure of a cock, as the emblem of vigilance, but in this case not of clerical vigilance. In the cathedral of Bayeux, in France, is a piece of tapestry, representing the actions of William the Conqueror, executed with the needle, either by his consort or under her direction, in which vanes are seen at the top of the masts, in many of the ships.†

GILDING.

THE astonishing extensibility of gold, a property in which it far surpasses all other metals, induced mankind, at an early period, to attempt beating it

* The *Encomium Emmæ* was printed for the first time in Du Chesne, *Historiæ Normannor. Scriptor.* Lutet. Paris. 1619. fol. It is there said, p. 166: Hinc erat cernere leones auro fusiles in pupibus, hinc autem volucres in summis malis venientes austros suis signantes versibus. It is inserted also by Langenbeck in *Scriptor. Rerum Danicar.* tom. ii. Hafniæ 1773. fol. p. 476. In all probability *versionibus*, or *versationibus*, was contracted in the manuscript, and the transcriber thence made *versibus*. The meaning however is clear: The birds turned according to the wind, and thereby announced its direction.

† This honourable memorial of the last half of the eleventh century is explained and illustrated by a figure in *Memoires de l'Academ. des Inscript.* Paris 1733. 4to. vol. viii. p. 602.

into thin plates, as the value of it led them to the art of covering or gilding things of every kind with leaves of it. It is proved by Herodotus that the Egyptians were accustomed to gild wood and metals; * and gilding is frequently mentioned in the books of the Old Testament. † The gold

* Herodot. lib. ii. 63. p. 133: το αγαλμα εον εν νηφ μικρω ξυλινη κατακεχυρωμενη. Simulaerum in parvo ligneo sacello deaurato. At the end of the same book; p. 193: αγαλμα επιχυσειν. See *Winkelman's Geschichte der Kunst*. Vienna 1776. 4to. p. 25. *Caylus, Recueil d'antiquités*, i. p. 193. Gori seems to have had in his possession two Egyptian gilt figures. See *Mus. Etr.* t. i. p. 51.

† Having requested professor Tyehsen to furnish me with some information on this subject, I received from him the following remarks. In the books of the Old Testament gilding and gold plates are clearly mentioned. Moses caused several parts of the sanctuary to be overlaid with gold. 1st. The ark of shittim wood, which was covered with that metal, both on the outside and inside, Exodus, chap. xxv. ver. 11, also the staves, ver. 13. 2d. The wooden table with its staves, ver. 23 and 28. 3d. The altar of burnt incense, chap. xxx. ver. 3. 4th. The boards which formed the sides of the tabernacle, chap. xxvi. ver. 29. They were in number forty-eight, each about seventeen feet and a half in length, and two feet and a half in breadth, making a surface of about forty-three feet and a half, without including the five rows of bars with which they were kept together.

Solomon caused various parts of the temple to be overlaid with gold. 1st. The whole inside of the house, 1 Kings, chap. vi. ver. 21 and 22. 2d. The altar of burnt incense, ver. 20 and 22. 3d. The wooden cherubim above seventeen feet in height, ver. 28. 4th. The floor, ver. 30. 5th. The doors of the oracle, on which were carved cherubims, palm-trees, and open flowers, ver. 32 and 35, so that the gold accurately exhibited the figures of the carved work.

Now the question is, whether all these were gilt, or covered, or overlaid with gold plates. I am acquainted with no work in which this has been professedly discussed, and therefore I submit the following remarks to your examination :

plates, however, used for this purpose, as may be readily conceived, were not so thin as those made at present; and for this reason, the gilding on

1st. The expression continually used for overlaying is $\eta\epsilon\upsilon$, the original meaning of which in the Arabic صفا *clear*, to *be bright*, seems still to remain. The signification, therefore, is to *make clear*, to *render bright*: but, as is commonly the case, nothing decisive can be obtained from this etymology, for it is equally applicable to gilding as to overlaying with gold.

2dly. Overlaying with copper occurs in Exodus, chap. xxvii. ver. 6, and chap. xxxviii. ver. 6, where the altar of burnt-offering and its staves were to be overlaid (בהשת) with that metal.

3dly. Several, therefore, have understood this word, where it is combined with *gold*, as alluding to plates of that metal. Philo (*de vita Mosis*, iii. p. 517) says; the Mosaic ark was covered with thick plates of gold: and the Talmud speaks of three boxes, two of gold and one of wood, placed within each other, so that the wooden one was in the middle.

4thly. But when the passages are compared with each other, it seems, in several places, to denote *gilding*; for even if plates of gold could be made sufficiently fast to smooth wooden surfaces, though the drying of the wood and the softness of gold, which in regard to the staves, floor, &c. would soon be rubbed off, seem to occasion difficulties, I much doubt whether the thinnest gold plates could be so applied as to fit and exhibit accurately carved wooden figures and flower-work, as is said in 1 Kings, chap. vi. ver. 35. Would not the parts of the Mosaic tabernacle, had they been covered with plates of gold, been too heavy for transportation, especially as several of them required to be carried on the shoulders of men? And where could Moses have obtained this immense quantity of gold? He had only twenty-nine talents (*kikar*) and seven hundred and thirty shekels, Exodus, chap. xxxviii. ver. 24, which, according to the calculation of Michaelis, make 127,520 ducats, but according to others 300,000 ducats. Even if we take the last calculation, for both are hypothetical, I doubt whether Moses, who caused so many vessels and other things to be made of pure gold, would have enough left to plate all the articles above enumerated. [The sum here mentioned, ac-

statues, which have lain many centuries in the earth, appears to be still entire. Winkelmann says,* that among the ruins of two apartments in the imperial palace, on the palatine hill, in the Villa Farnese, the gold ornaments were found to be as fresh as if they had been newly applied, though these apartments, in consequence of being buried under the earth, were exceedingly damp. The circular bands of sky-blue, with small figures in gold, could not be seen without admiration. The gilding also is still preserved in the ruins of Persepolis.

But, in the time of Pliny, the art of gold-beating was carried so far at Rome, that an ounce of gold could be beat into seven hundred and fifty leaves

according to Arbuthnot, would amount only to about 10,000*l.* sterling.
TRANS.]

“The oldest translation, the Alexandrian, where gold is alluded to, always expresses ΠΕΥ by the word καταχρυσω, to *gild*, and the vulgate by *deauro*. The more modern translators and Michaelis use, for the most part, the ambiguous expression to overlay, *obducere*; yet Michaelis, in regard to the boards of the tabernacle, uses the term *to gild*. Exodus, chap. xxvi. ver. 34.

“The Hebrews might have brought the art of gilding with them from Egypt, where it seems to have been very old, as gilding is found not only on mummies, the antiquity of which indeed is uncertain; but, if I am not mistaken, in the oldest temples, on images. It appears also, that in the time of Moses the Hebrews understood the art both of gilding and of overlaying with plates of gold, and expressed both by the general term ΠΕΥ. In determining where the one or the other is to be understood, the philologue must consult the technologist.”

* Page 534.

and more, each four square inches in size.* I shall not compare this result with what the art can do at present, because the account of Pliny is not the most accurate, and because the conversion of the old measures into the modern standard is always attended with uncertainty. Buonarotti, however, who made some researches on this subject,† is of opinion, that the gold used at Rome for fire-gilding, in his time, that is, at the end of the seventeenth century, was beat six times as thin; and that the gold employed for gilding wood and other things, without the application of fire, was twenty-two times as thin as the

* Lib. xxxiii. 3: Nec aliud (metallum) laxius dilatatur, aut numerosius dividitur, utpote cujus uncie in septingenas et quinquagenas pluresque bracteas, quaternum utrobique digitorum, spargantur. The thicker gold-leaf was called, at that time, *bractea Prænestina*; the thinner, *bractea quæstoria*.

† Io mi son trovato più volte a sentir discorrere sopra la vivacità dell' indorature, che si veggono sopra de i bronzi antichi; questa non è cosa da maravigliarsene, perchè, tralasciando le diligenze, che vi hanno potuto usare attorno maggiori di quelle degli artefici moderni, le foglie d'oro, che adopravano, erano più grosse delle nostre a proporzione di sei a uno in circa, parlando di quelle, che servono per indorare a fuoco, e di 22 a 1, e più, di quelle, che s'adoprano per i ligni e altre cose senza fuoco, come si cava da Plinio, il quale scrive, che a'suoi tempi d'un' oncia d'oro cavavano 50 e 70, e più foglie, larghe per ogni verso quattro diti, cioè 36 semisestule; quando adesso, per quanto m' hanno fatto vedere gli artefici, d'un oncia qui di Roma, ch' è ancora di minor peso dell' antica, cavano delle più grosse, per indorare a fuoco 230 foglie large 52, delle medesime semisestule antiche per ogni verso, e 1800 delle più sottili, e ordinarie larghe 35 in quadro. *Osservazioni istoriche sopra alcuni medaglioni antichi.* In Roma 1698, fol. p. 370.

gold leaf made at Rome in the time of Pliny. But this Italian author, as appears to me, has, through too great precipitation, translated the words *septingenæ et quinquagenæ bracteæ* fifty and seventy. Gold, however, at that time, was beat so thin at Rome, that Lucretius compares it to a spider's web, and Martial to a vapour.*

I have, however, not yet met with any information in regard to the method in which the ancient artists beat the gold, or the instruments and apparatus they employed for that purpose. But the German monk Theophilus, whose real name seems to have been Rüger, and who, as Lessing thinks, lived in the ninth, but, according to Morelli, in the twelfth century, describes the process nearly as it is at present.† The gold, at that time, was beat

* Lucret. iv. 730: *Tenuia, quæ facile inter se junguntur in auris. Obvia cum veniunt, ut aranea, bracteæque auri.* *Martial.* viii. 33.

† Lessing zur Geschichte und Litteratur, iv. p. 309. *De petala auri.* Tolle pergamenam græcam, quæ fit ex lana ligni, et fricabis eam ex utraque parte cum rubeo colore, qui comburitur ex ogra minutissime trito et sicco, et polies eam dente castoris sive ursi, vel apri, diligentissime, donec lucida fiat, et idem color ipsa fricatione adhæreat. Deinde incide forcipe ipsam pergamenam per partes quadras ad latitudinem 4 digitorum æqualiter latas et longas. Postmodum facies eadem mensura ex pergameno vituli, quasi marsupium, et fortiter consues, ita amplum ut multas partes rubricatæ pergamenæ possis imponere. Quo facto tolle aurum purum et fac illud attenuari malleo super incudem æqualem diligentissime ita, ut nulla sit in eo fractura, et incide illud per quadras partes ad mensuram duorum digitorum. Deinde mittes in illud marsupium unam partem rubricatæ pergamenæ, et supra eam unam partem auri in medio, sicque pergamenam et rursus aurum; atque ita facies donec implea-

between parchment, in the same manner as is still practised; and the artists knew how to prevent the gold from adhering to the parchment, by covering it over with burnt ochre reduced to a very fine powder, and then rubbing it smooth with a tooth. With the like view, our gold-beaters rub over with a fine bolus the thin paper used for making the books into which they put their gold leaf, in order to preserve it. But the flattening-mills, between the steel rollers of which cast and hammered ingots of gold are at present reduced to thin leaves, seem not to have been then known, at least this monk makes no mention of them. Lessing, to whom we are indebted for this curious fragment of Theophilus, is of opinion, that each artist, at that time, was obliged to beat the gold leaf which he used, because gold-beating was not then a distinct branch of business. This I will not controvert; but it is no proof of it, that the monk

tur marsupium, et aurum semper sit in medio commixtum. Dehinc habeas malleum fusilem ex auricalco, juxta manubrium gracilem et in plana latum, unde percutes ipsum marsupium super lapidem magnum et æqualem, non graviter sed moderate; et cum sæpius respexeris, considerabis, utrum velis ipsum aurum omnino tenue facere, vel mediocriter spissum. Si autem supercreverit aurum in attenuando et marsupium excesserit, præcides illud forcipe parvulo et levi, tantummodo ad hoc opus facto. Hæc est ratio aureæ petalæ. What *pergamena græca ex lana ligni* means I have not been able to conjecture. May it not be fine bark? *Pergamenum vituli* is afterwards named, which may perhaps mean that of unborn calves. Respecting the author of this work, see *Codices Latini bibliothecæ Nanianae a Jac. Morellio relati*. Venetiis 1777. 4to. p. 33.

taught the art to his brethren; for in convents the clergy endeavoured to make every thing they used, in order that they might purchase as little as possible.

During the progress of the art, it being found that parchment was too thick and hard for the above purpose, workmen endeavoured to procure some finer substance, and at length discovered that the skin of an unborn calf was the most convenient. By means of this improvement, gold leaf was made much thinner than it had ever been before possible; but the art was brought to still greater perfection by employing that fine pellicle which is detached from the gut of an ox or a cow. Lancellotti, who wrote in the first half of the seventeenth century,* says, that this invention was made by the German gold-beaters, when, in con-

* Adopravano prima quei che battono l'oro certe forme di carta non nata, cioè di pelli di vitelli non nati, ma di madre che disperdeva, perche quella pelle si era senza pelo, dentro la qual carta si batteva l'oro. Ma per le guerre di Fiandra, donde veniva, non potendo haversene i Tedeschi si sono ingegnati della pelle del budello gentile lanato benissimo e tagliato, e steso sopra un telaio, e poi un'altro rivolto sopra quello, che viene ad attaccarsi subito insieme, e posto non al sole, perche si guasterebbe, ma all'aria sola, e con polvere di pomice, e con un'altra pomice, nettata quella pelle da quei carnicci, e tagliata in quadretti e messo un quadretto di carta nostrana, et uno di quella, battendola con un mazzetto o martello di 20 libbre in circa sino a tanto ch'è fuori il grasso et humido, que rieve in se là carta bianca, fassi una cosa o carta sopra ogni credere sottilissima. *L'oggi di overo gl'ingegni non inferiori à passati.* In Venetia, 1636, 8vo. p. 444.

sequence of the war, they were not able to obtain from Fländers the skins of unborn calves.

I have often heard that the preparation of this pellicle, which the French call *baudruche* and the Dutch *liezen*, and which is so thin that two of them must be pasted together, is a secret, and that the best is obtained from England. But in the year 1785, when I paid a visit to a very ingenious gold beater at Hamburgh, he assured me that he prepared this substance himself, and that the case was the same with most of the gold-beaters in Germany. Even in England, in the year 1763, this art was known only to two or three persons, who practised it as a business, but kept it so secret that Lewis was not able to obtain a proper account of it.* In Ireland also this skin is prepared and sent to England.† When the French, in the beginning of the revolutionary war hoped to out-manœuvre the Germans by the use of aerostatic machines, it became of some importance to them to obtain a supply of these skins. On this account, the *Commission des armes et poudres* drew up instructions for preparing them, which they caused to be printed and distributed to all the butchers. At Strasburgh they were

* *Zusammenhang der Künste*. Zurich 1764, 8vo. i. p. 75. Those desirous of more information on this subject may consult *Traité des monnoies, par Abot de Bazinghen*. Paris 1764. 4to. i. p. 102. Also *Krünitz Encyclopedie*, xix. p. 562.

† Rutton's *Natural History of Dublin*, 1772, 2 vol. 8vo. i. p. 264.

printed in French, and at the same time in German, but in many parts faulty and unintelligible. A copy of them, which is given in a note below, I obtained through the friendship of professor Hermann.*

* *Instruction sur la nature, l'extraction, et la preparation des peaux de baudruches. L'an. 3 de la republ. Françoisse: one sheet quarto.* "On entend par la peau de Baudruche une pellicule mince qui enveloppe le plus gros boyau du bœuf ou de la vache. Ce boyau est au milieu de la partie que l'on nomme fraise, il est long d'environ deux pieds et demi, placé au bout du boyau gras et le seul sur lequel on puisse enlever la pellicule nommée Baudruche.

"Cette désignation est suffisante pour la faire distinguer, malgré la différence des noms qu'on lui donne. A Paris, l'on appelle *Ratti* la partie du corps de l'animal où se trouve le boyau; ailleurs il se nomme *Gros*. Le boyau lui-même porte differens noms, mais il est plus généralement connu sous celui de *Baudruche*.

"Voici la maniere d'opérer: en tirant les entrailles du corps de l'animal, on partage la fraise d'avec la panse. C'est dans la première que se trouve la Baudruche. Il faut la détacher de la graisse avec beaucoup de precaution pour ne point l'écorcher ou la percer. On coupe ce gros boyau de la longueur de deux pieds et demi environ, à partir de l'extrémité de la poche qui forme le gros bout. Cette section se fait pres d'un petit boyau qui traverse et qui partage ce qu'on appelle le boyau gras, ou gras boyau; on fend ensuite légèrement et dans toute sa longueur, du côté qui tenoit a la fraise, la pellicule mince qui enveloppe le boyau nommé Baudruche, et d'où elle a pris elle-même le nom de peau de Baudruche; on la lève adroitement sans la déchirer. L'extraction finie, on la lave dans l'eau de rivière ou de pluie; on a remarqué que l'eau de puits altéroit beaucoup les peaux de Baudruches, ce nétoyage enlève les ordures qui auroient pû s'y attacher; il est essentiel de veiller à ce qu'elles ne soyent pas trainées dans le sang, attendu qu'elles sont d'un naturel spongieux qui ôte la possibilité de les bien nétoyer lorsqu'une fois elles en sont impregnées: elles sont dans cet état, longues d'environ deux pieds et demi, et larges de huit pounces. Cette bande est extrêmement mince et transparente. Quand elle est bien lavée on la laisse se réunir dans

About the year 1621, Mersenne excited general astonishment, when he showed that the Parisian gold-beaters could beat an ounce of gold into 1600 leaves, which together covered a surface of 105 square feet. But in 1711, when the pellicles, discovered by the Germans, came to be used in Paris, Reaumur found that an ounce of gold, in the form of a cube, five and a quarter lines at most in length, breadth, and thickness, and which covered only a surface of about twenty-seven square lines, could be so extended by the gold-beaters as to cover a surface of more than one hundred and forty-six and a half square feet. This extension, therefore, is nearly one half more than was possible about a century before.*

When these skins are worn out by the hammer of the gold-beater, they are employed, under the

sa largeur seulement, en lui conservant toute sa longueur. On la fait glisser doucement entre les doigts pour en exprimer l'eau; elle présente alors la forme d'un cordon plus gros qu'un tuyeau de plume; après cette preparation on doit la secher.

“ On suspend les peaux de Baudruches par leur extrémité la plus mince en tortillant cette extrémité autour d'une ficelle, afin qu'elle ne touche à rien, et que l'air puisse librement circuler autour. On les place dans un lieu sec et à l'ombre, à trois ou quatre pouces de distance les unes des autres.

“ Lorsque le dessechement est opéréc, elles n'ont plus que la grosseur d'une paille de froment, et c'est alors qu'elles peuvent être employées.”

* *Physische Abhandlungen der Pariser Akademie übersetzt von Steinwehr. Breslau 1750. iv. p. 375. Similar calculations may be found in Boyle de subtilitate effluviiorum, cap. 2. p. m. 10. Rohault's tractatus physicus. Amstelod. 1700. 8vo. p. 38.*

name of English skin, for plasters, or properly to unite small wounds. By the English they are called *gold-beaters' skin*;* but, since silk covered with isinglass and Peruvian balsam, which is named English plaster, for the Germans at present call every thing English, has become the mode, this skin is much less used.† I mention this that I might have an opportunity of remarking, that in the middle of the twelfth century, in the Levant at least, a very thin pellicle was in like manner used for wounds. For when the emperor, John Comnenus, accidentally wounded himself in the hand with a poisoned arrow while hunting, a piece of skin, which, from the name and description may be considered the same as that used at present by the gold-beaters, was applied to the wound.‡ The emperor, however, died in con-

* Von Uffenbach Reisen, iii. p. 218.

† The method of preparing this plaster is described in my *Physikal. ækon. Biblioth.* vol. iii. p. 485, and vol. v. p. 114. In the apothecary shops it is called *emplastrum adhæsionis Woodstockii*. I was told by professor Arnemann, that professor Pickel of Würzburg prepares gold-beaters' skin by means of a varnish, which renders it fitter for use; and that a student of that place had found out the art of making it transparent, in order that the wound might be seen; but this is as ridiculous as if one should wish to hear the grass growing. See Arnemann's *System der Chirurgie*, i. p. 94.

‡ Cinnami Historia. Trajecti ad Rhen. 1652. 4to. p. 23. Ex eo vulnere cruenta sanie effluente, tenuis membrana, quam vulgo exco-riationem vocant, imponitur, ut scilicet coalescerent rupta et obdu-cerentur, neve vulnus inflammatum atque intumescens dolores concitaret, ἡμην τις λεπτος, ὃν εκδηραν ὁι πολλοι ιδιωτικως ονομαζουσι. This name is derived from εκδερω, *excorio*, *pelle[m] detraho*.

sequence of this wound, after it had become inflamed under the pellicle, which, in large wounds, and when the skin is suffered to remain too long, is commonly the case, though the poison alone would have been a sufficient cause of death. Reaumur and others are astonished that artists should have sought for and found a part of their apparatus in the bowels of an ox; but I am of opinion that this pellicle, which is sometimes separated in washing and cleaning the bowels, was first observed by the butchers, and made known by them as a plaster; and that it came into request among the German gold-beaters, as the finest of all the pellicles then known, in the beginning of the seventeenth century.

The art of gilding, and particularly unmetallic bodies, was much facilitated by the invention of oil-painting; but it must be acknowledged that the process employed by the ancients in cold-gilding, was nearly the same as that used at present. Pliny says,* that gold leaves were applied to marble with a varnish, and to wood with a cer-

* Lib. xxxiii. § 20. p. 616. *Marmor et iis quæ candescere non possunt, ovi candido illinitur; ligno glutini ratione composita leucophoron vocant. - - - Aes inaurari argento vivo, aut certe hydrargyro, legitimum erat, de quibus ut dicemus illorum naturam redentes, excogitata fraus est. Namque æs cruciatur in primis, accensumque restingitur sale, aceto, alumine. Postea exarenatur, an satis recoctum sit, splendore deprehendente, iterumque exhalatur igni, ut possit edomitum, mixtis pumice, alumine, argento vivo, inductas accipere bracteas.*

tain kind of cement, which he calls *leucophoron*. Without entering into any research respecting the minerals employed for this cement, one may readily conceive that it must have been a ferruginous ochre, or kind of bole, which is still used as a ground (*poliment, assiette*).* But gilding of this kind must have suffered from dampness, though many specimens of it are still preserved. Some of the ancient artists, perhaps, may have employed resinous substances, on which water can produce very little effect.

That gold-leaf was affixed to metals by means of quicksilver, with the assistance of heat, in the time of Pliny, we are told by himself in more places than one. The metal to be gilded was prepared by salts of every kind, and rubbed with pumice-stone in order to clean it thoroughly, and to render the surface a little rough.† This pro-

* Plin. lib. xxxv. § 17. p. 685. Sinopidis Ponticæ selibra, silis lucidi libris x et melini Græciensis duabus mixtis tritisque una, per dies xii leucophoron fit, hoc est, glutinum auri, cum inducitur ligno.

† Lib. xxxiii. § 32. p. 622. Cum æra inaurantur, sublitum bracteis pertinacissime retinet. Verum pallore detegit simplices aut prætenues bracteas. Quapropter id furtum quærentes ovi liquore candido usum cum adulteravere. See also sect. 42. p. 626. I acknowledge that this passage I do not fully comprehend. It seems to say that the quicksilver, when the gold was laid on too thin, appeared through it, but that this might be prevented by mixing with the quicksilver the white of an egg. The quicksilver then remained under the gold; but this is impossible. When the smallest drop of quicksilver falls upon gilding, it corrodes the noble metal, and produces an empty spot. It is, therefore, incomprehensible to me how

cess is similar to that used at present for gilding with amalgam, by means of heat, especially as amalgamation was known to the ancients. But, to speak the truth, Pliny says nothing of heating the metal after the gold is applied, or of evaporating the quicksilver, but of drying the cleaned metal before the gold is laid on. Had he not mentioned quicksilver, his gilding might have been considered as that with gold-leaf by means of heat, *dorure en feuille a feu*, in which the gold is laid upon the metal after it has been cleaned and heated, and strongly rubbed with blood-stone, or polished steel. Felibien was undoubtedly right when he regretted* that the process of the ancients, the excellence of which is proved by remains of antiquity, has been lost.

False gilding, that is, where thin leaves of a white metal, such as tin or silver, are applied to the article to be gilded, and then rubbed over with

this could be prevented by the white of an egg.—Did Pliny himself completely understand gilding? The French translator, Poinsinet de Sivry, seems not to have suspected any difficulty.—“ Lorsque la feuille est trop mince, le mercure la perce, et trahit, par la pâleur qu’il lui communique, la fraude des ouvriers; e’est pourquoi, pour mieux couvrir leur larcin, ils rendent le mercure plus tenace et plus siccatif au moyen d’un blanc d’œuf.” Perhaps Pliny only meant to say, that many artists gave out the cold-gilding, where the gold-leaf was laid on with the white of an egg, as gilding by means of heat. - - I shall here remark, that the reader may spare himself the trouble of turning over Durand’s *Histoire naturelle d’ l’or et d’ argent*, Londres 1729, fol. This Frenchman understood still less what he translated.

* Principes de l’architecture. Paris 1676. 4to. p. 280.

a yellow transparent colour, through which the metallic splendor appears, is much older than I believed it to be in the year 1780. The process for this purpose is given by the monk Theophilus, already mentioned, whose fragments were first printed in 1781.* According to his directions, tin beat into thin leaves was to be rendered of a golden yellow colour by a vinous tincture of saffron, so that other pigments could be applied over it. The varnish or solution of resin in spirit of wine or oil, used for this purpose at present, appears not then to have been known. But in the sixteenth century this art was very common; and instructions respecting it were given by Garzoni†, Cardan,‡ Caneparius§ and others in their writings. About the same period a pewterer at Nuremberg, named Melchior Koch, was acquainted with the art of communicating a golden colour, in the like manner, to tin goblets and dishes. He died in 1567; and with him, as Doppelmayr says,|| the art was lost. A method of applying a white metal to paper, and then drawing over it a gold-varnish, has been known in China since the earliest periods.¶ At present this method of gilding is

* Lessing zur Geschichte und Litteratur, vi. p. 311.

† Piazza universale. Venetia 1610. 4to. p. 281; and in the German translation, Franckfort on the Mayn, 1659. 4to. p. 741.

‡ De rerum varietate, xiii. cap. 56.

§ De atramentis. Roterod. 1718. 4to p. 333.

|| Nachricht von Nurnberg Künstlern, p. 290.

¶ Memoirs concernant les Chinois, par les missionaires, xi. p. 351.

practised more in Sicily* than in any other country. It appears also to have been used, at an early period, for gilding leather and leather tapestry; and this perhaps was first attempted at Messina, as we are told by John Matthæus, † who, however, in another place ascribes the invention to a saint of Lucca, named Cita. But gilt leather was made so early as the time of Lucian, who conjectures that Alexander the impostor had a piece of it bound round his thigh. ‡ The dress of the priests, on the festival of Bacchus, was perhaps of the same kind. §

FUR DRESSES.

As long as mankind lived under palm-trees in their original country, between the tropics, they had no

* Lettres écrites de Suisse, d'Italie, de Sicile, et de Malthe, par M. Amst. 1780. 12mo. iii. p. 349.

† Cita Lulensis mulier et sancta, auripellem, id est, aurum in pelle reperit. Quam ob rem hujus rei artifices ejus diem festum singulis annis maximo honore colunt et observant.—Pag. 41. Pelles bractea argentea obducere, dein eas fuco tingere in aureum colorem, quas auripelles vocant, Messanenses suum, ut ferunt, inventum fuit, magis novum quam vetus. *De rerum inventoribus*, Hamburgi 1613. 8. p. 37.

‡ Luciani Opera, edit. Bipont. v. p. 100. ὁ μίμος αὐτοῦ χρυσοῦς διεφάνη, δερμάτος, ὡς εἰκος, ἐπιχρυσοῦ περιτεθέντος. Femur ejus aureum apparuit, circumposita, ut probabile est, pelle inaurata.

§ Plutarchi Sympos. iv. in fine. Francof. 1620. fol. ii. p. 672. ἰ ἀρχιερεὺς νεβροῖδα χρυσοσπαστῶν ἐνημμένους. Pontifex hinnuli pellem auro

occasion to provide either food or clothing. The former was spontaneously supplied by the earth, that is, without care or labour; and the latter in that warm climate was superfluous. The art of cultivating plants, and that of preparing clothes, were not innate, but first taught by necessity; and this did not exist till men, in consequence of their increase, were obliged to spread towards both the poles. In proportion as they removed from their former abode, provisions became scarcer, and the climate colder. Hence arose the breeding of cattle, as well as agriculture; and men then first ventured on the cruelty of killing animals, in order that they might devour them as food, and use their skins to shelter them against the severity of the weather.

At first these skins were used raw, without any preparation; and many nations did not till a late period fall upon the art of rendering them softer, and making them more pliable, durable, and convenient. As long as mankind traded only for necessaries, and paid no attention to ornaments, they turned the hairy side towards the body; but as the art of dressing skins was not then understood, the flesh side must have given to this kind of clothing, when the manners of people began to be more refined, an appearance which could not fail of exciting disgust. To prevent this the Ozolæ in-

contactam indutus. Compare with Plutarch's account, *Braun de vestitu sacerdotum Hebræorum*. Amst. 1701. 4to. i. p. 52 and 77.

verted the skins, and wore the hair outwards; and in this manner some account for the bad smell which exhaled from their bodies.* This custom, however, was so general, that Juvenal, where he describes a miserly person, says: “to guard himself against the cold he does not wear the costly woollen clothing of the luxurious Romans, but the skins of animals, and these even inverted, that is to say, with the hairy side turned inwards, without caring whether the appearance be agreeable or not.”† In what manner the art of tanning was afterwards found out, Goguet‡ has endeavoured to conjecture from the accounts given by travellers, in regard to the savages in the northern parts of America and Asia, but particularly in regard to the Greenlanders. The far more ingenious method of manufacturing wool, first into felt and then into cloth, seems to have been discovered by the inhabitants of temperate districts, where the mildness of the winter rendered fur dresses unnecessary.

The sheep came from Africa; but in that country it has hair and not wool; and it is only in

* Pausan. x. 38. p. 895 : *Accepimus, Ozolas, cum vestem texere nondum didicissent, velare corpora solitos ad frigus propulsandum ferarum recentibus coriis, pilo extrorsum converso, quo vestitus plus decoris haberet.* το δαθυ των δερματων ες το εκτος υπερευπρεπειας τρεποντες.

† Nil vetitum fecisse volet, quem non pudet alto

Per glaciem perone tegi, qui summovet Euros

Pellibus inversis.

Sat. xiv. 185.

‡ Von Ursprung der Gesetze und Künste, i. p. 122.

colder climates that the former becomes so refined as to acquire a woolly nature. If it be true that a Hercules first brought this species of animal from Africa to Greece,* that improvement may have first been effected in the latter; and in that case it is probable that the first attempts to manufacture wool were made by the Athenians, that is to say, among the Greeks; for this art was before known to the Egyptians, who ascribe the invention of it to their Isis.†

It may be readily comprehended that many centuries must have elapsed before the tender sheep could be conveyed to and reared in the northern countries, where thick and immense forests produced in abundance a great variety of those animals which were capable of supplying the best furs; where mankind increased but slowly; applied to hunting till a later period; and were not so soon compelled to employ artificial methods of obtaining the most necessary productions; and where they also lived too widely scattered to be soon conducted to the arts by a communication of experience and inventions. The northern nations, therefore, clothed themselves in the raw skins of animals, a long time after the southern tribes were acquainted with the spinning and weaving of wool,

* Varro de re rust. lib. i. l. 6: oves, quas Hercules ex Africa in Græciam exportavit.

† Goguet, *ut supra*. i. p. 124, 125.

flax, and cotton; and on this account the former were astonished at the appearance of the latter.

When the Greeks give us a picture of these barbarians, they scarcely ever fail to state how disgusting they were on account of their dress; which, however, by the acknowledgement of their historians, was long worn by their own forefathers.* The heroes even of the Grecian fabulous history clothed themselves in the skins of the most terrible animals,† such as lions and tigers, and on these they also slept.‡ When the Romans wished to describe the manners of their ancestors, and to exhibit the difference between them and their own, they commonly mentioned the use of skins. Thus Propertius calls the senators of the earliest periods the *pelliti*;§ and Valerius Maximus says,|| speaking of the luxury of his time, that no one in imitation of Cato would use goat skins as a covering to his bed. But it appears that the Greeks and the Romans, at the time of their prosperity, when

* Diodor. Siculus, ii. p. 151. Pausanias, x. cap. 38. p. 895. Propertius, iv. 1. 12.

† Virg. Æneid. ix. 306: Dat Niso Mnestheus pellem horrentisque leonis Exuvias. xi. 576: Pro longæ tegmine pallæ, Tigridis exuviæ per dorsum a vertice pendent.

‡ Æneid. viii. 177: Præcipuumque toro et villosi pelle leonis Adeipit Ænean. viii. 368: stratisque locavit Effultum foliis et pelle Libystidis ursæ. To the same purpose are the passages quoted from the Odyssey in Hieron. Magii Miscellan. 3. 7. p. 144.

§ Eleg. iv. 1. 12: patres pelliti.

|| Si quis hoc sæculo vir illustris pellibus hædinis pro stragulis utatur, nonne mirabilis existimetur? Valer. Max. iv. 3. 11.

the arts and sciences were cultivated among them, made little use of fur clothing. It was worn at that period only on certain festivals,* and merely by the poorer classes and rustics,† or employed in the time of war.‡ At any rate, it is not mentioned among the dresses of the rich, or articles of magnificence and ornament.

The ancient physicians, where they treat on the influence which clothing has on the health, and the choice of it for winter and summer, make no mention of furs.§ Suetonius, describing the manner in which the emperor Augustus dressed in winter, names various articles of clothing, but no furs;|| which the emperor, who was so sensible of cold, would certainly have worn, had they been usual. They no doubt would have been much more convenient and answered the purpose better, than the four *tunicæ* drawn over each other, and the thick

* Thus the *Bacchæ* clothed themselves in fox-skins. See Hesychius, *v. βασσαραι* and Suidas, *βασσαρος αλωπηξι*.

† See *Ferrarius de re vestiari*. iv. 2. 2. in *Thesaurus Antiquitat. Roman.* vi. p. 908; and passages respecting *διφθερα* collected by others. Varro *de re rust.* 2. 11: *pellium usum apud antiquos quoque Græcos fuisse apparet, quod in tragædiis senes ab hac pelle vocantur διφθεριαι et in comediis. Aristophan. Nubes*, 1. 1. 73.

‡ Livius, v. 2. p. 11. Florus, 1. 12. Tacit. *Annal.* 14. 38. Corn. Nepos, *Agesil.* cap. 8. Lipsius *de Militia Rom.* lib. v. dial. 1. p. 313.

§ See, for example, Galen in *Hippocratis lib. de salubra diæta*, according to Gesner's edition, class 2, p. 81.

|| Cap. 82. p. 415. Quassato corpore neque frigora neque æstus facile tolerabat. Hieme quaternis eum pingui toga tunicis; et subucula et thorace lanco, et feminalibus et tibialibus muniebatur.

toga, the woollen shirt and breast-cloth, and all the other articles mentioned. Martial ridicules a *petit-maitre*, who wished for the arrival of winter and for severe weather in that season, in order that he might exhibit his costly winter dresses.* Had furs, at that period, been the fashionable and principal winter clothing, the poet certainly would not have omitted to mention them. At present the *baccaræ* for the like reason make their appearance as soon as the first frost takes place, along with large muffs, which leave scarcely any part of the body to be seen but the head and the feet. Had furs been employed by way of ornament in the time of Pliny, he no doubt would have noticed this use of them, especially as he mentions and ridicules so many superstitious ways of applying the skins of animals; but I do not remember to have read in the works of this naturalist any account of fur clothing. He relates that an attempt had been made to manufacture the fur of the hare; but it had not succeeded, because the fur, on account of its shortness, as he supposes, would not adhere, or,

- * Et dolet et queritur, sibi non contingere frigus
 Propter sexcentas Baccare guasapinas.
 Optat et obscuras luces, ventosque nivesque;
 Odit et hibernos, si tepuere dies.
 Quid fecere mali nostræ tibi, sæve, lacernæ,
 Tollere de scapulis quas levis aura potest?
 Quanto simplicius, quanto est humanius istud:
 Mense vel Augusto sumere guasapinas?

Martial. Epig. lib. vi. 59.

as we say at present, could not be felted.* He, however, says nothing of hare's fur being employed to line clothes. It appears also that furs do not often occur, as clothing, in the sacred scriptures.†

* Lib. viii. 55. p. 483: *Nec non et vestes leporino pilo facere, tentatum est, tact unon perinde molli, ut in cute propter brevitatem pili dilabidas.* The hair of this animal, however, seems to have been an article of trade, and comprehended under the head of wool; for in the Roman code of laws we find: *Lana legata etiam leporinam lanam et anserinam et caprinam credo contineri. L. 70. § 9. De legat. 3. or Digestor. lib. xxxii. leg. 70. 9.* Cushions, however, were stuffed with it. See *Waarenkunde*, i. p. 271.

† For the following information on this subject I am indebted to the friendship of professor Eichorn. “Of furs being used as dresses of magnificence I find very faint traces. I shall, however, quote all the passages where allusion is made to furs.

“In Genesis, chap. xxv. ver. 25, Esau is said to have felt to the touch like a hairy garment, אדרת שער. A fur dress must here be meant; for Rebecca endeavoured to make Jacob like his brother, by binding pieces of goats skins around his hands and neck. Genesis xxvii. ver. 16.

“In Joshua, chap. vii. ver. 21, the true reading is אדרת שכער, and signifies a Babylonian mantle, consequently one made of wool, respecting which many passages have been collected by various authors, and particularly Fischer in *Prolusiones de version. Græc. Vet. Test.* p. 87. One manuscript, according to Kennicot, has, however, שער אדרת, a hairy mantle or fur; but this has arisen either through an error in transcribing; one consonant, נ Nun, being omitted, or from the conjecture of some Jewish copyist, who was acquainted with costly furs but not with a Babylonian mantle. If the reading of Kennicot is to be retained, it would, on account of the price, be an important passage, in regard to costly furs.

“Among the Hebrews, the prophets wore fur dresses, if not in general, at any rate very often.

“The mantle of Elijah, 2 Kings, chap. ii. ver. 8, 13, 14, was of fur; because on account of his clothing he was called a hairy man, 2 Kings, chap. i. ver. 8.

In the third, or perhaps even the second century of the Christian æra, fur dresses seem to have been known to the Romans, and to have been much esteemed by them. The numerous northern tribes, who at that time advanced towards the south, were clothed in furs; but they were not all raw, dirty, and disgusting, like those which had before been in use. It may with certainty be supposed, that the chief men among them had the most beautiful furs; and that in general they were so well acquainted with the art of preparing them, and wearing them in the most graceful manner, that they by these means recommended them to the notice of the young Romans. For that all those warlike tribes who attacked the Roman empire, and in part subdued it, are not to be considered as uncultivated, savage barbarians, unacquainted with the arts or the sciences, addicted to plundering and murder,

“ A hairy mantle, as a mark of distinction, is mentioned in the book of Zeehariah, chap. xiii. ver. 4.

“ In 1 Maccabees, chap. xiii. ver. 37, the high priest Simon obtained from king Demetrius *βαρν*, which is certainly a false reading for *βαρτα* or *βαρν*, already substituted with great propriety by Drusius. See Michaelis *Uebersetzung des ersten Buchs der Maccabäer*, 1788. 4to. p. 288. The conjecture of Drusius has been introduced into the version from the Syriac, where the translator makes *ἱματιον* to signify *vestis ex cavuis*. The only question is, whether *βαρν*, which was merely a shepherd's dress, consequently made of sheep skins, signified also a dress of state, as there is reason to conjecture from the persons who sent and who received it as a present. See *Theocrit. Idyll. iii. 25. et ibi Schol.* Furs, as a present, in the hot climate of Bassorah, are mentioned by Niebuhr, *Reise*, vol. ii. p. 235. Compare also vol. ii. p. 317. and vol. i. p. 158.”

who overturned governments and destroyed public happiness and trade, has been lately remarked, when the French applied the term Vandalism to the horrid cruelties committed during the late revolution.* It can be proved that the Romans adopted from their uninvited guests those kinds of dress; that furs soon became fashionable among

* The best refutation of this supposed Vandalism is to be found in a book where one would hardly expect it. I mean Schlözer's Essay, in the second edition of F. I. L. *Mayers Fragmenten aus Paris*. Hamburg 1798. 8vo. ii. p. 353. No where do we find that the works of art were destroyed by the Goths or Vandals; on the contrary, it appears that they had sufficient culture to hold them in just estimation. Genserich carried away works of art from Rome, in the same manner as the Romans had done from Greece; but they were carefully packed up and not destroyed; he did therefore what Bonaparte did in those countries which were unable to withstand the force of his armies. If the epithet of Vandalism is to be applied to modern events, it seems most applicable to those who carried away works of art from countries into which the conquerors promised to introduce the rights of man, liberty, and happiness. The Christian writers even, and among these St. Augustine, admit that the Goths after their victories were not so cruel and rapacious as the Romans. Orosius, who lived in the beginning of the fifth century, relates, that a Goth of high rank, after the taking of Rome, having found in a house some gold and silver vessels which had been plundered from the church of St. Peter, gave notice to Alarich, and that the latter caused them to be sent back safe to the church. To this subject belong the passages quoted in *Mascov's Geschichte der Teutschen*, i. p. 367 and 450: *Augustin. de civitate Dei*, lib. iii. cap. 29: *Orosius*, lib. vii. 1. cap. 39. p. 667, according to the edition of Cologne 1582. 8vo. *Procopius de bello Vandal.* lib. i. cap. 5. The account given of the arms and accoutrements of these northern tribes proves also, that they were acquainted with the arts, and that they employed them to ornament their clothing. The fur dresses, therefore, may have been very handsome.

them, and were an object of luxury and of commerce; and it appears that skins were the first article which occasioned a trade from Italy to the most distant parts of the North, as in the fifteenth century they were the cause of the discovery and conquest of Siberia.

The later the art of manufacturing wool, and of converting the noble metals into lace and other ornaments, was known in the northern countries, and the later the inhabitants became acquainted with cotton, silk, and precious stones, the earlier and the more they exerted themselves to find out and prepare the most beautiful furs, and to trim and to border with them their dresses; and it needs excite no surprise that the southern nations, though their climate did not require it, adopted this magnificence; especially as the distance and scarcity of furs made them dear enough to be considered by the rich and people of rank, as a luxurious mark of distinction. This, in my opinion, will be proved by what follows.

When historians speak of those northern nations with whom the Romans carried on long and for the most part unfortunate wars, they scarcely ever forget to mention their fur clothing; and this is the case in particular with those writers who lived at the time. We are told by Herodotus,* that the people near the Caspian sea clothed themselves in

* Lib. i. 202. p. 96: *φοκηνι δερματι.*

seal-skins. The same thing is related by Strabo of the Massagetæ;* and Cæsar † and Sallust ‡ both assert, that the skin of the rein-deer formed in part the clothing of the ancient Germans. I allude here to those dresses which they called *renons*. That this word is derived from the animal named at present by the Swedes *Ren*; that the rein-deer was common in ancient Germany, when, in consequence of its being covered with forests and marshes, it had a much colder climate and produced more rein-deer moss than at present; and that Cæsar, where he describes the most remarkable things of Germany, mentions the rein-deer under the name of *bos cervi figura*; I think I have proved in my juvenile production on the ancient animals of that country. *Reno* is also *Lappmud*, or the rein-deer skin, which is still worn in Sweden, which I have worn there myself, and which is handsome and costly. The objection of Wachter § to this opinion is of very little weight. How is it possible to believe, says he, that these animals were formerly so numerous, that all the Germans and Gauls could clothe themselves in their skins? But on this occasion he does not re-

* Lib. xi. p. 781 (513): ἀμπεχόνται δὲ τὰ τῶν φακῶν δερμάτα.

† De Bello Gallico, vi. 25.

‡ Germani intectum renonibus corpus tegunt. These words have been repeated by Isidorus and Servius. They may be found among the *Fragmenta*, in Havercamp's edition. 2. p. 121.

§ Glossarium, p. 1282.

collect what he has often proved by examples, that the name of a species is often given to the whole genus. Because a great many wore *renones*, of which the Romans perhaps were fondest, they gave the name of *renones* to all these fur dresses of the Germans. The proofs, in ancient authors, in regard to the fur clothing of the Scythians, the Goths, the Getæ, and Hunns, are too numerous to be collected. I shall, therefore, refer only to those passages which I have occasionally remarked, and which I shall soon employ for another purpose.*

* Virgili Georg. iii. 381: Talis Hyperboreo septem subjecta trioni Gens effræna virum Rhipæo tunditur Euro, Et pecudum fulvis velatur corpora setis.

Ovid. Trist. iii. 10. 19: Pellibus et sutis arcent male frigora braccis; Oraque de toto corpore sola patent.

Trist. v. 7. 49: Pellibus et laxis arcent male frigora braccis; Oraque sunt longis horrida tecta comis.

Ex Ponto, iv. 10. 1: Hic mihi Cimærio bis tertia ducitur æstas, Littore pellitos inter agenti Getas.

Justinus, ii. 2. p. 43: Scythis lanæ usus ac vestium ignotus, quam continuis frigoribus urantur; pellibus tamen ferinis aut murinis utuntur. This is the language of a Roman who was acquainted only with woollen clothing for winter, which, however could not have been sufficient for the Scythians in their much colder climate.

Seneca, Epist. 90: Non hodieque magna Scytharum pars tergis vulpium induitur ac murium, quæ tactu mollia et impenetrabilia ventis sunt?

Rutilii Itiner. ii. 49: Ipsa satellitibus pellitis Roma patebat. Claudian viii. *de quarto consulat. Honorii*, 466: metitur (cæditur) pellita juvenus. xxvi. *de bello Getico*, 481: - Crinigeri sedere patres, pellita Getarum Curia. v. *in Rufinum*, ii. 79: revocat fulvas in pectore pelles. 82: Nec pudet sumere - - - vestemque Getarum. 85 Mœrent captivæ pellito indice leges.

Ammian. Marcell. xxxi. 2. p. 474: Indumentis operiuntur liu-

It can easily be proved, that the Germans and other northern nations, in consequence of their intercourse with the Romans, gradually left off the use of furs, and became more and more accustomed to woollen clothing; and, on the other hand, that the Romans adopted the state dress of their conquerors. Even in the time of Tacitus, those Germans who lived on the Rhine and the Danube, and consequently who were nearest to the Romans, set much less value on furs than those who, residing further within the country, were at a greater distance from intercourse with fo-

teis, vel ex pellium sylvestrium murium consareinatis - - - hirsuta crura coriis munientes hædinis.

Prudentius in Symmachum, ii. 695: Tentavit Geticus nuper delere tyrannus Italiam, patrio veniens juratus ab Istro, Has arces æquare solo, tecta aurea flammis solvere, mastrucis proceres vestire togatos.

Isidor. Origin. xix. 23: Mastruca vestis Germanorum ex pellibus ferarum.

Sidon. Apollin. Epist. i. 2. p. 6, edit. Savari, Parisiis 1599, 4to. p. 6: where he describes Theodoric II king of the Goths, the son of Theodoric I and brother of Thorismundus: *pellitorum turba satellitum*. Epist. vii. 9. p. 423, the kings of the Goths are called *pelliti reges*. Carm. vii. 224. p. 87: in media pelliti principis aula.

Fortunatus, lib. ix. *poem*. 5: Pelligeri veniens Chlodovechi gente potenti. Such is the manner in which these words of this ecclesiastical poet of the sixth century are quoted by Ludewig and others. But in the best edition of his works, edited by Luehi at Rome in 1786, 4to, the reading is, i. p. 316, *Belligeri*, and not *Pelligeri*. This word also is not found among the different readings, p. 489.

Prosper Aquitanus, who lived in the fifth century, says, in his treatise *de providentia*: Ad Scythiæ proceres regesque Getarum respic, queis ostro contempto et vellere seram, eximius decor est tergis horrere ferarum.

reigners and from trade.* The latter had the most costly furs, which they knew how to ornament and variegate with trimmings of every kind, in the same manner perhaps as our furriers at present ornament white fur with the tail of the ermine.† These people possessed no other articles of luxury, and had no other means of distinguishing themselves among their countrymen, but by the rarity and costliness of their furs. Such was the case with the Spartans when Lycurgus deprived them of all their superfluities. They then ornamented, and thereby enhanced the value of the necessary articles they had left, beds, tables, and wooden bowls, from which they drank water, and to such a degree, that at length these things were as capable of gratifying the taste of luxury as the foreign wares they had before purchased at so dear a rate.‡

* Gerunt et ferarum pelles, proximi ripæ negligenter, ultiores exquisitius, ut quibus nullus per commercia cultus. Eligunt feras, et detracta velamina spargunt maculis, pellibusque belluarum. *Tacitus de Moribus German.* 17.

† Variegated furs of this kind sewed together are mentioned by *Pollux*, vii. 60. p. 729.

‡ Plutarchus in Lycurgo, edit. Francof. 1620. fol. i. p. 45: Quod in causa fuit, ut instrumentum quotidianum et necessarium, veluti lecti, sedes, mensæque supra modum fabricarentur apud eos concinne, et poculum Laconicum, quod cothon dicebatur, in commendatione esset maxime ad expeditiones - - - In causa et hic legislator fuit, quippe opifices, ubi discesserunt ab inutilibus, in necessariis expresserunt elegantiam: ἀπὸ ἀλλαγμοῦ γὰρ οἱ δημιουργοὶ τῶν ἀχρηστῶν, οἱ τοῖς ἀναγκαιοῖς ἐπιδείκνυντο τὴν καλλιτεχνίαν. This account deserves to be particularly noticed by writers in treating on luxury. In the like

The same thing has been remarked by the Danish and Swedish historians. When these nations, by their sea voyages, piratical expeditions, and trade, became acquainted with foreign manners, and more convenient kinds of clothing, they accustomed themselves to wool, cotton, and silk; yet, in so slow a manner, that the use of these wares was introduced as an extravagant luxury. Harold Hårdrát Sigurdson, or Harold IV king of Norway, in the middle of the eleventh century, who had collected great riches in the Levant, wore a red mantle lined with white furs.* In the twelfth century, the principal men at the Danish court were clothed in sheep-skins;† and when Duke Canute, or Canute Laward, the son of Eric Eiegod, who was assassinated in the year 1131, appeared at a festival at Ripe in a dress of red cloth, he excited attention and envy, and was subjected to the mortification of hearing the most bitter sarcasms from Henry Skatteler, or rather Skokal, that is, the lame, who wore a native sheep-skin. ‡

manner, the savages in the South Seas are acquainted with the art of giving more beauty and value to their ornaments made of feathers, shells, and the teeth of their enemies killed in battle.

* *En röd mantel fodrad med hvitt skinn.* See I. Murberg's *Abhandlung von den Kleidungen der Schweden zur zeit Gustaf I in Vitterhets historie och antiquitets academiens handlingar.* Stock. 1793. 8vo. iii. p. 78.

† Lagerbring *Svea Rikes Hist.* Part ii. p. 88.

‡ *En röd klädesklädning.* Murberg, p. 78. He refers to Lager-

That furs were considered by the Getæ as objects of magnificence, and that, as such, they were worn by their kings and the principal men at court, is proved by the passages I have quoted. The reproach thrown out by Claudian against Rufinus, that he was not ashamed to wear Getic furs, proves that the Romans adopted the manners of their conquerors, and that this practice was censured by their patriots. It is worthy of remark also, that the jurists, Ulpian and Paulus, reckon

bring, who, it may readily be believed, found this circumstance in some old annalist. I have taken the trouble to search for this event in Saxo-Grammaticus, but I find there only the following account in *Histor. Dan.* lib. xiii. p. 368, according to the Leipsic edit. 1771. 4to. *Dimissa classe nuptialia sacra apud urbem Ripam agi placuit: Illuc siquidem frequens navigiis portus oppido splendidam mercium varietatem importat. Ubi cum Kanutus in veste Saxonica cæteris cultior progredetur, Henricus obfusis invidia oculis alieni cultus splendorem ferre nequiens, orta inter ipsos altercatione, latus ejus adversum gladios ostro tutum fore negavit. Quem Kanutus nihilo majus ovillis securum tergoribus respondit; lacessitum vestis suæ fulgorem urbano rusticitatis opprobrio speciosius quam minis aut conviciis ultus. Itaque exprobratam sibi externi cultus æmulationem domestici cavillatione prosequi contentus exstitit.* It is certain that the Danes, at that period, spent in eating and drinking the treasure they obtained in plundering; that they employed their time only in hunting and breeding cattle, and clothed themselves in the skins of their sheep; but that this Canute endeavoured to introduce among them the Saxon manners and dress. He had invited into his kingdom from Lower Saxony, which province was at that time considered as the seat of the arts and sciences, as well as of more refined manners, a great many workmen and artists, a colony of whom he established in Roeskild, the capital. See *Gebhardi in Allgemeiner Wellhistor.* xxxii. p. 471.

furs among articles of dress, to which before their time they did not belong.*

Acron, an old commentator on Horace, whose period, as far as I know, has not yet been determined, says, † that in his time the senators and principal men, when they appeared in their official dresses, wore costly furs obtained from foreign countries, and Tertullian ‡ indignantly inveighs against the female dresses bordered and trimmed with furs, which seem to be mentioned also by bishop Maximus in the fifth century.§

* Digestor. lib. xxxiv. tit. 2. l. 25. § 3: Item pelles caprinæ et agninæ vestes erunt. *Ibid.* l. 23 et 24: Vestis etiam ex pellibus constabit, cum et tunicas et stragula pellicea nonnulli habeant.

† Ad Horat. i. satyr. 6. 28. Gothofredus quotes the words of Acron in his annotations to the *Cod. Theodos.* lib. xiv. i. p. 236: Latum clavum purpuram dicit Horatius quæ in pectore extenditur senatorum: Græci τὸν κόλοβιονα vocant. Usus ejus retinent principes, injicientes vesti a cervice ad pectus indumentum ex purpura vel pellibus pretiosis muris pontici, vel aliis, dum regio habitu prodeunt in publicum. But this passage is not to be found in the edition of Basle, 1580, fol. p. 1802; which, however, is one of the Henrico-Petrini editions, and these are considered as the best ever given of the scholiasts. See the elegant edition of Horace by professor Mitscherlich, i. p. 46. The case with Acron is the same as with Servius, scarcely any edition is like another, and there is none perhaps complete: unfortunately also, it is not known at what time Acron lived, and whether many annotations have not been added by others.

‡ De habitu muliebri, cap. 1. p. 551: adornari tibi in mente est, supra pelliceas tuas tunicas.

§ Maximus Taurinensis episcop. *Homil.* 2, de avaritia: Unde enim Barbaris auri, gemmarumque monilia? Unde pellita sericea vestimenta?

In the year 397, the emperor Honorius forbade Gothic dresses, and in particular furs, to be worn either in Rome or within the jurisdiction of the city; but that such orders against fashions had very little effect appears from this circumstance, that these laws, extended as well as rendered more severe, were renewed in 399 and 416, and yet were not obeyed. Even the Goths themselves were forbidden to use such dresses. The Gothic servants, who at that time were kept in most families, were to be subjected to corporal punishment, and those of higher rank to a fine, in case they transgressed this prohibition.* But Synesius, who lived at that period, and as a good patriot lamented the use of these outlandish dresses, which afforded a melancholy presage that the dominion of the Goths would at length prevail, relates, that the principal men among these people appeared at Rome in the Roman dress, but on their return home they exchanged it for their native clothing, and again assumed their furs.†

* Cod. Theodos. lib. xiv. tit. 10. 2. 3. 4. p. 240: *Majores crines, indumenta pellium, etiam in servis, intra urbem sacratissimam precipimus inhiberi; nec quisquam posthac impune hunc habitum poterit usurpare. Si quis autem neglexerit nostræ sanctionis vigorem, ingenuus legis laqueos non evitet, servus operi publico vindicabitur. Quod innotescere non solum intra urbem petimus, verum etiam in vicinis regionibus non licere sancimus (An. 416).*

† Synesii Opera, edit. Petavii, p. 23: *Paululum curia egressi rursum pelliceas vestes sumunt, αὐτῆς ἐν τοῖς κωδικοῖς εἰσι, τόγανque ubi inter comites fuerint, derident, qua cum felicem stringendi ensis peritiam esse negant.*

Furs, however, were not the only part of the Gothic costume which became modish among the Romans; for they adopted also their breeches or hose. That such articles of dress were not used before that time, either by the Greeks, the Romans, or the Hebrews, has been proved by many. On this account mention is so often made of indecent postures, as when the Scots' Highlanders *rendent les armes*, by which parts are exposed that modesty requires to be concealed. This is considered by Theophrastus as one of the marks of clownishness.* Thus, a posture inadvertently assumed, exposed Philip to reproach, as we are told by Plutarch; † and to guard against a similar indecorum, Cæsar as he fell, collected his robes around him. Hence, as is well known, the expression retained by Luther, *seine füsse bedecken*, "to cover one's feet," or as the Greeks say, "to compose one's clothes." ‡ Persons who laboured under weakness or indisposition, wrapped bandages around their legs; and in the time of Quintilian the use of these could be excused only by sickness. § They, however, became afterwards more common, so that by Ulpian they are reckoned

* *Notationes morum*, cap. 5 et 12.

† *Apophthegm.* p. 178, according to the Franckfort edition, 1620. fol.

‡ *Καθελκεσθαι και ανελκεσθαι.* See *Herodiani Histor.* ix. 13: *τας εσθητας των μηρων καθελκειν.*

§ *De Institut. orat.* xi. 3. 144. p. 586.

among the ordinary articles of dress.* They formed a step towards breeches, properly so called, which, as is well known, covered for many centuries the loins, thighs, and legs, as may be seen on seals and carved work of the thirteenth century.† That the Batavians, Gauls, Germans, Sarmatians, Getæ, Goths, &c. had such articles of clothing, is proved by many passages in ancient authors, already quoted by others, and by the well-known appellation *Gallia braccata*. The *anaxurides* also of the Persians were breeches, which the Romans adopted, not from these people but from the northern nations, yet without the approbation of the patriots, who exclaimed against them, as they had before done against furs. At first they seem to have been used only on journeys and in war. When the Gothic costume was forbidden by Honorius, breeches were expressly mentioned; and Ovid reproaches the people of Tomi, on the Pontus Euxinus, that though they wished to be thought of Greek extraction they were not ashamed to wear Persian breeches. ‡

As furs for dresses of ceremony were either not used at all by the Greeks and the Romans, or

* Lex 25. de auro, argento, mundo.

† See the instances quoted by G. S. Treuer in *Anastasis veteris Germani Germanæque feminae*. Helmstad. 1729. Thirty-six pages in 4to.

‡ Trist. v. 10. 31. For a complete history of their dress the reader must consult the authors quoted in *Fabriçii Bibliograph. antiquaria*, p. 861; and in *Pitisci Lex. antiq. v. Bracca*.

were adopted only at a late period and seldom employed, an account of the fur trade is not to be expected in their writings. I am well aware that Isaac Vossius had an idea that the history of the golden fleece might be considered as the oldest trace of it,* and therefore asserted, that the object of the Argonautic expedition to Colchis was a commercial speculation, as was the case with the voyages of the English to Nootka Sound. It is also true, that this opinion met with some approbation; but it has no more probability than that entertained by the alchemists in regard to the same expedition since the time of Suidas. That the Colchi, indeed, carried on a very extensive trade is sufficiently proved by the testimony of Pliny † and Strabo; ‡ but the latter, in the catalogue of wares, mentions timber for ship-building, pitch, wax, linen, and hemp, but not furs, which at that time could not be an article much sought after in foreign commerce.

* In his annotations on Catullus, p. 100. This opinion is given at more length in a dissertation entitled, *Dass Moscau das wahrhafte güldene Vliesse besitze, erinnerte sich als 1712 Carl VI einige Ritter des güldenen vliesses machte und bewies*. B. L. R. Two sheets 4to. the place where printed not mentioned. The author, in all probability, was G. S. Treuer, for it is found in the library of our university in a volume inscribed, *G. S. Treueri dissertationes academicae*, from the library of the abbot of Lockum, who had the best opportunity of knowing that Treuer, then at Helmstadt, was the author. It is there stated, on the authority of a manuscript thesis of Grævius, that he entertained the same opinion as Vossius.

† Lib. vi. cap. 5.

‡ Lib. xi. p. 761 (498).

Another account which we read in Pliny seems much rather to refer to the fur trade. I here allude to that lately quoted by Böttiger,* from which it appears that furs were reckoned among the articles obtained at that time from the Seres.† I, however, freely confess, that I cannot readily admit this single word of Pliny as a complete proof. As far as I have yet been able to find, other writers, among the articles furnished by the Chinese, mention iron, pearls, silk, cotton, and silk or cotton clothes, but say nothing of furs; and it is very improbable, that a country which produced silk or cotton could supply such furs as would be worth conveying to so great a distance. The only thing I can admit is, that the furs were brought by a transit trade to Europe; that is to say, the Seres obtained them from the fur countries, properly so called, or those which at present furnish sables, and again sold them to the Romans. Now this was a very circuitous route, whether we consider *Serica* to have been China, Siam, or the Lesser Bucharìa; yet not so circuitous as that by which the Chinese at present obtain from the English, through Russia, the best beaver skins brought from Canada and Hudson's Bay.

Were we to reckon among the *pelles Serum* of

* In that learned and ingenious work *Erklärung der Vasengemälde*, i. 3. p. 186.

† Lib. xxxiv. cap. 14. § 41. p. 667: Seres hoc ferrum cum vestibus suis pellibusque mittunt.

Pliny the *lucida vellera, tactu mollia Serum*, mentioned by Seneca,* Boethius,† and others, we should undoubtedly be in an error; for these may be explained by the false information which, at that time, was obtained partly in regard to cotton, and partly in regard to silk, and which may be seen in Solinus,‡ and others. Is it not possible that these *lucida vellera* may have been meant likewise by Pliny?

I have some doubts also respecting a passage of Strabo, where he relates that, among the wares brought by the nomadic tribes of Europe and Asia to the Tanais, or present Azoph, at the mouth of the Don, there were slaves and furs.§ It is certain that *dermata* may signify, not only furs but also tanned skins. If Strabo here meant furs, I am inclined to conjecture, that they were disposed

* Thyestes. 378. Hercules Œt. 667. Hippolyt. 386. Alcimus Avitus, who, with Boethius, lived in the beginning of the sixth century, says, *ad Fuscinum sororem*: *Mollia vel tactu quæ mittunt vellera Seres*.

† Lib. ii. Carmen. 5: *Nec lucida vellera Serum Tyrio miscere veneno*. This passage was pointed out to me in 1781 by professor Nass, of Stuttgart, who conjectured that it might allude to the fine lamb-skins of the Bucharians and Calmucks. But it appears to me more probable that cloth, and not furs, is here meant, because the poet says, at the same time, that the *vellera Serum* were dyed different ways.

‡ Cap. 50. § 3.

§ Lib. xi. p. 755: *ανδροποδα και δερματα*. See in regard to this passage C. W. J. Galterer's *Abhandlung vom Pelzhandel*. Mannheim 1794. 8vo. p. 81: which may be found also in *Schriften der Pfälzischen Œkonom. Geselsch.* for 1793.

of in the nearest countries, but did not come into the European trade; and the case, perhaps, was the same with the slaves mentioned in the same passage. Polybius also, among the wares brought from Pontus to Byzantium, mentions *dermata*.* I must, however, confess, that if I found that the Romans actually obtained *dermata* from Asia, I should carefully examine whether under that term skins, or even dyed leather, were not rather meant. Skins, and particularly for military purposes, they indeed procured from very distant places. Thus the Frieslanders, instead of a tax, were obliged to supply ox-hides; † and it may be proved, by the testimony of various writers, that the art of giving a beautiful dye to leather is very old in Asia; and, therefore, that many kinds of what we call morroccò was, at an early period, brought from it to Europe.

On the other hand, from what is said by Ælian, ‡

* Histor. lib. iv. p. 306, according to Wechel's edition, 1609, fol.

† Tacitus Annal. iv. 72.

‡ Hist. animal. xviii. 17. p. 937: ὡνπερ οὖν καὶ τὰς δοῦρας ἰσασιὶν δε τούτων καπηλοὶ, καὶ ἐς Περσῶν ἀγοῦσι φορτὸν εἰσι δε ἀπαλαὶ καὶ συννεράμμεναι, χιτῶνες τε ἅμα γιγνόνται, καὶ ἀλειουσι αὐτοὺς· καλοῦνται δε ἀρα οὗτοι καναυ- τανες, ὡς ἐκεῖνοις φίλον. Quorum pelles molles institores ad Persas vehunt, quibus vestes consuuntur, et corpus optime fovetur, hosque suo sermone *canautanas* appellunt. The singular word *καναυτανες*, respecting which a great deal has been said by Paw, in his annotations to *Phile de Animal*. 48. p. 246, has lately been translated by Böttiger very happily, by the word *kaftane*, a kind of Turkish robe, unless those skilled in the oriental languages make any objection. At present these dresses of ceremony are of cotton, with flocks of

I entertain no doubt, that in his time a trade in furs was carried on with Persia. To that country were sent, he says, the soft skins of the Pontic mouse, which, when sewed together, formed warm dresses. I am convinced also that more proofs might be found of the use of fur-clothing among the Persians. They employed furs likewise instead of mattresses and bolsters. Thus we are told by Plutarch,* that Pharnabazus reclined upon soft furs: and it is not improbable that the rough or thick winter gloves of the Persians, mentioned by Xenophon, were of the same material.† It is stated by modern travellers, that, at present, sable and ermine skins are among the most common and valuable ornaments of the Persians; and it is well known that the costume of these people is very

silk worked into them, and for the most part are whitish, with a few rudely-formed pale yellow flowers: but the word formerly may have signified clothes in general, or fur clothing in particular, and perhaps the silk flocks may have been at first intended to represent fur. That furs, at present, are employed at Bassorah as presents, is proved by the information above quoted by professor Eichorn.

* Vita Agesilai. p. 602, according to the Franckfort edition, 1620, fol. ὑποβελημεων αυτω κωδιων μαλακων και ποικιλων δαπιδων. Substratis mollibus pellibus et versicoloribus tapetibus. Xenophon, who relates the same thing, speaks of cushions or bolsters: ὑποτιθεντων δε των θεραποντων βαπτα εφ' ων καθιρουσιν οι Περσαι μαλακως, cum famuli pulvinos substernerent, in quibus Persæ molliter sedere consueverunt. *Rerum Græc.* lib. iv. p. 348, in the edition of Basle, 1555, fol.

† *Cyropædia*, at the end of the eighth book, p. 165, where he mentions χειριδας δασειας. The Greeks and the Romans, however, did not wear gloves.

old, because they are not exposed as we are to the influence of fickle fashion.

But the Persian skins, *pelles Parthicæ* or *Persicæ*, which are often extolled, especially in later times, on account of their beauty, do not belong to this head; though Vossius and Brisson, as well as our Gesner, who has followed the two former, consider them to have been sables. They were undoubtedly different kinds of dyed leather, of which shoes were made for princes and opulent persons. In the time of the emperor Maximianus, a Roman soldier having found a leathern purse which contained real pearls, threw away the latter and retained only the purse, because it had a beautiful colour.* Of the same kind of leather was that dyed with kermes, mentioned by Zosimus; † and that which by Constantine Porphyrogenetes, where he mentions all those wares which the northern nations obtained through Constantinople, is expressly named highly dyed Persian leather. ‡

* Ammian. Marcell. xxii. 5. p. 232: Notum est, sub Maximiano Cæsare vallo regis Persarum direpto, gregarium quendam post sacculum Parthicum, in quo erant margaritæ, repertum, projectis imperitia gemmis, abisse pellis nitore solo contentum. Of the same kind were the *zanchæ Parthicæ* of Trebellius Pollio in *Claudio*, 17. *Corippus laud. Justiniani*, i. 106 ed. Rittershusii. Altorfi, 4to. p. 24, calls them *tergora Parthica*, and the scholiast on Juvenal, v. 165: *Parthica corrigia*.

† Lib. v. 41: *κοκκινοβαφη δερματα*. The translation has *vellera coccinea*, but they were *coria coccineo colore tincta*, as Heyne calls them in Reitmeier's edition, Leipsic 1784, 8vo. p. 646.

‡ Constantin. Porphyrog. de administrando imperio, cap. 6:

Of a similar kind, as appears, was the Babylonian leather. Zonaras * speaks of a costly tent made of it; and in the time of St. Jerome it was considered as an object of luxury. † As Persian and Babylonian leather are mentioned at the same time, there is reason to think that a distinction was made in commerce between these two kinds. ‡

δερματα αληθινα παρθια. Salmasius has considered them improperly as the raw skins of panthers and tigers.

* Annal. lib. xiii. p. 10, according to the Venetian edition 1729, fol. ; or according to the Paris edition, p. 12. The author, speaking of Adanarses, says: σκηνη ποτε τη πατρι αυτου διεκομισθη εκ Βαβυλωνος, δερμασιν εγχωριοις πρηνικλωτερον ειργασμενη. Aliquando patri ejus tentorium Babylone allatum est, e variis illius loci pellibus confectum. In *Athenæus Deipnos*. v. p. 197, Callixenus describes Persian counterpanes with figures representing animals, but I do not know whether I ought not, with Valois, to consider them as painted leather, or rather worked tapestry. Ψιλοι Περσικαι ακριση την ευγραμμιαν των ευφασμενων εχουσαι ζωδιων: Glabri Persici (tapetes) exacta pingendi scientia intextis pusillis animalibus.

† Ad Lætam de institutione filiæ: Divinos codices amet, in quibus non auri et pellis Babylonicæ vermiculata pictura, sed ad fidem placeat emendata et erudita distinctio.

‡ Digest. lib. xxxix. tit. 4. 16. 7, or L. ult. § 7. de publicanis. In *Expositione totius mundi et gentium in Gronovii Geographia antiqua*, p. 261, it is said, that a great trade was carried on in Cappadocia with Babylonian leather: Negotia hæc optima ubique mittere eam aiunt: Ieporinam vestem et Babylonicum pellinum - - - Du Cange quotes the words in Greek, and calls this writing *Alypii Antioch. Geographia*; but the author, who lived in the fourth century, is unknown, and the Greek words are taken only from the Greek translation made by Gothofredus. See *Fabricii Biblioth. Græca*, iii. p. 80. *Placii Theatrum*, ii. p. 31. *Götze Merkwürdigkeiten der Dresdn. Biblioth.* ii. p. 205 and 208. The *vestes leporinæ* appear to have been made of the hair of the Angora rabbits. See *Waarenkunde*, i. p. 519, where I have considered the Greek

The emperor Constantine, among the persons charged to furnish articles for the imperial wardrobe at Constantinople, and who on that account enjoyed certain immunities, mentions the *parthi-carii*, *particarii*, or *parthiarii*;* and though we are uncertain in regard to the orthography, it may be readily conceived that these words do not allude, as Vossius says, to furriers, but to merchants who dealt in costly dyed, and perhaps painted skins, which they procured from Persia. It is well known that, at present, the Persians understand the art of preparing and dyeing many kinds of leather in a more beautiful manner than the Europeans; and among these, in particular, are shagreen and Morocco, which are still imported from the East.†

From the grounds here adduced I am led to conjecture, that the trade in furs to the southern parts of Europe, had its commencement during the expeditions of the northern tribes to Italy; and I must acknowledge, that I have found no older information on this subject, than that furnished by Jordanes or Jornandes, who lived in the sixth century. This writer, speaking of the northern na-

translation as the original, an error into which I was chiefly led by Gothofredus.

* L. 7. C. de excus. mun. or Cod. lib. 10. tit. 47. 7. p. 890: *Negotiantes vestiarios, linteones, purpurarios et particarios, qui devotioni nostræ deserviunt, visum est ab omni munere immunes esse.*

† Chardin, iv. p. 245.

tions, mentions the *Suethans*, and says,* that these are the people who send to the Romans the celebrated furs; which, however, passed necessarily through the hands of many intermediate tribes. These Suethans, according to his account, inhabited a part of *Scanzia*, and that under this name he included Sweden, Norway, Lapland, Finland, &c. has been already proved by Mascou.† Soon after he mentions also *Hunugari*, whom he reckons among the Scythians; these he says were known on account of their trade with mouse skins.‡

It is too well known to require any proof that, in the oldest periods, the whole riches of the northern countries consisted in furs; that these, if not the only, were the principal wares exported, and that all taxes were paid with them. Otho, who lived in the ninth century, states the number of martin, rein-deer, bear, and otter skins, which were delivered annually by the Finlanders and Norwegians.§ When Thorolf, in the year 878, sent

* *Alia vero gens ibi moratur Suethans—Hi quoque sunt, qui in usus Romanorum Saphirinas pelles, commercio interveniente, per alias innumeras gentes transmittunt, famosi pellium decora nigredine. De rebus Geticis, cap. 3. p. 612.*

† *Mascovs Geschichte der Teutschen, ii. p. 76.*

‡ *Cap. 5. p. 616. Hunugari autem hinc sunt noti, quia ab ipsis pellium murinarum venit commercium.*

§ *Periplus Otheri et Wulfstani, according to the Latin translation in Langebek Scriptores rerum Danicarum, fol. ii. p. 111: Unusquisque pendit pro ratione natalium suorum. Nobilissimus*

a ship to England with merchandise, there were among it *pelles mustelinæ albæ*.* I shall remark

tenetur pendere quindecim martium pelles, rangiferorum quinque, ursi unam, ac decem modios plumarum (*down*), cum tunica e pelibus ursinis vel lutrinis, atque duobus insuper funibus nauticis, quorum uterque sit sexaginta ulnas longus, alter autem e balænarum, e phocarum alter corio confectus. —I shall take occasion to remark that such ropes, made of the twisted skins of large sea animals, are still used in Greenland and other countries. See *Torfæi Groenlandia antiqua*. Havniæ 1725, 8vo. p. 83. I have in my collection of leather a piece of such a rope, some inches in thickness, and on which hair can still be distinguished.

* Torfæi Hist. Norveg. P. 2. p. 34. Compare Schlözer's *Nordische Geschichte in Algem. Welthistor.* vol. xxxi. p. 445. 458.— Having heard from Mr. Schlözer that the first certain traces of the Russian fur trade were to be found in the Russian Chronicles, works never yet used, I requested him, as the only person in Germany who could draw from these sources, to transmit to me what he had remarked on that subject. I am indebted to him, therefore, for the following valuable information, the result of a laborious comparison of various manuscript chronicles, for which he will no doubt receive the reader's thanks.

“ The following are the passages respecting which we lately conversed, taken from the ten Russian Chronicles, the greater part of them still in manuscript, as a proof that from the ninth century tribute in furs was demanded from the people in Russia by their conquerors.

I. “ In the year 859 the Wäringians, who came by sea, had tribute from the Tschudi, the Slavi, the Meri, and the Kriwitsches, a squirrel per man. The Chazares (in the Crimea) had tribute from the Poles (the inhabitants of the Ukrain), the Severians, and the Wæitsches, a squirrel for each fire-place or hearth.

“ The squirrel *Sciurus vulgaris* had, in the old and new Russian language, the five following names: 1st. *Běla*. This primitive word has been lost in the new Russian language, but is still preserved in the Chronicles, and in the adjectives *bělij* and *běliczij měch*, *Grauwerk* (squirrel-skins). *Běl* in all the Slavonic dialects signifies *white*: Can any connexion be discovered between the squirrel and a

also, that so early as the third century, skins and leather began to be counted by *decuriæ*;* from which is derived the appellation *decher*,

white colour? 2d. *Bělka*, the diminutive of the former, is at present generally current. 3d. *Wěkscha*, from which is derived, 4th. *Wěkschitza*, the diminutive. 5th. *Weweritza* is old, but still exists in the Polish. See the Great *Russian Lexicon of the Russian Academy, Petersburg 1789—1794*. vi. vol. 4to.

“ The variations of these words which occur in manuscripts are abundant, and some of them exceedingly laughable. One transcriber has *běla*; most of the rest add *wěkscha*, *wěkschitza*, or *weweritza*, as if *běla* were the adjective white. Two manuscripts say expressly, ‘ *běla*, that is *wěkscha*.’ In one, however, from *běla weweritza* has been made *běla dewitza*, a fair or beautiful maid. *Saml. Russ. Geschichte*, vol. i. p. 9.

II. “ In the year 883 Oleg went against the Drewians and Severians, whom he obliged to pay tribute, each a black martin.

“ *Po czerně kuně* stands in all the manuscripts; one only has the diminutive *kunitzě*. Another bad manuscript, which has *koně*, a black horse, is not worthy of any remark.

III. “ In 969 Svātoslav spoke to his mother and boyars: ‘ I am not fond of Kief; I will reside in Pereyaslawetz on the Danube. There I shall be in the middle of my lands, to which every thing good in my territories flows: from the Greeks gold and *pavoloki* (silk-stuffs?), and wine and fruit of every kind; from the Tseheches (Bohemians) and Hungarians silver and horses; from Russia *skora*, wax, honey, and servants.’ *Skora*, *skura*, furs, according to the Lexicon above quoted, from which is derived *skornāk*, similar furs prepared. That coarse skins or furs (in Russian *schurka*), such as the *terga boum*, imposed by the Romans on the Frieslanders, are not here meant, is proved by a passage in the *Chronicle of Nikon*, vol. ii. p. 15, where it is related of a savage people, who lived far to the north on the Ural, that they gave *skora* for a knife and a hatchet.

“ That martin-skins, as well as pieces of them (*morki*) and of squirrel-skins, were used as money in Novogorod, till the year 1411, is well known from *Saml. Russ. Geschichte*, vol. v. p. 430.”

* Trebellii Pollion. *Vita divi Claudii*, cap. 14: dabis ei pellium tentoriarum decurias triginta.

adopted into the English, Swedish, and Danish languages, as well as the word *dacra* or *dacrum pellium*,* used in the middle ages. Sables and ermines, however, are still sold by *zimmer*; and this appellation also is very old. A *timber* of hare-skins occurs about the year 1300, and *unum timbrium martrinarum* † so early as 1207. At present a *zimmer* makes four *dechers* or twenty pairs, and in the time of George Agricola sable-skins were sold in this manner, forty in one lot. ‡ But a *zimmer* has not always been the same in all countries and at all times; at any rate, in France a *zimmer*, *timbre*, was reckoned to contain sixty skins.

Before I proceed further, I must endeavour to explain the different names of furs which occur in the works of the ancients; but in this attempt I can scarcely hope to attain to great probability. The information of the ancients in regard to those species of animals with the country of which they were not acquainted, is exceedingly defective. What they relate was obtained from the accounts of merchants; and these, in all probability, through a principle of self-interest, falsified the little that they really knew. Besides, the ancient writers do not always accurately distinguish the names of the different furs, nor affix to them the same

* Du Cange Glossarium.

† Du Cange, and Frisch in his *Wörterbuch*.

‡ De ~~minantibus~~ *subterraneis*, p. 490.

meaning; which is the less surprising, as few know how to give proper names to the principal kinds of furs even at present. It is probable that the skins of the ermine, martin, and squirrel, became, at a very early period, objects of commerce, and formed the chief articles in this branch of trade; but from the little known on this subject, no zoologist would venture to determine, with certainty, the species. He must be so candid as to admit all conjectures which he is not able to refute.

If I am not mistaken, the skin of the mouse, and particularly the Pontic or Caspian mouse, is that of which the first and most frequent mention occurs in the oldest times. That the name *mus*, denoted at first not only that animal to which we apply it, but also all small warm-blooded quadrupeds, has been long ago remarked. In the same manner, every large animal was formerly called *bos*. When the Romans first saw elephants they gave them the name of *boves lucæ*. Pausanias also calls the rhinoceros the Ethiopian ox; and Cæsar names the rein-deer, the ox with stag's horns. The ox was the largest, as the mouse was the smallest, warm-blooded animal with which the ancients were acquainted, and therefore they called all large animals oxen, and all small ones mice.* It is to be observed, in explaining the ancient

* Varro de ling. Lat. lib. vi. p. 51 : Boves appellati sunt ab eo, quod nostri cum maximam quadrupedem, quam ipsi haberent, vocarent bovem.

names of animals, that at first they had a much more extensive signification, and one must endeavour to conjecture what the animals comprehended under them had in common with each other, according to the ideas of the ancients. To words of this kind *formica* seems to belong, and perhaps the principal idea related to collecting and laying up; and perhaps in this manner one might be able to explain the fable of the gold-searching ants, mentioned by Herodotus. It is, however, often difficult to conjecture what the principal idea was. What idea did the ancients affix to the term *passer* (sparrow), when they called the ostrich the large Libyan or Arabian sparrow? We learn nothing more, therefore, from the words *pelles murium*, than that they were not the skins of large animals. The epithets Pontic and Caspian only show, that these wares, like many others, were brought from Pontus and the Caspian sea. From such epithets, were we to determine the original country of any article used in commerce, or the place where it was first produced, we should often fall into error. Wares were frequently called Syrian, Turkish, and Arabian, though it is certain that they were brought from very different countries.*

What further information I have been able to

* Such were the *malobathrum Syrium*, and the *merx Syra* and *nardus Assyria* of Horace; the *amomum Assyrium* of Martial, and the *myrrha Orontea* of Propertius. In like manner Aristotle called τιν των μολυβδων των εκ των Τυριων.

find, in regard to this species of animal, merely is, that its skin was exceedingly soft; that it formed a good defence against the wind, and that a great many of them were sewed together in order to make a garment.* Now, if credit be given to the account of Aristotle and Pliny, that the Pontic mouse belongs to the ruminating class of animals, how can any thing characteristic be deduced from it?†

Those who wish to afford more room for conjecture might, from a passage of St. Jerome,‡ render it probable, that this kind of fur had the same smell as musk. Musk indeed was then known; but is it not possible that this father may have considered the musk animal to be a mouse, as Conrad Gesner suspected? To me it is more probable that he was acquainted with the musk bags used in commerce, and named them *peregrini muris olentes pelliculæ*. It, however, cannot be proved by this passage, that the skin of the musk animal was purchased for fur clothing on account of its smell. For, in the first place, the skin of this animal, with the hair on it, has not a musky smell; and this is known not only from the description given of it, but is proved by a skin

* Seneca, epist. 90. *Pollux*, vii. 60. p. 729.

† Arist. Hist. animal. ix. 80. *Plin.* x. 73 § 93. p. 582.

‡ Contra Jovianum, lib. ii. Odoris suffitus et diversa thymiamata, amomum, cyphl, oenanthe, muscus, et peregrini muris pellicula.

which I obtained in a very fresh state. In the second place, this animal is as large as a deer half a year old; the size, therefore, will not warrant the use of the diminutive *pellicula*. And, in the third place, the skin does not afford valuable fur. The hair is thick; almost bristly, and so tender that it breaks with the least force. These skins are used only by the natives of the country where they are produced, for caps and winter clothing; but when they have been freed from the hair, and tanned white, they form leather exceedingly soft and fine.* Those who are satisfied with an appearance of probability may recollect, in reading the passage of Jerome, that the sable, when daily used, throws out a faint and not unpleasant smell of musk, and assert that the Pontic mouse was the sable.

Far more probable is the conjecture of our great zoologist, that *mus Ponticus* was the name given at first to the earless marmot, *M. catili*, and that it was afterwards applied to the squirrel and ermine.† This opinion he supports by the observation, that the torpidity in winter, the rumination, and the affinity to the alpine mouse,

* Georgi in the *Abhandlungen der Petersburg. ökon. Geselsch.* i. p. 25. A further account may be found under the head *musk*, in my *Waarenkunde*, i. p. 248.

† Pallas *Novæ species quadrupedum e glirium ordine.* Erlangæ, 1778. 4to. p. 120.

M. alpinus, which Pliny seems to acknowledge,* agree better with the *M. catili*, than any other animal. To this may be added, that it is said by Hesychius and Varinus,† that the Parthian name of the animal was *simoor*; and that the earless marmot is still named by the Tartars *symron*, and by the Calmucks *dshymbura*. The similarity is indeed great, and this opinion is further confirmed by the skins of the earless marmot being used, at present, by some of the Siberian tribes, for summer clothing, and sent as articles of commerce, with other furs, to China, though they belong only to the cheapest kinds, so that a thousand of them cost scarcely eight or ten rubles.‡

Amidst this scanty information, were I allowed to offer a conjecture, I should be inclined rather to the opinion of those who consider the Pontic mouse to have been our ermine. For, in the first place, this animal is very abundant in the countries from which the ancients obtained their beautiful

* Plin. viii. 37: *conduntur hyeme et pontici mures - - - conduntur et alpini.*

† Varini Phavorini Dictionar. Venetiis, 1712. fol. p. 658. *Σιμορ* παρα Παρθοις καλεϊται τι μυος αγριου ειδος, ου ταις δοραις χρωνται προς χιτανας. These words are taken from Hesychius.

‡ Pallas, p. 142: I shall here take occasion to remark, that the use of this animal's skin, as well as the name, occurs, in the eleventh century, in Bernardus Sylvester:

*Cismus obrepit et vestitura potentes
Marturis, et spolio non levioe biber.*

furs; and it seems almost impossible, that they should not at an early period have remarked the superiority of its skin to that of the earless marmot. Secondly, it appears that the Pontic mouse has been commonly considered as the ermine, since that name in general was known; and there is reason to think, that our forefathers could not err in the name of an article which has been uninterruptedly employed in commerce.

The name ermine occurs very often in works of the middle ages, and written in various ways, such as *Harmellina*, *Harmelinus*, *Ermelinus*, *Harminia* and *Arminia* or *Armerina* or *hereminia pelles*, *Ermena*, *Erminea*, and *erminatus*, ornamented with ermine; all which words Du Cange supports by proofs. At what time these names were first used; I am not able to determine; but they are to be found, at any rate, so early as the eleventh century, in the letters of Peter Damiani.* Du Cange asserts, that they came from Armenia, in which country this kind of fur was in old times highly esteemed, as is proved by the passage in Pollux already quoted;† and he has rendered this probable, by the circumstance that the words *Herme*nia and *Herme*nii were formerly used and written instead of *Armenia*, and *Armenii*.‡ Fischer has

* Lib. ii. ep. 2. Ovium itaque simul et agnorum despiciuntur exuviae, ermellini, gebellini, martores exquiruntur et vulpes.

† vii. 60.

‡ See a dissertation *de l'origine des couleurs et des métaux dans les armoiries*, added to his edition of *Histoire de S. Louis*, par Joinville.

rejected this opinion too inconsiderately, because the ermine was not procured from Armenia, but sent through it, from the northern countries, to Europe.* The same thing is said by Du Cange; but he gives it to be understood that this commodity was among the Armenian productions; and even if he has erred in this respect, his derivation still remains the most probable. Marco Polo, the celebrated traveller of the thirteenth century, mentions the ermine among the most expensive ornaments of the Tartars; and says, that it was brought from the northern countries to Europe.†

The sable seems to have been known much later than the ermine. Its real country is the most northern part of Asia, to which commerce was not extended till a late period; yet it is probable that it was known before the Russians became acquainted with Siberia, by means of the Permians, Woguls, and Samoeides, at the end of the fifteenth century. It is also fully proved, that the fine furs of Siberia were the production which

Paris, 1668. fol. p. 127. It may be found also in the latest edition in *Collection universelle des memoires relatifs à l'hist. de France*. Londres, 1785. 8vo. i. p. 317. See also the article *Hermine*, in his Glossary to Geoffroy de Ville-Hardouin's *Conqueste de Constantinople*, in *Histoire de l'empire de Constantinople sous les empereurs François* (par Du Fresne), according to the Venetian edition of 1729. fol. i. p. 183; and of the Parisian, i. p. 364. This whole article has been inserted by Menage, in *Diction. etymolog.* both under the head *Ermine* and *Hermine*.

* Geschichte des Teutschen Handels, i. p. 245.

† Page 49. 78, 164. 166.

induced the Russians to make a conquest of that country.* Besides, sables existed formerly in Permia, where at present they are very scarce. The numerous remains of antiquity still found in Siberia prove, that at a very early period it was inhabited by a people who carried on commerce, and were well acquainted with the arts.

Conrad Gesner believed, that the name sable occurs for the first time in Albertus Magnus, who wrote in the thirteenth century, under the word *Cebalus*, or *Chebalus*.† In the same century Marco Polo mentions, at least in the Latin translation, *zibellina pellis*, as a valuable kind of fur. But if *sabelum* be the sable, as the similarity of the word seems to show, it must have been known in the twelfth century, and even earlier. The name *sabelum* occurs in Alanus Insulanus,‡ and Du Cange found *sabelinæ pelles* so early as the year 1138, though *sabelum*, perhaps, means the martin. *Gebellinica pellis*, *gibelini* or *gibellini martores*, were mentioned in the eleventh century, as appears by the passage already quoted; and *sabel-*

* Mullers Sammlung Russischer Geschichte, vi. p. 491. *Fischers Sibirische Geschichte*. St. Petersburg. 1768. 8vo. p. 290.

† Gesner quotes the following words: *Fassuron* (satyrion Aristotelis?) est chebalus dictus latine; hirsutam et nigram habens pellem pretiosam valde, qua utuntur ante pallia varia.

‡ The words quoted by Du Cange from *Planctus naturæ* are as follows: *Illic martes et sabelo semiplenam palliorum pulcritudinem eorum postulantem subsidia, suarum nobilitate pellium, ad plenum deducebant.*

linæ and *gebellinæ pelles* were undoubtedly the same.* I shall not, however, enter further into this inquiry, which it appears would be endless, and at the same time of little benefit.

The martin, the fur of which approaches nearest to that of the sable, appears to be first mentioned by Martial, who says, speaking of an unsuccessful hunting excursion, that the hunter was overjoyed if he caught only a martin.† But the reading is very doubtful; for many, instead of *martes*, read *meles*; and the latter occurs in Varro, Pliny, and other writers, whereas the former is found nowhere else. In the middle ages, however, or at any rate in the twelfth century, *martures*, *mardrini*, and *marturinæ vestes* frequently occur; and I can see no reason why they may not be considered as martin skins, a name which has been retained in all the European languages.

With as little certainty can it be determined what our forefathers meant by the words *vares varii*, *vairus*, *vajus*, *varus*, *vayrus*, *veyrus* or the *vair* of the French, and under *griseum* and *grisum*. That they belong to costly kinds of fur is universally admitted. Sometimes *varium* and

* Du Cange in his observations on Joinville, p. 137, thinks that the *zebelinæ* or *sabelinæ pelles* came from Zibel or Zibelet, a maritime town in Palestine, formerly called *Biblium*, because the skins were sent from it to Europe. This author meant *Byblus*, at present *Gibelet* or *Gibeletto*; but this derivation appears to me highly improbable.

† Epigram. x. 37. 18. Venator capta marte superbus adest.

griseum appear to be the same; and sometimes the former seems to be more valuable than the latter.* That the former was spotted, or parti-coloured, is apparently announced by the name; for both the leopard and panther are by Pliny called *variæ*. What in heraldry is named by the French *vair*, and the Germans *eisenhüttlein*, *vellus varium*, and which is considered by the former as the skin of an animal gray on the back, and white on the belly,† alludes to this also. Sometimes, however, it seems to signify a fur dress, composed of differently-coloured pieces of fur sewed together. Most writers are of opinion that it means *grauwerk*, *petit-gris*, *vech*, *veh*, *vech*, *vehwammen*, also the squirrel; and there is certainly a species of that animal which might justify the name *varius*, as its skin is at present employed for variegated bordering or trimming; but I do not know whether *grauwerk*‡ could be so dear as *varium* is said to have been, as it is among the productions of Europe, though the best at present comes from Siberia. The word *vech* is derived, as Frisch says, from the Italian *vaio*; the latter, according to Muratori, § is formed from *varius*, and even

* For example, in the passages from *Ceremon. Roman.* lib. iii. p. 323. b. quoted by Du Cange.

† *Triers Wapen-Kunst.* Leipsic, 1744. 8vo. p. 62. *Gatterers Abriss der Heraldik.* Gottingen, 1792. 8vo. p. 41.

‡ *Grauwerk veh* or *feh* means properly a kind of fur, composed of that of the Siberian squirrel and the martin joined together. TR.

§ Muratori *Antiquit. Ital. mediæ ævi.* ii. p. 413.

at present, a dress lined with fur is called *roba vaja*.

Cirogillinæ pelles, named by the council of Paris in the year 1212, were rabbit skins.* Rabbit warrens, so early as the thirteenth century, were not scarce in England; for in a letter of grace respecting the forests, in 1215, every proprietor was permitted to establish them on his own lands.†

By the term *cattinæ pelles*,‡ which are also often named, must undoubtedly be understood cats' skins. In France, in the twelfth century, the skins of native animals were considered as of little value; but the Spanish and Italian were highly prized. § The skins of the black fox, which at present are the dearest kind of furs, as a single one in Russia is often sold for six hundred and even a thousand roubles, || occur in the thirteenth century, among the wares which were sent from the most northern countries to Europe; ¶ and with-

* See the passages quoted by Du Cange, and what Gesner has said in *Histor. animal.* under the head *Cuniculus*. In *Britonis Philipp.* i. 682, instead of *tirogrillus* we must read *cirogryllus*; and Barth has translated this word improperly, p. 77, by *crinaceus*.

† Rapin *Geschichte von England*. Halle 1756. 4to. p. 181.

‡ See this article in Du Cange and Hoffman's *Lexicon*.

§ *Cattinarum sive aliarum pellium notabilis et damnosa curiositas, quæ in tantum, ut ipse novi, processerat, ut Gallicanorum cattorum pellibus contemptis ad Iberorum vel Itatorum catts religiososorum hominum curiositas transmigraret. Petri Venerabilis Consuetudines Cluniac.* cap. 17.

|| Muller's *Sammlung Russischer Geschichte*, iii. p. 532.

¶ *Vulpes nigræ et alia quædam animantia, quæ hominibus illis*

out doubt these were meant by Damiani in the passage above quoted.*

Clothing made of the beaver skin occurs much earlier. It seems to be mentioned by Claudian† in the fourth century; and it is spoken of by Ambrosius,‡ who lived at the same period. Sidonius Apollinaris,§ in the fifth century, called those who wore it *castorinati*. The scholiast of Juvenal, who indeed belongs to an unknown but much later period, has also *pelles bebrinæ* or *beverinæ*. || As the ermine was called the Pontic mouse, the beaver was named the Pontic dog.

I, however, firmly believe that this castor clothing was no more fur clothing, than our beaver hats are fur hats. At that time the hair was spun and wove; and Claudian, in my opinion, speaks of a worn-out beaver dress, which had nothing more left of that valuable fur but the name. This method of manufacturing beavers' hair seems not to have been known in the time of Pliny; for though he speaks much of the castor, and men-

lenissimas præbent pelles, et ad nostras per mercatores deferuntur regiones. *Mar. Paul. Venet.* iii. 48. p. 164.

* Lib. ii. epist. 2.

† Epig 92: de birro castoreo.

‡ De dignitate sacerdotali, cap. 5: Quod si juxta sensum litteræ tantum respiciamus, non aliud sacerdotes quam amictum quærimus clariorem. Verbi gratia: castorinas quærimus et sericas vestes. Et ille se inter episcopos credit esse altiozem, qui vestem induerit clariorem.

§ Epist. 7. lib. v. p. 313. edit. Paris, 1599. 4to.

|| Sat. ii. v. 99.

tions *pellis fibrina** three times, he says nothing in regard to manufacturing the hair, or to beaver fur. As attempts, however, had then been made to manufacture the fur of the hare, it is probable that beaver hair began to be worn soon after. Isidorus, who lived nearly about that period, as he died in 636, reckons beaver hair, which he calls *fibrinum*, among the materials employed for making cloth; † and where he enumerates the different kinds of cloth, he mentions also *vestis fibrina*, and says that the warp was of beaver, and the woof of goats' hair, perhaps the so called camel hair. ‡ An upper garment of this cloth was worn by the emperor Nicephorus II. Phocas, at his coronation in the year 963, which undoubtedly was not a castor pellice; because fur clothing, as

* Lib. xvii. cap. 28. § 47. p. 91. Lib. xxxii. cap. 9. p. 588; and 10. p. 589.

† Lib. xix. cap. 27. p. 474: *Fibrinum lana est animalium, quæ fibros vocant; ipsos et castores existimant.*

‡ Lib. xix. cap. 22. p. 469: *Fibrina (vestis) tramam de fibri lana habens caprina.* That this passage is faulty may be easily seen. Barth on Claudian's epigram, quotes it in this manner: *Fibrina vestis, tramam de fibris, lanam habens caprinam.* In my opinion, the word *subtremen*, or *subtegmén*, or *stamen*, which Isidore seems to use for woof, has been omitted; it ought to be *tramam de fibri lana habens stamen de caprina.* A little before, he mentions the woof and the warp of another kind of cloth, in the following manner: *Tramoserica stamine lineo, trama ex serico* - - A complete edition compared with different manuscripts of this book, as yet too little employed, would be exceedingly useful.

I shall soon prove, was not fashionable at the court of the Greek emperors.*

It deserves here to be remarked, that furs began to be dyed so early as the twelfth century; and it appears that the colour was chiefly red, for we find *pelles rubricatæ arietum*, that is, sheep-skins dyed red; but Du Cange thinks he can prove that the skins of the martin and ermine were dyed of the same colour. This I can believe in regard to the ermine; but to dye the dark fur of the martin and sable would, in my opinion, be hardly possible. St. Bernard says, that such red dyed leather in the twelfth century was called *gulæ*, which, with *Hermin engolé* of the old poets, seems to signify the same thing, ermine skins dyed red.†

When fur dresses became fashionable in Italy, they were soon spread all over Europe. At first the best indigenous furs were employed; but afterwards those of foreign countries, as being superior; and the dearer they were, the more they were esteemed. At every court they formed the state costume of the reigning family, and in a little time that of the richest nobility. In particular the mantle, *cottes d'armes* of the knights, which they

* Constantin. de ceremoniis aulæ Byzantinæ, i. p. 254: *σακαραμαγγιον καστωριον*. Reiske thinks, p. 145, that it may have been a pellice, because *Herodotus*, iv. 109. p. 309, *ed. Wessel.* speaks of the beaver's skin being used for clothing. But how different must the old Sarmatian manners have been from the Byzantine!

† Bernhardi Epist. 42: *murium rubricatas pelliculas, quas Gulas vocant.* Compare *Du Cange* in *Glossar.* and on Joinville, p. 136.

drew over their cuirass or harness, was bordered with the costliest furs. It had no sleeves, and resembled the dress of ceremony worn by our heralds. On this account, as is well known, ermine and other kinds of fur became parts of the oldest coats of arms. Sometimes magnificence, in this respect, was carried to such an extravagant length; that moralists declaimed against it, while governments endeavoured to limit the use of furs by laws, and the clergy to prohibit them entirely. Many kinds, therefore, were retained only by the principal nobility, and others were forbidden.

Charlemagne, however, wore in winter a pellice which covered his shoulders and breast; but being an enemy to all foreign dress, he employed only the furs of his native country; and, according to the statement of some manuscripts, otter skins alone.* It, nevertheless, appears that the costly oriental furs were then known at his court; for having gone out a hunting with his suite, on a cold rainy holiday, he himself wore only a sheep's skin, but the dresses of his attendants, who had become acquainted in Italy with the valuable articles in which the Venetians then dealt, consisted of foreign cloth and furs. These, when thoroughly drenched and dried at the fire, crumbled to pieces.

* Eginhartus, Vita Caroli Magni, cap. 23. p. 112: ex pellibus lutrinis thorace confecto, humeros et pectus muniebat - - - Peregrina vero indumenta, quamvis pulcerrima, respuebat, nec unquam eis indui patiebatur.

The emperor then caused his sheep's skin when dried to be rubbed, and showing it to his courtiers ridiculed them on their foreign fur dresses, which though expensive were of little use.* The impe-

* This is related by the monk of St. Gall, who is commonly considered to have been Notker, in his book *de gestis Caroli Magni*, ii. 27, to be found in *Bouquet, rerum Gallicarum et Franciæ Scriptor.* tom. v. p. 152. Cum in eadem regione (Friaul) aliquantis per immoratus fuisset Carolus, quadam festiva die post missarum celebrationem dixit ad suos: ne otio torpentes ad ignaviam perducamur, eamus venatum donec aliquid capiamus, et singuli in eodem habitu pergamus, quo nunc induti sumus. Erat autem imbrifera dies et frigida, et ipse quidem Carolus habebat pellicium berbericum, non multum amplioris pretii, quam erat roccus ille S. Martini, quo pectus ambitus, nudis brachiis deo sacrificium obtulisse astipulatione divina comprobatur. Ceteri vero, utpote feriatis diebus, et quæ modo de Papia venissent, ad quam nuper Venetici de transmarinis partibus omnes orientalium divitias advectassent, phœnicum pellibus avium serico circumdatis et pavonum collis cum tergo et clunis mox florescere incipientibus, Tyria purpura, vel diacedrina litra decoratis, alii de lodicibus, quidam de gliribus circumamicti procedebant, saltusque peragrantes, ramis arborum spinisque et tribulis lacerati vel imbribus infusi, tum etiam sanguine ferarum pelliumque volutabro fœdati remeabant. Tunc dixit Carolus: Nullus nostrum pellicium suum extrahat, donec cubitum eamus, ut in nobis ipsis melius sicari possit. Quo jussu singuli corpora magis quam indumenta curantes, usque quaque focos inquirere et calcificare studebant; ac mox reversi, et in ministerio ejus usque ad profundam noctem persistentes, ad mansiones remittebantur. Cumque tenuissimas pelliculas, vel tenuiores brandeas extrahere cœpissent, rugarum et contractionum rupturas quasi virgarum in ariditate fractarum procul audiri fecerunt, gementes et suspirantes conquerentesque se tantum pecuniæ sub una die perdidisse. Præceptum vero ab imperatore susceperant, ut in eisdem pellibus crastina die se illi præsentarent. Quod cum factum fuisset, et omnes non in novis resplenderent, sed potius pannis et decolori fœditate horrerent, dixit Carolus ad cubicularium suum: tene illud pellicium nostrum inter manus, et adfer in conspectum nos-

rial princesses, however, on holidays wore dresses ornamented with precious stones, gold, silver and silk, and also foreign furs; at any rate the princess Berta had a valuable mantle or tippet of ermine, which Alcuin calls *murina**.

Fur gloves were at that time usual also. The monks, at least, in winter wore gloves of sheep's skin, which were called *muffulæ*; whereas the summer gloves were named *wanti*.†

trum. Quo integerrimo et candidissimo allato, assumens illud inter manus, et cunctis adstantibus ostendens hæc pronunciavit: o stolidissimi mortalium, quod pellicium modo pretiosius et utilius est? Istudne meum uno solido comparatum, an illa vestra non solum libris sed et multis coempta talentis? Tunc vultibus in terram declinatissimam ejus animadversionem sustinere nequibant.—Whether *Notkerus Balbulus* was the author of this chronicle is not known, but there can be no doubt that it was written after the year 883 and before 887, as has been proved by Basnage. *Rock* also is one of the oldest words in the German language. *Diacedrinum*, orange-coloured. *Διακίτριον*, according to Simeon Sethi, is orange-peel preserved or seasoned with honey. *Litra*, border or hem. *Glîres* are certainly the *mures Pontici*. *Brandææ* or *brandea*, a girdle or belt. It appears to me to be clearly proved from this passage that the skin of the peacock was used for ornament; and therefore *pavontalis vestis* does not always signify cloth wove or painted so as to resemble the colours of the peacock. The people of all nations ornamented themselves with feathers till they became acquainted with dyeing. The art of those who prepared feathers was banished by that of the dyers.

* *Carmen de Carolo Magno*, in the new edition of the abbot Frobenius, 1777. fol. ii. p. 453. v. 225: *Lactea quippe ferunt pretiosam colla murinam*.

† At the council of Aix-la-Chapelle in 817, where the dress of the monks was defined, it was ordered: *abbas provideat, ut unusquisque monachorum habeat - - - wantos in æstate, muffulas in hieme*

In the Welsh laws of Hywel Dda, who reigned in the tenth century, the skin of an ox, a deer, a fox, a wolf, and an otter, are estimated at the same price, that is, eight times as dear as the skin of a sheep or a goat. The skin of a white weazle was eleven times as dear; that of a martin twenty-four times, and that of a beaver one hundred and twenty.*

In the year 1001, the emperor Otto III. sent an ambassador to Constantinople, whose attendants were clothed in costly furs.† Adam of Bremen, who lived in the same century, says, in his description of the countries bordering on Poland and Russia, that from these districts were procured those costly furs which were so eagerly purchased by the luxurious‡. When Godfrey of Bou-

vervecinas. See Sirmond's *Concil. Antiq. Galliaë*, Paris 1629. fol. i. p. 442. *Wantus* is still retained in the Netherlandish dialect, where *want* signifies a glove without fingers, having only a place for the thumb; perhaps it is the same word as *want*, *wand*, or *gewand*, which formerly denoted every kind of woollen cloth. Hence is derived the French word *gant*; for *gwantus* and *gantus* were formerly used instead of *wantus*. It is equally certain that *Muffula* is of German extraction; *mouw* at present in the Netherlandish signifies a sleeve. But at what time that covering into which both hands are thrust at present to secure them from the frost, and which according to the size now fashionable covers the whole body and is called a *muff*, I am not able to determine.

* *Leges Wallicæ*, ed. Wottoni. Londini. 1730. fol. p. 261.

† Landulphus senior, lib. ii. cap. 18, in Muratori *Rerum Italic.* tom. iv. Magno ducatu militum stipatus coram Græco imperatore stetit, quos pellibus martulinis, aut cibellinis, aut rhenonibus variis et hermellinis ornaverat.

‡ Adam Bremensis in Lindembrogii *Scriptores rerum Germanic.*

illon, in the year 1096, paid a visit to the emperor Alexius at Constantinople, what the latter chiefly admired was the rich and costly dresses of the Europeans bordered with furs.* In the beginning of the twelfth century, the canons of a cathedral suffered themselves to be corrupted by beautiful furs.† The use of them, however, was forbidden to the clergy at one of the councils. According to that of London, in 1127, the abbesses and nuns were to wear those only made of lamb-skins and cat-skins.‡ In the year 1187, when the Christians were beat near Tiberias, count Raimond having treacherously gone over to the Turks, the

p. 67. cap. 227: regio abundat pellibus peregrinis, quorum odor nostro orbi lætifera superbiæ venenum propinavit. Et illi quidem ut stercora hæc ad nostram forte habent damnationem, qui per fas nefasque ad vestem anhelamus marturinam, quasi ad summam beatitudinem. Itaque pro laneis indumentis, quæ nos dicimus paldones, illi offerunt tam preciosos martures. At that time, therefore, the Germans gave woollen cloths in exchange for furs. In page 68, he says: pelles castorum et marturum, quæ nos admiratione sui dementes faciunt.

* Albertus Aquensis, *Histor. Hierosol.* lib. ii. cap. 16. in *Gesta Dei per Francos*, i. p. 203: Imperator tam magnifico et honorifico duce viso, ejusque sequacibus, in splendore et ornatu preciosarum vestium, tam ex ostro quam aurifrigio, et in niveo opere harmelino et ex mardrino grisioque et vario, quibus Gallorum principes præcipue utuntur, vehementer admirans honorem et decorem illum, ducem osculo suscepit.

† Ivo Carn. *Epistolæ* 104: quos sibi pelliculis peregrinorum murium, atque aliis hujusmodi vanitatum aucupiis inescaverat.

‡ Canon 12: Statutum est, ut nulla abbatissa vel sanctimonialis carioribus utatur indumentis, quam agnibus vel cattinis.

latter found among the plunder of the Christian camp a complete assortment of furs.* At the end of the twelfth century Gottfried or Gaufred, prior of Vigeois, complained that no one would any longer wear sheep-skins and fox-skins, which before had been worn by barons and the principal clergy.†

We, however, find that princes sometimes endeavoured by the most effective means to restrain this magnificence. When Philip II of France, and Richard I of England, about the end of the twelfth century, undertook a crusade to the Holy Land, they resolved that neither of them should wear ermine, sable, or other costly furs.‡ It appears that a similar resolution was adopted by St. Louis (Louis IX) in the following century; for the historians speaking of his crusade expressly say, that he avoided all magnificence, and wore no costly furs.§ In the year 1336, in the reign of Edward

* Albertus Aquensis, viii. 20, *Gesta Dei per Francos*, i. p. 321: Sustulerunt Turci molles vestes, pelliceos varios, grisios, harmelinos, mardrinos, ostra innumerabilia auro texta.

† In Labbei Biblioth. nova, tom. ii: Barones tempore prisco munifici largitores vilibus utebantur pannis, adeo ut Eustorgius episcopus, vicecomes Lemovicensis et vicecomes Combornensis arietinis et vulpinis pellibus aliquoties uterentur, quas post illos mediocres deferre erubescunt.

‡ Whilhelmus Neubrigensis, or Wilh. Bach. lib. iii. cap. 22: Statutum est etiam - - - quod nullus vario vel grisio, vel sabcllinis vel escarletis utatur.

§ Whilhelmus de Nangis, p. 346: Ab illo tempore nunquam indutus est squarleto, vel panno viridi seu bruneto, nec pellibus variis,

III king of England, when foreign articles imported into the kingdom began to be taxed, it was enacted, that no person whose yearly income did not amount to a hundred pounds should wear furs, under the penalty of losing them.*

In Germany, in 1497, citizens who did not belong to the nobility or equestrian order were forbidden to wear lining of sable or ermine.† According to an ordinance of 1530, common citizens, tradesmen and shop-keepers were to wear no trimmed clothes, nor to use martin or other costly lining, and the rich were to wear lining made only of lamb-skins or those of the cow, fox, weasel, and the like. Merchants and tradespeople were not to wear martin, sable, or ermine, and at most weasel-skins; and their wives were to wear the fur only of the squirrel. Counts and lords were allowed all kinds of lining, sable and such like expensive kinds excepted.‡ The latter permission was repeated, word for word, in the year 1548.§

sed veste nigri coloris, vel camelini seu persei. *Gottfr. de Bello loco*, cap. 8. *Joinville Hist. de St. Louis*, p. 118 : C'est assavoir, que onques puis en ses habitz ne voulut porter ne menuver, ne gris, ne escarlate, ne estriesz, ne eperons dorez. *Histoire de St. Louis*, Paris 1688. 4to. p. 460.

* Barrington's Observations on the more ancient statutes. The third edit. Lond. 1769. 4to. p. 216.

† Reichsabschied zu Lindau. 1497. § 11. in *Samlung der Reichsabschiede*. Franckfort 1747. fol. ii. p. 31.

‡ Reformation guter Polizey zu Augsburg, 1530. § xi. 1. xii. 2. xiv. 4. in the same, p. 337, 338.

§ Ibid. 1548. § xiii. 3. in the same, p. 594.

When one considers how much the use of fur dresses was spread all over Europe, it must excite astonishment that they were not introduced at the court of Byzantium. No traces of them are to be found in any of the Byzantine historians; not even in that work in which the emperor Constantine describes the whole ceremonial of his court, and in which dresses of various kinds are named, as Reiske has already remarked.* Furs are nowhere represented on Grecian statues, in paintings, or other works of art; and it is seen by the passages above quoted, that in the magnificence which the European princes displayed in the time of the crusades at the court of Constantinople, nothing attracted so much attention as the different kinds of fur dresses. This seems the more astonishing, as a great trade was carried on, at that time, between Constantinople and those countries from which these wares were sent to Europe.

Over one of the gates of Milan is an image cut out in stone, of the twelfth century, representing an emperor, whose mantle is ornamented with small triangular patches of fur. Flamma believed that this carving was intended to represent one of the Greek emperors; but Giulini justly remarks, in opposition to this opinion, that furs never occur in any of the Greek sculpture. Be-

* Constantini libri de Ceremoniis aulæ Byzantinæ. Lipsiæ 1754. fol. ii. comment. p. 144.

sides, that image was evidently formed to ridicule the emperor, as is proved by the hideous monster seated close to him. But at that time the Milanese certainly had no cause to offend the Greek emperor, with whom they were in alliance; and Giulini has proved, in a very satisfactory manner, that the Milanese erected this image to ridicule the emperor Frederick I, who was their bitterest enemy.* On another image at Milan cut out in stone, of the thirteenth century, which represents the emperor of Germany on his throne, surrounded by the electors, the latter have small mantles which are ornamented with triangular patches of fur of the same kind.†

S T E E L.

STEEL is the same metal as iron, but it has some remarkable properties by which it is distinguished from common iron. It possesses such a superior degree of hardness, that it is capable of filing the latter; it strikes fire with vitreous stones, and scratches the hardest glass; it is heavier, has a stronger sound, exhibits on the fracture a finer

* Memorie della città di Milano, raccolte dal conte Georg. Giulini. In Milano, 4to. vi. p. 407. For this information I am indebted to my friend professor Fiorillo.

† Ibid. P. viii. p. 443.

grain, assumes a bright white splendour when polished, is susceptible of greater elasticity; becomes more slowly magnetic, but retains that power longer; does not so easily acquire rust; when ignited gives fewer sparks: in the fire it assumes various strong tints, and when heated is speedily cooled in cold water, but is then harder, more brittle, and less pliable. In consequence of these qualities it is fit for many uses to which common iron either cannot be applied, or is less proper. In regard, however, to what essentially renders iron steel, we are altogether ignorant. Those who, without prejudice, can acknowledge the truth, must say that we do not know, with certainty, whether the conversion into steel is effected by the iron being condensed, or by the loss or addition of a component part, or whether this part be carbon, caloric, manganese, molybdæna, or something else. Many opinions have been formed on this subject, and one new one gives place to another.

It is nevertheless certain, that the invention of steel is of very great antiquity. In the Old Testament, however, the mention of it is very doubtful, according to professor Tychsen, whose remarks on this subject I subjoin, with his permission, in a note below; * but it appears that it was used so

* In regard to the hardening of iron and the quenching of it in water, nothing, as far as I know, occurs in the Hebrew text of the Scriptures. The passages where it seems to be mentioned are, Isaiah, chap. xlv. ver. 12. The smith bends the iron, works it in a fire of

early as the time of Homer, and that the Greeks gave to it different names, one of the most common of which was *stomoma*, though it seems certain that this word did not so much denote steel itself as the steeled part of an instrument, or the

coals, and forms it with the hammer; he labours on it with a strong arm, &c. according to the translation of Michaelis. It may indeed be translated otherwise, but it certainly alludes to the formation of an image of metal. The words, chap. liv. ver. 16, are still more general.

Iron, *barzel*, often occurs, and in some passages indeed steel may be understood under this name. For example, in Ezekiel, chap. xxvii. ver. 19, *ferrum fabri factum*, or, according to Michaelis and others, sabre blades from Usal (Sanaa in Yemen). A pretty clear indication of steel is given in Jeremiah, chap. xv. ver. 12: Iron from the North, which is described there as the hardest. To the north of Judæa was situated Chalybia, the ancient country of steel. It appears that the Hebrews had no particular name for steel, which they perhaps comprehended under the term *barzel*, or distinguished it only by the epithet Northern, especially as the later Jews have for it no other name than *אסטמא*, *istoma*, which however is nothing else than the Greek *στομωμα*, and signifies rather steeling or hardening. In Buxtorf's Chaldaic Lexicon the word *כרכומא*, *carcoma*, is explained by *chalybs*, but this is merely a mistake. The word in all the places there quoted means *æs*, *χαλκος*, and is itself the Greek *χαλκωμα*, with the usual conversion of the *l* into *r*.

Chalamisch is certainly a hard kind of stone; granite or porphyry, according to Michaelis, who treats expressly of it in *Supplem. ad Lex. Hebr.* N. 740. [The latter refers to the following passage in *Hieron. Magii Miscellanea*, lib. ii. cap. 8. ed. Venet. 1564. 8vo. p. 88. b. Hebreis *στομωμα* dicitur *חלמוש*, *chalamisk*, ut fuit pridem adnotatum a Francisco Forrerio, Ulyssoponensi theologo, in *Commentariis in Jesaiam*, cap. 50, cujus vocis etymon esse dicit a verbo *חלש*, *chalasc*, inserta litera *mem*, id est, domuit cum omnia domet sua duritie. Quamquam video Hebræos quadratum nomen esse dixisse, cujus radix sit *חלמש* *chalamasc*.]

operation of steeling.* The name *chalybs* was given to steel from the Chalybes, a people on the southern shore of the Pontus Euxinus, between Colchis and Paphlagonia, who had considerable mines, and in particular iron and steel works; though others, on the contrary, derive the name of the people from the principal article of their commerce.† This derivation appears the more probable, as Justin says that a river of Spain, on which there were steel works, was named *Chalybs*, but at a much later period. Some also have ascribed to the *Chalybes* the invention of iron, which however is much older. ‡

But it seems to be less known that *adamus* also at first denoted steel. This is expressly said by Hesychius, and many epithets derived from *adamus* are applied to articles made of steel or of iron. Among these may be mentioned the helmet of

* On this account we often read σιδηρου στομωμα. To steel was called στομωσαι. *Pollux*, v. 3. § 21: εστομωσθαι την ακμην, aciere aciem. In Pliny the expression is, aciem indurare; densare incudes et malleorum rostra; ferrum temperare. In *Dioscorides and Actius*, x. 11, λεπισ του στομωματος σιδηρου is undoubtedly what the Germans call *gluhspar* or *hammerschlag*, that is to say, those scaly particles which fly off from the ignited metal during the preparation of steel. Pliny, however, xxxiv. 11, seems to have used στομωμα to denote also copper filings; but not through a mistake, as Salmasius thinks, since the same signification of it occurs in the medical writers quoted by Hardouin, *Oribas.* xiii. p. 233, and *Celsus*, vi. 6, in collyrio Clconis.

† The proofs I have already quoted in *Aristot. Auscult. mirab.* cap. 49. p. 94.

‡ The phrase χαλυβεινον, or χαλυβεινον στομωμα, it is well known, occurs often in *Pollux* and others.

Hercules, in Hesiod,* and the so called adamantine chains, gates, and bars of the poets, which in dictionaries are always explained as consisting of precious stones.

It was not till a late period that this word was applied to the most costly of all the precious stones. In this sense it occurs neither in Homer, Hesiod, Herodotus, Orpheus, nor Dioscorides, though the first of these writers often describes various kinds of valuable ornaments. Gouget and others thence conclude, that the diamond was not then known.† At present, I cannot enter into the history of this stone; but I must own, that I consider the knowledge of it to be older, and suspect that it was first introduced under another name, and is mentioned by Orpheus and some others under that of jasper (jaspis). This poet compares his jaspis to rock crystal, and says, that it kindles fire ‡ in the

* Scutum Herculis. x. 137. See also the annotations of the scholiast.

† Gouget *Geschichte der Gesetze, Künste* ii. p. 103. *Plinius*, xxxvii. sect. 15. p. 772: *adamas diu non nisi regibus, et iis admodum paucis cognitum.*

‡ Ἦυτε περ κρυσταλλος, ανευ πυρος εκ φλογα περπεις.

Orphei Argonaut. &c. Traject. ad Rhen. 1689. p. 207.

Speaking of crystal the same author says, p. 198,

Ει γαρ ατερ κρατεροιο θελεις πυρος ες φλογας ορσαι,
 Κεκλομαι αναλων μιν υπερ δαιδων καταθειναι,
 Αυταρ ογ' ηελιοιο καταντιον αυγαζοντος
 Αυτιχ' υπερ δαιδων ολιγην ακτινα τανυσσει.
 Ἦδ' οτε καρφαλης τε Σιγη και πιονος υλης
 Καπνον, επειτα δε πυρ ολιγον, μετα δε φλογα πολλην
 Ορσει.

same manner. That he knew how to use rock crystal as a burning-glass, he expressly tells us himself; but he certainly could not procure a diamond of such a size as to be able to burn with it. From its vitreous nature, however, he conjectured, and very properly, that it might be employed for that purpose. He calls the jaspis transparent, compares it to glass, and says that it had that sky colour which at present is named *color hyalinus*. This is probably the reason why Dioscorides and others call some kinds of jasper transparent and sky-coloured. The jaspis in the Revelation of St. John,* described as a costly transparent crystalline kind of stone, was perhaps our diamond, which afterwards was every where distinguished by that name.†

* Chap. xxi. ver. 11, 18, 19.

† As I have here ventured to touch upon the different meanings of the word *adamas*, I shall add what follows. It signified also something, I know not what, found along with or among gold ore, or which occurred in smelting it. See a remarkable passage in the *Timæus* of Plato, according to the Franckfort edition of 1602, fol. p. 1066; and in his *Politica*, p. 558; also *Pollux*, vii. § 99. Those who wish for an explanation may consult, if they can use it, what Salmasius says on Solinus, p. 763 and 773. The magnet also, which is indeed an iron-stone, has sometimes been named *adamas*. See *Menage, Diction. etymolog.* I do not know whether Gilbert has assigned the right cause for this appellation, in his scarce book *De magnete, Londini* 1600, fol. lib. iii. cap. 13. p. 143: *Adamas aliquando sideritis (magnetis) nomine insignitur, non quod ferreus sit, aut quia ferrum ducit, sed propter splendorem ferro micanti similem, quali præstantissimi adamantes refulgent. Hinc multa imputantur adamanti a plurimis, quæ revera sideriti magneti competunt.*

The Romans borrowed from the Greeks the word *chalybs*; and in consequence of a passage in Pliny,* many believe that they gave also to steel the name of *acies*, from which the Italians made their *acciajo*, and the French their *acier*. The word *acies*, however, denoted properly the steeled or cutting part, only of an instrument.† From this, in later times, was formed *aciarium*, for the steel

* Lib. xxxiv. sect. 41. p. 666: *Stricturæ vocantur hæ omnes, quod non in aliis metallis a stringenda acie vocabulo imposito. Et fornacum maxima differentia est; nucleus quidem ferri excoquitur in his ad indurandam aciem; aliquæ modo ad densandas incudes, malleorumve rostra.* According to my opinion, *stricturæ* was the name given to pieces of steel completely manufactured and brought to that state which rendered them fit for commerce. At present, steel comes from Biscay in cakes, from other places in bars, and both these formerly were called *stricturæ*, because they were employed chiefly for giving sharpness to instruments or tools, that is, for steeling them. In speaking of other metals, Pliny says that the finished productions at the works were not called *stricturæ* (this was the case, for example, with copper), though sharpness could be given to instruments with other metals also. The words of Pliny last quoted are read different ways, and still remain obscure. I conjecture that he meant to say that some steel works produced things which were entirely of steel, and that others were employed only in steeling. I shall here remark that the *stricturæ ferri* remind us of the *strigiles auri*: such was the name given to native pieces of gold, which without being smelted were used in commerce. *Plin. xxxiii. 3. p. 616.*

† This has been already said by H. Stephanus in *Hypomneses de Gallica lingua*, 1582. 8vo. p. 152: voce *acier*, quam ex Latina *acies* fecerunt (facta a Græco ακις) permiserunt sibi pro chalybe uti, quod *acies*, id est cuspis, ex chalybe fieri soleret; et ita ei quod cuspidis materia erat, nomen dederunt, quo ipsa cuspis a Latinis vocabatur. See also *Salmasii Epistolæ*. Lugd. Bat. 1656. 4to. p. 97.

which gave the instrument its sharpness, and also *aciare* to steel.*

At present there are two methods of making steel; the first of which is by fusion either from iron-stone or raw iron, and the second by cementation. I have never found in the works of the ancients any traces of steel prepared by cementation; nor am I acquainted with the antiquity of that process, though the ancients, without knowing it, employed it for brass. Spielman says, † that Pliny in one part calls it *tostio*; but this word occurs neither in Pliny nor in any ancient writer. It is, however, possible that the word *torrere* may somewhere signify cementation, but I have not yet met with an instance of it.

The preparation, however, by fusion, as practised by the Chalybes, has been twice described by Aristotle; but as I have already given in another work ‡ every thing I was able to collect towards an explanation of these passages, I shall not here repeat it. I shall only remark, that the steel of the ancients, in consequence of not being cemented, suffered itself to be hammered, and was not nearly so brittle as the hardest with which we are acquainted at present.

On the other hand, the singular method of pre-

* See Vossii Etymol. and *Martinii Lex. Philolog.*

† *Institut. chimiæ*, p. 252. He refers to lib. xxxiii. cap. 4.

‡ In my observations on *Aristot. Auscult. mirab.* cap. 49, p. 94. *Aristot. Meteorolog.* iv. 6.

paring steel employed by the Celtiberians, in Spain, deserves to be here described. According to the account of Diodorus* and Plutarch,† the iron was buried in the earth, and left in that situation till the greater part of it was converted into rust. What remained, without being oxydated, was afterwards forged and made into weapons, and particularly swords, with which they could cut asunder bones, shields, and helmets. However improbable this may appear, it is nevertheless the process still used in Japan; and Swedenborg has introduced it among the different methods of making steel.‡ Those who consider steel only as

* Celtiberes arma et tela singulari quodam modo conficiunt. Laminas enim ferri sub terra absconditas, tam diu jacere sinunt dum ferri parte debiliori ferrugine ambesa, validior supersit. Hinc gladios eximios aliaque belli instrumenta fabricantur. Armis hoc modo elaboratis, adeo quævis subjecta dissecantur, ut nec clypeus nec galea nec os (tanta ferri præstantia est) ietum sufferre queat. *Diodor. Siculus*, lib. v. cap. 33. p. 356. ed. Wessel.

† Sicut Celtiberes ferro aciem soliditatemque parant, eo in terram defosso crassas terrestresque partes expurgando, ita Laconica oratio. *Plutarchus de Garrulitat.* edit. Francof. 1620, fol. ii. p. 510. --- Suidas also speaks of this excellent steel under the word *μαχαίρο*. vol. ii. p. 510.

‡ De ferro, i. p. 194: In itinerariis referunt aliqui de Japonensibus, quod ferrum suum in contos excusum locis palustribus immergant, et ibi tam diu relinquant, dum ad multam partem ferrugine sit consumptum, exemptum dein e novo exsudant, et iterum in palude per spatium 8 vel 10 annorum recondant, usque dum iterum in aqua paludinea salsa admodum exesum sit; pars ferri quæ restat, speciem chalybis referre perhibetur, exinde dein vomeres fabricant; exque ferro sic rubiginoso instrumenta sua et utensilia conficiunt. See also *Watson's Chemical Essays*, Cambridge 1781. 8vo. i. p. 220.

the most perfect kind of iron, may perhaps think, with Plutarch, that the softer and more ignoble part of the metal is first converted into rust, and that the better part of the whole mass is thus separated from the rest. Without entering into a further discussion of this subject, I shall only mention an observation, made a few years ago. In digging up the floor of a cellar, in an old house near Gottingen, there was found an anvil, which had lain under the damp earth for many years. It still retained its original form and size; but was become so soft that it could be easily crumbled to pieces. When broken, there were seen, every where on the fracture, exceedingly white grains with a metallic brightness, which resembled polished steel, and were attracted by the magnet, consequently had not yet been converted into rust.

The art of hardening steel by immersing it suddenly, when red hot, in cold water, is very old.*

Of the iron works in Japan I know nothing further than what has been said by Thunberg in his *Reise*, ii. 2. p. 102 and 83. That country possesses very little of this metal; but the sabres made there are incomparable: without hurting the edge one can easily cut through a nail with them; and, as the Japanese say, cleave asunder a man at one blow. These sabres are often sold for fifty, seventy, and even a hundred dollars.

* Lord Bacon seems not to have been of this opinion; for in his *Silva silvarum*, cent. i. § 86, he says: Experimentum indurationis per frigus hodie inventum est; metalla scilicet repetita ex calefactione et extinctione in frigido indurescere. But this method of hardening was usual in the eleventh or twelfth century; for it is described by *Theophilus Presbyter*, lib. iii. cap. 19.

Homer says, that when Ulysses bored out the eye of Polyphemus with a burning stake, it hissed in the same manner as water when the smith immerses in it a piece of red-hot iron, in order to harden it.* Sophocles uses the comparison of being hardened like immersed iron; † and Salmasius ‡ quotes a work of an old Greek chemist, who treats on the method of hardening iron in India. It is also a very ancient opinion, that the hardening depends chiefly on the nature of the water. Many rivers and wells were, therefore, in great reputation; so that steel works were often erected near them, though at a considerable distance from the mines. Instances of this may be found in Pliny § and in Justin. || The more deli-

* 'Ως δ' οτ' αυηρ χαλκευς πελεκυν μεγαλ, ηε σκεπαρον,
 Εν ἕδατι ψυχρω βαπτει μεγαλα ιαχοντα,
 Φαρμασων, (το γαρ αυτε σιδηρου τε κρατος εστιν.)

Veluti eum faber securim magnam aut asciam
 In aqua frigida mergit valde stridentem,
 Temperans, (nam hinc ferrum accipit duritiem).

Odys. ix. 391.

† Βαφη σιδηρος ως. *Ajax*, 720.

‡ Exereitat. Plin. p. 763: περι βαφης Ινδικου σιδηρου. I do not find this work mentioned in *Fabricii Biblioth. Græca*.

§ Lib. xxxiv. 14. p. 666: Summa differentia in aqua est, cui subinde candens immergitur. Hæc alibi atque alibi utilior nobilitavit loca gloria ferri, sicut Bilbilin in Hispania et Turiassonem, Comum in Italia, cum ferraria metalla in his locis non sint - - - Tenuiora ferramenta oleo restingui mos est, ne aqua in fragilitatem durentur.

|| Lib. xlv. 4. p. 620: Præcipua his quidem ferri materia, sed aqua ipso ferro violentior; quippe temperamento ejus ferrum acius redditur; nec ullum apud eos telum probatur, quod non aut Bilbili

cate articles of iron were not quenched in water but in oil.

An opinion, it is well known, has prevailed to the present time, that there are various fluids and mixtures of them which communicate to steel different degrees of hardness, and every artist thinks he knows a peculiar hardening kind of water, the preparation of which he keeps as a secret. This opinion is still maintained; because there are often found stones cut by the ancients, which the moderns, on account of their hardness, as is believed, have seldom ventured to touch. Of this kind is the hardest porphyry. People, therefore, still endeavour to find out that hardening kind of water, in which the ancients prepared their tools for cutting such stones. According to Vasari,* who, as far as I know, is the first by whom this circumstance is mentioned, that water was actually discovered by the archduke Cosmo, in the year 1555. Among a large collection of stones he had a block of porphyry, from which he wished a bason to be made for a well, but was told by the most experi-

fluvio, aut Chalybe tinguatur. Unde etiam Chalybes fluvii hujus finitimi appellati, ferroque ceteris præstare dicuntur.

* *Le Vite de pittori*. In Bologna 1681. 4to. i. p. 11: Per agevolar' al maestro il modo di lavorar' il profido, fece di non sò che herbe stillar' un' acqua di tanta virtù que spegnendovi dentro i ferri bollenti fà loro una tempera durissima. The same account is given by Felibien in *Principes de l'Architecture*, Paris 1677, 4to. p. 51. But what is quoted from *Sandrar's Malerakademie* in *Blainville's Reisen*, Lemgo 1767, 4to. vol. v. p. 308, is incorrect in regard to the name, date, and other circumstances.

enced artists that it was impossible. On this, says Vasari, in order to render the work possible, he prepared from certain herbs, which he does not name, a water wherein the red-hot tools were quenched, and by these means so hardened, that they were capable of cutting porphyry. With tools tempered in this manner the artist Francesco del Tadda not only made the required bason, but various other curious articles.*

Winkelman,† therefore, does injustice to Vasari when he says, "Vasari, in pretending that Cosmo archduke of Tuscany discovered a water for making porphyry soft, betrays childish credulity." But with all due respect for the learning of this celebrated man, it must be confessed that he was unacquainted with chemistry; had not this been the case, he would have avoided many mistakes, and determined many points on a much better foundation. Here, however, he very properly asserts that there is no water of such a quality as to soften porphyry; though Porta,‡ and many old writers, imagined that they were ac-

* Some account of this artist is given in *J. C. Bulengeri de pictura*, lib. ii. cap. 7, in *Gronovii Thesaurus antiq. Græc.* ix. p. 875: F. de Tadda Florentinus primus est ausus duritiem lapidis porphyretici nostro ævo vincere sub Cosmo Medicis I. On the other hand Leon. Christ. Sturm says, in that part of the *Ritterplatzes* which relates to architecture, p. 18: An archduke at Florence discovered again the art of working porphyry, but suffered it to die with him in the year 1556.

† *Geschichte der Kunst.* Wien. 1776. 4to. p. 522.

‡ *Magia naturalis.* Francof. 1591. 8vo. xiii. 7. p. 497.

quainted with one capable of producing on that stone, which they considered as a species of marble, the same effects as an acid does on the latter. But Vasari says nothing of the kind.

After Tadda's death, the art of cutting porphyry came to Raphael Curradi, who communicated to Dominico Corsi this secret, which was afterwards employed by Cosimo Silvestrini.* I, however, agree in opinion with Winkelman and Fiorillo, our learned connoisseur in the arts, that the method of working porphyry was known in every age, and even in the most barbarous, though artists, no doubt, preferred working on other stones which were less brittle and hard. In a word, we know from the latest researches, that all the kinds of hardening water, hitherto invented, are in nothing superior to common water; and that in hardening more depends on the nature of the steel, or rather on the degree of heat, than on the water; although it is true that the workman does right when he adds to the water a thin cake of grease, or pours over it hot oil, through which the steel must necessarily pass before it enters the water, for by these means it is prevented from acquiring cracks and flaws.

The invention of converting bar iron into steel by dipping it into other fused iron, and suffering it to remain there several hours, is commonly

* Fiorillo *Geschichte der zeichnenden künste* 1798. 8vo. i. p. 461.

ascribed to Reaumur.* But this process is mentioned by Agricola,† Imperati,‡ and others, as a thing well known and practised in their time.

Pliny, § Daimachus, || and other ancient writers mention various countries and places which, in their time, produced excellent steel. Among the dearest kinds were the *ferrum Indicum* and *Sericum*. The former appears to be the *ferrum candidum*, a hundred talents of which were given, as a present, to Alexander in India.¶ Is it not probable that this was that excellent kind of steel still common in that country, and known under the name of *wootz*, some pieces of which were sent from Bombay in the year 1795 to the Royal Society of London? Its silver-coloured appearance

* Art de convertir le fer en acier, p. 245.

† Agricola de re Metallica. Basilæ 1561. fol. lib. ix. p. 342.

‡ Historia natur. Coloniae 1695. 4to. xv. 27. p. 499. xviii. 18. p. 581.

§ Page 667: Ex omnibus generibus palma Serico ferro est. Seres hoc cum vestibus suis pellibusque mittunt. Secunda Parthico.

|| Stephanus de urbibus, under the word *Λακεδαιμων*, p. 413: *Λακονικον σιδηρον στομωματων γαρ το μεν Χαλυβδικον* - - - *Laconicum ferramentum*; *acierum enim alia est Chalybdica, alia Sinopica, alia Lydia, alia Laconica. Sinopica vero et Chalybdica ad fabrilia, Laconica ad limas, et ferrea terebra, et eharacteres, et ad omnia instrumenta quibus lapides elaborant. Lydia quoque ad limas et machæras et novaculas et scalpra, ut inquit Daimachus in Commentariis polioreeticis.* These words have been quoted by Eustathius on the second book of the Iliad.

¶ See the authors already quoted in a note to the article on tin. *Clemens Alexandr. in Pedagog.* ii. p. 161, according to the edition of Cologne, 1688, fol. and to that of Wirzburg, p. 395, says, speaking of luxury: One can cut meat without having Indian iron.

when polished may have, perhaps, given occasion to the epithet of *candidum*. The method of preparing it is still unknown; but it is supposed to be a kind of fused steel.* This, however, is a mere conjecture unsupported by any proofs - - - At what time was damasked steel obtained from the Levant?

STAMPING-WORKS. †

IN order to separate metallic ores from the barren rock or stones with which they are combined, and to promote the fusion of them, it is necessary that the pieces of rock or stone should be reduced to small fragments, by stamping them, for which the German miners use the term *pochen* or *puchen*. For those ores which occur in a sandy form, this is unnecessary; and in regard to rich silver ore, which contains very little or no lead and other metals, this process might be hurtful; for with dry stamping a great deal would fly off in dust, and

* Philos. Transact. 1795. ii. p. 322; and thence copied into Voigt's *Magazin für Naturkunde*, i. p. 64.

† I shall refer those desirous of being acquainted with the nature of this labour, to *Gatterer's Anleitung den Harz zu bereisen*. Gottingen 1785. 8vo. i. p. 101. Figures of the stamping-works may be seen in *Calvör's Maschinenwesen des Oberharzes*, ii. p. 79; and in *Delius' Anleitung zur Bergbaukunst*. Wien. 1773. 4to. p. 426.

with wet stamping a considerable part would be washed away by the water.

However imperfect the knowledge of the ancients may have been in regard to the fusion of ores, they were acquainted with the benefit of stamping; but the means they employed for that purpose were the most inconvenient and expensive. They reduced the ore to coarse powder, by pounding it in mortars; and then ground it in hand-mills, like those used for corn, till it acquired such a degree of fineness that it could be easily washed. This is proved by the scanty information which we find in Diodorus Siculus* and Agatharcides, † in regard to the gold mines of the Egyptians; in Hippocrates, respecting the smelting-works of the Greeks, ‡ and in Pliny in regard to the metallurgy

* Diodor. iii. 13. p. 182: Οι δ' ὑπερ ετη τριακοντα παρα τουτων λαμβαναιτες ὤρισμενον μετρον του λατομηματος, εφ ὀλμοις λιθινοις τυπτουσι σιδηροις ὑπεροις, αχρὶς αν οροβου το μεγαθος κατεργασωνται. παρα δε τουτων την οραβιτην λιθον αι γυναικες και οι πρεσβυτεροι των ανδρων εκδεχονται, και μυλων εξης πλειωνων εντων επι τουτους επιβαλλουσι, και παρασταντες ατα τρις η δυο προς την κωπην αληθουσιν, ες σεμιδαλεως τροπον το δοθεν μετρον κατεργαζομενοι. Viri trigesimum annum excedentes, certam lapidis cruti mensuram ab illis acceptam, in mortariis saxeis, ferreis pilis contundunt, donec ad ervi magnitudinem sit redacta. Ab his deinceps feminae virique grandiores lapillos excipiunt, et in molas, quarum longa illic series, congerunt, binique aut terni uni adsistentes paviculæ, eo usque molunt, dum traditam sibi mensuram ad similæ modum contriverint.

† Photii Biblioth. p. 1342; where the same thing is related nearly in the same words.

‡ Hippocrates de Victus rat. lib. i. edit. Wechel. 1595. fol. sect. 4. p. 13. Χρυσιον εργαζονται, κοπτουσι, πλυνουσι, τηκουσι πυρι. Qui aurum perficiunt, tundunt, lavant, liquant igne.

of the Romans.* Remains of such mortars and mills as were used by the ancients, have been found in places where they carried on metallurgic operations; for instance, in Transylvania,† and the Pyrenees. The hand-mills had a resemblance to our mustard-mills;‡ and for washing the mud they employed a sieve,§ but in washing auriferous sand they made use of a raw hide. From the latter, Count von Veltheim has explained, in a very ingenious manner, the fable of the ancients concerning the ants which dug up gold.||

* Plin. xxxiii. 4. sect. 21. p. 617: Quod effossum est, tunditur, lavatur, uritur, molitur in farinam, ac pilis cudunt.

† Köleseri de Keres-ecr Auraria Romano-Dacica. Cibinii 1717. 8vo. p. 76. Vidi Abrudbanyæ in valle Corna tale mortarium metallicum, supra fundum, aliquot digitis transversalibus perforatum, fundo crassiore et prominente. Of this scarce book, a new edition has been published at Ofen, by J. Seiffert.

‡ *Traité de la fonte des mines par le feu du charbon de terre*, par M. de Gensane. Paris 1770. 2 vol. 4to. i. p. 14. Speaking of the works of the ancients, the author says: On voit par quelques restes de leurs lavains, qu'ils commençoient par faire rougir leur mineral; ils le concassoient ensuite sous des marteaux applatis, après quoi ils le faisoient passer par des moulins à bras tout-à-fait semblable a nos moulins à moutarde, ou aux moulins dont on fait usage pour séparer l'argent de quelques mines par le voie de mercure. J'ai vu un nombre de ces meules aux Pyrénées, et j'en conserve deux très-entieres, du nombre de celles que nous y avons trouvées.

§ Besides the passages already quoted, see Pollux, *Onomast.* x. sect. 149. p. 1332, and vii. sect. 97. p. 757.

|| *Von den goldgrabenden Ameisen und Greiffen der Alten eine Vermuthung von A. F. Grafen von Veltheim. Helmstadt 1799.*

Our works for pounding ore, at present, are stamping-mills, which consist of heavy stampers, shod with iron. These stampers are put in motion by a cylinder furnished with cogs, which is driven by a water-wheel, and pound the ore in troughs lined with iron. When the ore subjected to this operation is poor, water is introduced into the troughs, which running through grates in the bottoms of them, carries with it the pounded matter into a gutter, where it becomes purified, and deposits the mud mixed with sand.

One might conjecture that this apparatus was invented soon after the invention of cylinders with cogs; but this was not the case, though I am not able to determine the antiquity of these cylinders. At any rate, it is certain that mortars and sieves were used in Germany, throughout the whole of the fifteenth century, and in France, to which the art of mining was conveyed in general from that country at a late period, they were still employed about the year 1579.* In the oldest times men

2 sheets 8vo. This dissertation may be found also in a valuable collection of different pieces by the same author, printed at Helmstadt, 1800. 8vo. ii. p. 263.

* This I prove by the book of François Garrault, printed at Paris 1579. 8vo. entitled: *Des mines d'argent trouvées en France*, where mention is made only of mortars, mills, and sieves. This Garrault is the first French writer on mining. His work, which is scarce, was printed by Gobet in the first part of the *Anciens mineralogistes de France*, Paris 1779. 8vo, where the passage occurs, i. p. 49.

were not acquainted with the art of employing water at mines, in so advantageous a manner as at present. The bellows were worked by men;* and those aqueducts raised on posts, by which distant water may be made to act on machines, was not yet invented. On this account, remains of ore are found in places where the moderns, in consequence of that indispensable article, water, would not be able to maintain metallurgic works.† According to the researches which I have hitherto had an opportunity to make, our stamping-mills were invented about the beginning of the sixteenth century, and, as appears, in Germany; but I cannot determine with certainty either the name of the inventor or his country. Those who established or introduced the first stamping-works in Saxony and the Harze are only mentioned; and these, as usual, have been considered as the inventors.

In the year 1519, the process of sifting and wet stamping were established in Joachimsthal by Paul Grommestetter, a native of Swarz, named on that account the Schwarzer, whom Melzer praises as an ingenious and active washer; and

* See the history of the bellows, in vol. i. p. 103.

† At the Nertschinski works in Siberia, the machinery must be still driven by men or cattle, because all the dams and sluices are destroyed by the frost, and the water converted into ice. Some of the works there, however, have machinery driven by water during the few summer months. See *Georgi Beschreibung des Russischen Reichs*. Königsberg 1798. 8vo. iii. p. 396.

we are told that he had before introduced the same improvements at Schneeberg. Soon after, that is in 1521, a large stamping-work was erected at Joachimsthal, and the process of washing was begun. A considerable saving was thus made, as a great many metallic particles were before left in the washen sand, which was either thrown away or used as mortar for building.* In the year 1525, Hans Pörtner employed, at Schlackenwalde, the wet method of stamping; whereas before that period the ore there was ground.†

In the Harze this invention was introduced at Wildenmann, by Peter Philip, who was assayer there, soon after the works at the Upper Harze were resumed, by Duke Henry the younger, about the year 1524. This we learn from the papers of Herdan Hacke, or Hæcke, who was preacher at Wildenmann in 1572. As far as can be concluded from his imperfect information, the first stamping-work there consisted only of a stamper raised by means of two levers, fixed to the axis of a wheel. The pounded ore was then thrown into a sieve, called in German the *sachs*, ‡ and freed

* Albinus in *Meisnische Bergk-Chronica*. Dresden 1590. fol. p. 75 and 76. *Mathesius* in *Joachimscher Chronik*. *Melzer* in *Bergkläuftiger Beschreibung von Schneebergk*. 1684. 4to. p. 645.

† *Beschreibung des Fichtelberges*, Leipsic 1716. 4to. p. 296.

‡ *Sachs* or *sax* in old times denoted a cutting or stabbing instrument, such for example as *schaar-sachs*, a razor; *schreib-sachs*, a pen-knife. See *Fritschs Wörterbuch*, who derives *sachs* from *secare*. May not the word σαλαξ, which in *Pollux* means the sieve used at

from the coarser parts. But as this stamping was performed in the dry manner, it produced so much dust, that the labourers were impeded by it, and the ore on that account could not be properly smelted. The business, however, was not given up; new improvements were made, and soon after Simon Krug and Nicholas Klerer introduced the wet method, and fortunately brought it to perfection.*

It is said in several modern works that wet stamping was invented in 1505, by a Saxon nobleman, named von Maltitz. This assertion has been so often repeated, that it was known to Gobet,† who adopted it as truth. I have not, however, been able to find the historian on whose testimony it is founded; but it appears by Gauhen's Dictionary of Nobility that Sigismund Maltitz was chief surveyor of forests, at the Erzgebürge, to the electorate of Saxony, in the sixteenth century.

smelting-works, be of the same origin? I conjecture also that the coulter of the plow which cuts the earth in a perpendicular direction had the name of *sech*, and that the words *säge* and *sichel* have an affinity to it. If this derivation be right, the High but not the Low German must have of *sachs* made *sech*. The latter would have said *sas* or *ses*, as it says instead of *sechs*, *ses*; instead of *wachs*, *was*; instead of *flachs*, *flas*; and instead of *fuchs*, *fos*. *Sech* is named also *kolter*, as in the Netherlands *kouter*, which words have arisen no doubt from *culter*.

* Calvör Maschinenwesen, ii. p. 74. *Honemann Alterthümer des Harzes*. Clausthal 1754. 4to. ii. p. 115.

† Anciens mineralogistes de France, i. p. 225.

KITCHEN VEGETABLES.

THE greater part of our kitchen vegetables, that is to say, those plants which, independently of the corn kinds, are cultivated as food in our gardens, are partly indigenous and partly foreign. Of the former many at present grow wild, such as asparagus; but by continued cultivation, through a long series of years, they have produced numerous varieties, which differ as much from the wild plants as the European females from those of New Zealand. Many of our indigenous vegetables are collected for food, but are not reared expressly for that purpose; and these even, in all probability, might be improved by culture. Some indeed are here and there reared in an artificial manner, though we reckon them among our weeds; for example, dandelion, *Leontodon taraxacum*, the first leaves of which in spring are employed in the northern countries as salad. In some parts of England this plant is sown throughout the whole summer; and its leaves being blanched, it is used in winter as endive. Culture frees many plants from their harsh taste, makes them tender, larger, and more pulpy, and produces them at a season when the wild ones have become unfit for use.

Our foreign kitchen vegetables have, for the most part, been procured from the southern coun-

tries, but chiefly from Italy; and the number of them has increased, in an uncommon degree, in the course of the last two centuries. Many of them require laborious attention to make them thrive in our severe climate. On the other hand, some grow so readily, and increase so much without culture, even in the open fields, that they have become like indigenous weeds, as is the case with hops, which, at present, abound in our hedges. Some plants, however, both indigenous and foreign, which were formerly raised by art and used at the table, are no longer cultivated, because we have become acquainted with others more beneficial. Many of them served our forefathers in the room of foreign spices, to the use of which trading companies have accustomed us, much to their advantage and to our hurt. It is true also, that many have been banished merely by fashion; for this tyrant, which rules with universal sway, commands the taste as well as the smell to consider as intolerable, articles to which our ancestors had a peculiar attachment.

In the oldest times, mankind were so fond of sweet things, that the goodness and agreeable taste of every kind of food was determined according to the degree of its sweetness; and such is the manner of judging even at present, throughout all the East, in Africa, and in America. This is the case also among us with the greater part of the

lower classes, who are not able to follow the mode of richer tables. In the northern countries, this taste is almost every where prevalent. Thus, the Swedes spoil by the addition of sugar costly Rhenish wine, sour kraut, and other articles, the agreeable tartness of which is gratifying to other nations. In proportion to their population and luxury, the Swedes seem to use more sugar than the Germans, and the Germans more than the English or French; and one might almost suspect that a taste for sweet things were in the inverse ratio of culture. At any rate, one can thus explain why many vegetable productions, which some centuries ago were reckoned among the most agreeable dishes, appear to us to be nauseously sweet. Skirret, which the emperor Tiberius caused to be brought for the use of his table from the Rhine, is little relished at present; and the case is the same with parsnips, some kinds of apples, and several other things.

Fashion sometimes recalls into use species long forgotten; and with the greatest success, when they are introduced under a different name. Thus, after an interval of many years, some began to cultivate again monks-rhubarb,* and to recommend this sourish plant instead of the more savoury spinage. According to Bock, it was transplanted in the middle ages, by the monks, from the woods into gar-

* *Rumex patientia*. *Kerner's Oekon. Pflanzen*, Tab. 729.

dens, to which it has been again brought back, under the imposing appellation of English spinach.

Before the commencement of the Christian æra, when the use of sensual enjoyments was not so well regulated and modified by religious and political principles, many vegetables and other dishes were praised and recommended by writers on agriculture and cookery, as well as by the most favourite poets and eminent authors, on account of effects which cannot at present be named, except in the writings of physicians, without disgusting the reader, and incurring the imputation of indelicacy.

When this mode of thinking began to prevail, people detested to see in their gardens or on their tables, plants which, in consequence of indecent properties, were generally known; and by being thus disused, the knowledge of them was at length so much lost, that we know only their old names, and what the ancients have related respecting them.

In this manner, many receipts in Apicius are totally unintelligible, because we are no longer acquainted with the things for the preparation of which he gives directions. Of this kind are the numerous bulbous roots (*bulbi*), which formed the most favourite dishes of the Greeks and the Romans, and which at present no botanist, much less commentator, would be able to determine. They belong to the lost arts, but not to those which were abandoned because better ones were found to supply

their place. The American vanilla, which perhaps was indebted only to its high price for the permission of being mixed with chocolate, does not certainly supply the place of the ancient Megarean bulbs, as our gun-powder does that of the Greek fire.*

Among those kitchen vegetables which were formerly cultivated, but at present are no more esteemed, are the following: Winter cresses, † an indigenous plant, the young leaves of which, like water-cresses, may be eaten in winter as salad; also common alexanders, ‡ which in the seventeenth century was used instead of celery; bulbous chærophyllum, § the roots of which are still brought to market at Vienna, where people well know what is good, and where they are boiled and eaten as salad with vinegar and oil. Rampion || was formerly used in the like manner. The earth-nut, ¶ which grows wild in many parts of Germany,

* Spargite, quæque viros acuunt, armantque puellis,
Jam Megaris veniant genitalia semina bulbi;
Et quæ sicca legit Getulis obruta glebis,
Et quæ frugifero scriitur vicina Priapo,
Excitet ut Veneri tardos eruca maritos.

Columella, x. 105.

† *Erysimum barbarea*. *Kerner's Œkonomische Pflanzen*. Tab. 562.

‡ *Smyrniolum olosatrum*. *Kerner*, 356.

§ *Chærophyllum bulbosum*. *Kerner*, Tab. 299. *Jacquin, Flora Austriaca*, i. Tab. 63.

|| *Phyteuma spicata*. *Kerner*, Tab. 153.

¶ The tuberous roots of the *Lathyrus tuberosus*. *Kerner*, Tab. 328.

is still cultivated in Holland and in some districts on the Rhine. Rocket,* the young leaves of which were readily eaten by our forefathers as salad, is no longer esteemed, partly on account of its harsh taste, and partly on account of its nauseous smell, which resembles that of rancid bacon: it has, however, been still retained in Italy, *excitet ut Veneri tardos eruca maritos*.† Vetches ‡ are now banished from our gardens, as experience has shown that they are prejudicial to the health. When pepper was so dear, that to promise a saint yearly a pound of it was considered as a liberal bequest, œconomical housewives seasoned their dishes with the leaves of pepper-wort,§ which on this account is called, at present, in England *poor man's pepper*.

Borage, || since the fourteenth, or at least the fifteenth century, has been sown not only for medicinal purposes, but for the use of the kitchen. The young leaves, which however soon become hard, rough, and unfit for the table, were used in soup, and the beautiful blue flowers were put into salad and wine. This plant was not known to the ancients; for the conjecture that it was what they

* *Brassica eruca*, in Italian *Ruchetta*. *Kerner*, Tab. 137; also *Brass. erucastrum*. *Kerner*, Tab. 313.

† *Columella*, x. 109. *Virgil. Moretum* 85: *Vencrem revocans eruca morantem*.

‡ *Lathyrus sativus*, and *cicera*.

§ *Lepidium latifolium*.

|| *Borago officinalis*. *Kerner*, Tab. 167.

called *buglossum*, is not very probable.* As far as I have been able to learn, Nicholas Myrepsus, who lived in the beginning of the fourteenth century, is the first who uses the name *πουραξιον*, which certainly means *borago*.† But who knows whence this writer, who introduces in his works a great many new inexplicable names, some of them formed from the Greek, Latin, and Italian, obtained that appellation? Some of the old botanists have conjectured that it is derived from the word *corago*, which Apuleius, whose period is uncertain, gives as a synonym of *buglossum*. Some think that the reading in Apuleius, of whom we have no critical edition compared with manuscripts, ought to be *borago*; and others assert that *corago* is the true name, and arose from the quality which the plant has of strengthening the heart; consequently, we ought properly to read *corago* and not *borago*.‡ It is probable that our forefathers, under the idea that their borage was the *buglossum* of the ancients, and therefore had the property of strengthening

* The opinions of the old botanists are collected in *Bauhini Hist. Plant.* xxxiii. 2. p. 574.

† Sect. 1. Antidot. 110, 221, 224.

‡ Apuleius de Virtute Herbarum, cap. 41, p. 303. Buglosson Lucani coraginem dicunt. Nascitur locis cultis et sabulosis. Buglossa dicta est eo, quod folia aspera in modum linguæ bubulæ habeat. Folia habet aspera, obscura, terrestria. Hæc in vino mixta hilaritatem convivis facit; in cibum etiam cocta pro oleris sumitur, vel trita pro condimento. *Plinius*, xxv. 8: Jungitur huic buglossos, boum linguæ similis, cui præcipuum, quod in vinum dejecta animi voluptates auget.

the heart, threw the flowers into wine, that their spirits might by these means be more enlivened. Our borage is certainly a foreign plant, and Cæsalpinus said that it was brought from other countries to Italy. Linnæus* positively states that it first came from Aleppo; but I have not yet been able to find on what authority this assertion is founded. At present borage, at least in the German cookery, is no longer used.

Among the kitchen vegetables of which no certain traces are to be found in the works of the ancients, is spinage.† Its native country is unknown; but the name is new, and certainly derived from the nature of its prickly seeds. As far as I know, it first occurs in the year 1351, among the food used by the monks on fast-days;‡ and at that time it was written *Spinargium* or *Spinachium*. Meursius found in the middle ages *σπιναχιον*, in a poem which he has often mentioned, but not defined with sufficient accuracy.§ This plant seems to have been made known from Spain; for many of the old botanists, such for example as Bock, call

* Spec. Plantarum.

† Spinacea oleracea. *Kerner*, Tab. 115.

‡ Du Cange.

§ Meursii Glossar. Græco-barbar. Ludg. Bat. 1614. 4to. p. 521. *Anonymus de vulpe et lupo*. In p. 657, he says that this poem was printed; but where we are not told. Du Cange says nothing more in the *Index Auctorum* at the end of *Glossar. Græcitatibus*, p. 65. I have not yet been able to find it.

it *olus Hispanicum*. Ruellius and others name it *Atriplex Hispaniensis*; and the latter adds, that the Arabians or Moors called it *Hispanach*, which signifies Spanish plant: it is however well known that formerly every thing foreign was styled Spanish. None of the kitchen vegetables of the ancients seem to approach nearer to spinage than their *Blitum*, which Rondolet considered to be the same. But all the properties assigned to this vegetable production; namely, that it was insipid, and that on this account it was necessary to render it palatable by the addition of vinegar, pepper, and other things; that it readily multiplied; that it was indigestible and gently aperient; perfectly correspond not only with our spinage, but with many other plants, such, for example, as our beet and orach, and the good king Henry,* the young leaves of which are still dressed as spinage. It is also possible that the *blitum* of the ancients may have been a kind of *Amaranthus*, some species of which are certainly eatable. *Blitum*, therefore, will remain as difficult to be defined as the *malva*, which was used at the same time.

The *Brassicæ* of the ancients belonged certainly to the cabbage genus; yet no one, as far as I know, has examined botanically what is said of them, and completely proved their identity. It

* *Chenopodium, bonus Henricus*. *Kerner*, Tab. 443. Compare *Halleri Histor. Plant.* ii. p. 266. n. 1578.

would however be fruitless labour to attempt to apply our modern names to the cabbage kinds of the ancients, and search out in the writings of the Greeks and the Romans those which we use at present; for by continued culture, through so many ages and in so many countries, new varieties have from time to time arisen, and old ones must have become lost; so that it is as impossible for us to have all the varieties of the ancients, as it was for them to be acquainted with the whole of those produced in our times. I cannot, therefore, venture to assert that we still possess that kind of cabbage which the ancients, to prevent intoxication, ate raw like salad.* We can dress, in this manner, cabbage heads when they are chopped fine, but we do not know with certainty whether the ancients were acquainted with our cabbage; though Ruellius, not without probability, considered as such, that species which in the time of Pliny was known under the name of *lacuturris*.†

But even if this be admitted as true, we no where find any traces of that excellent preparation of cabbage called by the Germans sour kraut; though the ancients were acquainted with the art of preparing turnips in the same manner.‡ I

* See the passages quoted by Nielas in *Geopon.* v. 11. 3. p. 345.

† Plin xix. 8. sect. 41. p. 177. The same species is mentioned by *Columella*, x. 138. But of red cabbage no account is to be found in any ancient author.

‡ *Columella*, xii. 54. p. 822. *Pallad. Decem.* 5. p. 1011. Nican-
der in *Athenæus*, iv. p. 133.

should have been inclined to consider sour kraut as a German invention, first made in Lower Saxony, which our neighbours learnt from us in modern times, had not Bellon* related that the Turks are accustomed to pickle cabbage for winter food. It appears, however, that these people take the whole heads, as in Germany, but particularly in Upper more than Lower Saxony, some preserve *kumskohl*, a name which, as well as *compost* and the French word *compote*, Frisch derives with great probability from *compositum* (preserved).

The ancients were acquainted with curled cabbage and even with some of those kinds which we call *broccoli*. Under this term is understood all those species, the numerous young flowery heads of which, particularly in spring and autumn, can be used like cauliflowers. Such young shoots are called *cymæ*, but not *turiones*; for the latter term denotes the first shoots that arise, like those of hops, asparagus, and other esculent plants. The *broccoli* used at present was however first brought from Italy to France, together with the name, about the end of the sixteenth century.†

Our cauliflower, about the end of the same century, was first brought from the Levant to Italy; and in the end of the seventeenth was transplanted thence to Germany. For a long time the seeds

* Bellonii Observat. Itiner. iii. 27. p. 186.

† Menage, *Diction. Etymolog.* v. *Broccoli*.

were procured annually from Cyprus, Candia, and Constantinople, by the Venetians and Genoese, who sent them to every part of Europe, because at that time the art of raising seed was not understood.* Prosper Alpinus, in the year 1588, found abundance of this vegetable in Egypt, and from his account there is reason to conjecture that it was then very little known in Europe.† Conrad Gesner seems not to have been acquainted with it; at any rate it is not mentioned by him in a list of the cabbage kind of plants.‡ Even in the time of Bauhin, it must have belonged to those vegetables which were scarce; because he has been so particular in naming the garden in which he saw it.§ Von Hohberg, who wrote about 1682, says that cauliflower, a few years before, had been brought to Germany for the first time. ||

It would be difficult to define all the species of the cabbage kind the leaves and flowers of which

* This is stated in *Vincenzo Tanaro Economica del Cittadino in Villa*. This book, written about the year 1642, was often printed; but I have never been so fortunate as to meet with a copy. The eleventh edition, being the latest, was printed at Venice in 1745, 4to. See *Halleri Biblioth. Botan.* i. p. 468; and ii. p. 682. *Lastræ Biblioth. georgica*, p. 122. *Nonni Diæteticon*. p. 49: the first edition of which, printed in 1627, says, The seeds of cauliflower were brought from Italy to Antwerp, where no seed was raised, or such only as produced degenerate plants.

† *Hist. nat. Ægypti*, i. p. 157.

‡ In *Horti Germaniæ*, at the end of *Cordi opera*, p. 250. B.

§ *Histor. Plantar.* ii. p. 829.

|| *Georgica curiosa*, Nurnberg. 1716. fol. i. p. 643.

were used by the ancients as food ; but it would be a task still more arduous to determine those which have esculent roots. To render this clear, and to show what information I have been able to obtain on the subject by my researches, I must venture to indulge in a little botanical criticism. Our plant-connoisseurs have unfortunately not yet condescended to examine the class of kitchen vegetables ; though it would certainly be rendering a far greater service to botany, and promote its utility much more, to describe and delineate all the species, varieties, and deviations, than to give new names to a dozen of new genera from Polynesia. According to the Linnæan system, we have at present the following species of the cabbage, which have been adopted by all botanists, without further observation.

First, *Brassica oleracea*, to which belong all those kinds the leaves and flowers of which are eaten. It is certainly probable that all these have been gradually produced from one parent stock, which it is now impossible perhaps to find in its original wild state. A similarity is remarked between all these kinds ; and with a little ingenuity one might form a genealogical tree of them, as Buffon has done in regard to the race of dogs ; but a genealogical tree without proofs, is of as little value in natural history, as in claims for hereditary titles or estates. At present, in our system, we must admit that such plants as always

grow up from their seeds, without variation, and do not pass into other forms, are peculiar species; but this will not prove that these supposed species were not originally produced from one maternal stem. For the variation of the succeeding plants took place gradually; and the later ones always deviated more and more from the parent stock. Who knows how many steps and gradations were necessary before cabbage, savoys, and cauliflower were produced from our common colewort? Not fewer, perhaps, than were required to produce white men from Moors, or the tarrier and lap-dog from the bull-dog.

I shall call the mother plant, or original species, A, which by unknown causes has produced B, and the latter by continued and frequently changed culture has become C; from this has been produced D, and from this E, and from this F, &c. Now as we are unacquainted with the art of changing A into F, and F into A, we believe that F is a species really different from A. As we here compare two distant links of a chain, the various parts of which increase very gradually, we find them so different, that it is impossible for us to consider them as the same. But sometimes, perhaps, F changes again into E; E into D; D into C; and C into B or into A. Perhaps also B may be again produced from A, or F from E. Had a botanist observed this by experience, he probably would have no hesitation to consider B,

C, D, E, and F, as varieties of A. But such observations seldom occur; we have not the power of making them according to our pleasure, for we do not know all the causes by which these numerous variations are produced. The few observations which have been made no one has yet collected, compared, and employed for establishing any certain conclusions. The division, therefore, of the cultivated plants into species and varieties would be a fruitless and uncertain undertaking, respecting which one ought not to dispute without sufficient proofs.

It is needless to refer to the form, colour, smell, and taste of the leaves, flowers, and roots. That the indented leaves, such as those which all the cabbage species have, are most liable to change, is shown by experience. The colour is no less variable; and Reichard, who had a great belief in the perpetuity of the species of plants, asserts, that in the same country and climate he could produce from the seeds of red cabbage and black radishes, white cabbage and white radishes.* The production and change of the hermaphrodite plants is so well known that it is only necessary to mention them. The smell, for example; but the musky smell of cabbage establishes no essential difference. Nay, a plant may entirely lose its odorous principle, *spiritus rector*, and yet retain its

* Land-und Gartenschatz, p. 84.

old form, as well as all its other component parts and properties.* In sandy soil the smell of plants is often entirely lost; and the taste is frequently changed, according to the nature of the land and the manure. The most powerful medicinal plants are those which grow wild in their native country, and not those reared in rich gardens, where many poisonous plants become eatable. Even the duration does not always determine the difference of the species. Thus it is certain that winter and summer rape are the same plants, though the former is a biennial and the latter an annual. Where then are the proofs in regard to the cabbage kind, and, in general, those which show that different plants are species of one genus, and others only varieties? Precision or certainty in systems can be expected only by novices; but in botany the case is the same as in every other science, mathematics excepted; the more we learn, the more uncertainty we discover, and the more circumscribed is the real knowledge which we acquire. It is necessary that this should be known to those who may take the trouble to examine the history of kitchen vegetables and other oeconomic plants;

* See the ingenious experiments of Dalibert in *Memoires presentées sur les mathématiques et la physique*, tom. i. Strong smelling plants lose their smell in a sandy soil, and do not recover it when transplanted into a rich soil. On this Rozier founds his proposal for improving rape oil.

and therefore I shall offer no apology for having entered into this botanical disquisition.

To the *Brassica oleracea* belong two plants which are used in the same manner as turnips or roots. The first is the turnip-cabbage, *kohlrabi* above the earth (*Brassica gongylodes*), the stem of which swells out, above the earth, into a thick pulpy turnip-like tubercle, which is dressed and eaten in the same manner as turnips. It is a monstrous excrescence of the stem, which is hereditary, like the broad stem of the Italian fennel.* This turnip-cabbage was certainly not known to the ancients; it occurs for the first time among the botanists of the sixteenth century. Spielmann conjectures that it was brought from the Levant during the crusades; but it was known at too late a period to warrant this opinion. †

Still newer is that variety called *kohlrabi*, under the earth or turnip-rooted cabbage, the stem of which produces a similar tubercle at the surface of the earth or immediately under it. In my opinion, it was first described by Caspar Bauhin, in the year 1620, under the name *napobrassica*, which it still retains, as a new species, to which he was

* Compare *Linnæi Philosoph. botan.* p. 216, where the author speaks of *plantæ fasciatæ*.

† Figures of this turnip-cabbage may be seen in *Kerner's Œkonomischen Pflanzen*, Tab. 311; and *Mehler's Fortsetzung des Böhmischen Ackerbaues, Vierte Abtheilung*, Dresden 1795. 8vo. p. 14. Tab. iv. and v. (or 34 and 35.)

not able to assign any synonyms.* He says that this turnip was cultivated on the Bohemian frontiers, where it was called *Dorsen* or *Dorschen*; and the same name is given to it there at present, as is confirmed by Mehler, in whose work there is a good figure of it.† In Germany it is commonly called *Steckrübe*, and, as is said, was first made known there about the year 1764, by the Bohemian glass-dealers.

The second cabbage species in the Linnæan system is the *Brassica napus*, a plant which grows wild on the sandy sea-coasts of England, as well as in the island of Gothland, and which in many of the northern countries is cultivated for the oil obtained from the seeds, under the name of winter and summer rape. When thinly planted in a nourishing soil, it produces esculent roots, which have a somewhat harsh taste, and properly in German it ought to be called *Steckrübe*. Such is the name given to it in the works of all the old writers by whom it was first mentioned; and it is called so at present in Bohemia, where it is cultivated, as well as *kohlrabi* under the earth, which in some parts of Germany is improperly named *Steckrübe*, and a proper distinction is made between the two species.‡ This kind, which are the real *Steckrüben*,

* Prodrômus Theatri, p. 54. Pinax, p. 111.

† Mehler, p. 16. Tab. vi. (or 36). Kerner, Tab. 312.

‡ The only good figure I know has been given by Mehler, Tab. viii. (or 38).

are never very thick, being only of the size of those which grow in the Mark. The leaves arise immediately from the roots, but in the *gongylodes* and *napo-brassica* they proceed from the stem.*

This species of turnip I did not expect to find among the ancients. I conceived that it might perhaps have been produced in the northern countries, since rape began to be cultivated for oil. Afterwards this plant may have become so much domesticated among us, as to be found not unfrequently in a wild state. Some person may then have easily remarked the pulpy roots of plants growing in a manured soil, and making a trial of them found them well-tasted. When first cultivated, it must have been observed that their harsh taste was moderated, sometimes more and sometimes less, in a sandy soil, and rendered in some degree aromatic; by which means they acquired so great a superiority to the common and almost insipid rape, that they were brought to the first-rate tables, under the name of the Markish, Teltow, Borsfeld, Bobenhäuser and Wilhelmsburg rapes.

* Ehrhart, in *Beyträgen zur Naturkunde*, iv. p. 52, asks what Linæus understands by *radix caulescens*. In my opinion he meant to say that the thick roots of these plants are a continuation of the stem, without any perceptible interval, as is the case with both the *kohlrabi* and also the *Brassica rapa*. But then he ought not to have applied *radix caulescens* to the *Brassica napus*; for in the latter the root is evidently different. But this worthy man found himself in a dilemma; he thought it necessary to separate these species, and knew no marks, more certain, expressible in words.

In each country they were named after those places where they acquired the best savour; and this was the case only where the soil consisted of clay mixed with more or less sand. From such districts large quantities of them were sent to a great distance; but perhaps never in more abundance than from Teltow, in the Middle Mark, which small town sold to the amount of more than two thousand dollars, chiefly to Berlin and Hamburg; and from Hamburg these agreeable roots were frequently sent to both the Indies. Around Stendal also, in the Old Mark, they were raised in considerable quantity, but the seeds are procured there from Teltow.* If we wish to introduce them into our gardens, we must either mix much sand with the soil, or procure fresh seeds annually.

The Greeks and the Romans had little occasion for cultivating rapes. They had other vegetables, from the seeds or fruit of which they could obtain a better oil, and in more abundance. Where the olive would not thrive, they cultivated, as at present, sesamum; or expressed oil from the nuts and seeds of the turpentine tree, † without speak-

* See a figure of the Teltow rapes in Kerner's *Ækonom. Pflanzen*, Tab. 534.

† Geopon. lib. ix. 18. p. 611. *Aristotelis Auscult. mirabil.* cap. 99. p. 183, where I have shown the difference between the old turpentine-oil and that of the present day. The latter is obtained from the resin by distillation, a process with which the ancients were unacquainted.

ing of the many essential oils which they used for salves.

But however probable this may appear, I am inclined to suspect, that under *βουβιας* and *napus* our *steckrüben* are to be understood, as most of the old botanists have admitted; and that the roots of them were used for food, before the seeds were employed for making oil. The *napus* of the ancients had long thin roots, which were so small that they could be preserved without being cut into slices; on the other hand, the *rapa* had large conical roots, which could not be preserved till they were sliced. The *napus*, because the roots grew chiefly downwards, were sown thicker than the *rapum*. The *napus* was cultivated only for the use of man; but the *rapum* was raised in great abundance as fodder for cattle. Of the *napus* there were many known varieties, of different degrees of goodness, which, as is the case at present with *steckrüben*, were named from the place where they chiefly grew. When sown late in the season, they were injured by the earth-flea; to prevent which, the young plants were strewed over with soot. Both the *napi* and *rapa* were buried in the earth, where they were kept in a fresh state during the winter. The former, to prevent them from degenerating, required careful cultivation; and indeed there are few kitchen vegetables which so easily change their state, according to the nature of the soil, as the *steckrüben*.

But what opinion can be formed of the assertion, often repeated, that *brassica napus*, and *rapum*, or *rapa*, readily change into each other; consequently are only varieties or deviations of the same species? * I am not disposed to declare this assertion to be altogether false; though I will not vouch for the possibility of converting our Markish rapes into turnips or cabbage. I conjecture that in the oldest times, when these three plants were not so far separated from each other by intermediate species or degrees of degeneration, as they had a greater resemblance to each other, and were all nearer to the original species, such transitions were easier than they possibly could be at present. If I may be allowed to resume my former comparison, I shall suppose a link A of a chain, to which are connected on the one side the gradually increasing links B, C, D, E; and on the other the gradually decreasing b, c, d, e. In the oldest times there existed only the links B and b, which had a greater similarity, and could more easily be changed than E into e; or the varieties B and b could more

* Columella, ii. 10, 22—25. p. 434. ed. Gesneri, 1735. 4to. *Palladius Jul.* ii. 2. p. 969. *Colum.* xi. 3, 60. p. 773. xii. 54. p. 822. *Plinius*, xx. 4; and xix. 10 and 5. That I may not be too prolix, I shall leave the confusion which occurs in the works of the ancients untouched. Pliny has twice evidently confounded *napus* and *raphanus*; Galen uses the terms γογγυλις and βουνιας for the same species; and in Theophrastus βουνιας does not seem to occur. The *steckruben*, perhaps, in the neighbourhood of this writer, were not then known.

readily pass into each other than E into e, which we see at present.

The third species of cabbage in the Linnæan system, belonging to this place, is the *Brassica rapa*, the roots of which, more or less conical, differ in figure, colour, and taste*. That these roots are the same as those called by the Romans *rapa*, and by the Greeks γογγυλη or γογγυλις, appears to be subject to no doubt, though at present we may have a greater number of varieties.

The question whether the Greeks and the Romans were acquainted with our carrots, † seems to be attended with more difficulties than might be expected. Whoever wishes to answer it fully, and at the same time explain the information of the ancients, and examine the opinions of the botanists of the sixteenth and seventeenth centuries (for the modern botanists give themselves very little trouble in regard to such researches), must enter into a disquisition of such length as might be agreeable perhaps to few readers. I shall, however, here state what I think I know; and, however little it may be, it will perhaps afford some assistance to those who are desirous to illustrate the works of the ancient physicians and agriculturists.

* See the figure of the *Mayrübe* in Kerner, Tab. 553; of the *Guckelrübe*, Tab. 516; and Mehler's Tab. vii. (or 37).

† Kerner's *Ökonom. Pflanzen*, Tab. 319. *Mehler*, Tab. x. (or 40).

Dioscorides, who, next to Theophrastus among the Greeks, possessed the greatest share of botanical knowledge, was certainly acquainted with our carrot, and gave it the name of *staphylinos*.* For this plant, he says, like dill, bears *umbellæ* consisting of white flowers, which in the middle are of a purple red or almost saffron red colour. Our carrots, it is well known, have these characteristics, before the *umbellæ*, towards the time of their ripening, form themselves into a *nidus*. The plant meant by Dioscorides grew wild, but was reared in gardens, on account of its esculent root; and our carrots are certainly descended from plants which grew wild, though Millar, author of the Gardener's Dictionary, could not succeed in rendering the small pungent roots eatable by culture.

We must believe Columella† and Pliny,‡ that the *staphylinos* of the Greeks was, in their time, called *pastinaca*; though they give no information from which it can be concluded that their *pastinaca* was our carrot. § The former speaks of it as a plant useful to bees, which is the case also with our wild and cultivated carrots. Afterwards, he

* Lib. iii. cap. 59. p. 198: σκιαδιον ανηθη παραπλησιον· ἐφ' οὗ ανθη λευκα, εν μεση δε πορφυροειδες, τι μικρον, και ὀνοει προμιζον. Umbella similis anethi; in qua flores insunt candidi, ac in medio exiguum quiddam, colore purpureo et fere ad croceum inclinante.

† Colum. ix. 4, 5. p. 668. xi. 3, 35. p. 768.

‡ Plin. xxv. sect. 64. p. 377. xx. sect. 15. p. 192. p. 168.

§ Gleditschs Betrachtung über den Bienen-staud in der Mark Brandenburg, Riga 1769. 8vo. p. 252.

tells us that it was cultivated like *siser*. Those, therefore, have erred, who consider *siser* and *pastinaca* as the same plant, and believe it to be our liquorice.

That *staphylinus*, or *pastinaca*, or our carrot, was by the Greeks called also *daucus*, is asserted by Pliny,* as well as Galen; † and in the Geoponica, ‡ *daucon* is named among the kitchen vegetables. But Dioscorides § seems to make a difference between *staphylinus* and *daucon*, as he treats of them in different sections. He, however, says that *daucon* is like *staphylinus*, and has also a white umbella. *Daucon* perhaps may have signified a peculiar variety of carrot.

In the last place, that the *pastinacæ*, or carrots, were named also *carotæ*, is mentioned by Apicius. || This word is derived perhaps from *καρτον*, which in Athenæus ¶ denotes the large roots of the *staphylinus*, and also from *κερας*, which occurs in Hesychius and Apuleius ** as a synonym of *pastinaca*, *staphylinus*, and *daucon*; but it is possible that

* Plin. p. 168, and p. 377.

† De Alimentor. facult. lib. ii. cap. 67. clas. 4. p. 335, according to the edition of Basle, 1538. fol. *τινες του αγριου σταφυλινου ονομαζουσι δαυκον.*

‡ xii. 1, 2. p. 839.

§ iii. cap. 83. p. 207. Simeon Sethus, p. 24, uses only the name *δαυκιοι*.

|| Lib. iii. cap. 21. p. 101.

¶ Lib. ix. p. 371; where the words of Diocles are quoted.

** De Virtutibus Herbar. cap. 80. p. 334.

all these words may have been corrupted by transcribers. The Germans and French, however, have thence formed the appellation *carottes*. But *καρος*, a plant which Galen* names along with the roots of the *staphylinus* and *daucus*, signified, 'undoubtedly, our caraway. † Dioscorides says that the spicy aromatic seeds of the *καρος* were used, and that the roots also were boiled and eaten like carrots. ‡ Pliny calls the plant *careum*. The Greeks and the Romans, therefore, were acquainted with our carrots; but in my opinion they were far less used in cookery and as fodder for cattle than they are at present, otherwise they must have more frequently occurred in the works of the ancients.

But whether, under the term *pastinaca*, the ancients did not sometimes understand our parsnip, I will not venture to determine. § I can only assert, with some degree of probability, that the latter is by Dioscorides called *elaphoboscon*, || a name which occurs also in Pliny. ¶ The former says expressly that this plant had *umbellæ* with yellow flowers, and large white sweet roots fit to be eaten. Now among our umbelliferous plants,

* De Aliment. facult. ii. 67. Galen has ἡ καρῶ, not καρος.

† Carum carvi. Kerner, Tab. 65.

‡ Lib. iii. cap. 66. p. 200.

§ Pastinaca sativa. Kerner, Tab. 596, 597.

|| Lib. iii. cap. 80. p. 205.

¶ Lib. xxii. sect. 37. p. 278.

besides dill, fennel, and lovage, the parsnip is the only one which has yellow flowers; at any rate I know of no other with yellow flowers and esculent roots. If the parsnip had no other names among the Greeks and the Romans, it must have been very little used by them; for it is mentioned only by Dioscorides and Pliny. At present we know that it forms excellent fodder for black cattle, sheep, and swine.

It needs, however, excite little wonder that it is so difficult to discover these plants in the works of the Greeks and the Romans. They all belong to one natural order, the species of which can with difficulty be distinguished by the most expert botanist. I mean to say, that all the umbelliferous plants are so like to each other, that they may be readily confounded. This difficulty is still further increased by the old physicians, who used a great many plants of this kind, and named them after the kitchen vegetables to which they had a resemblance, so that by these means plants totally different occur under the same name. To distinguish these, it is necessary first to examine which of them was a kitchen vegetable, and which was used in medicine.

Among our kitchen vegetables, as among the spices, there are many kinds which, at first, were known only on account of their medicinal properties, but afterwards were esteemed and cultivated on account of their good taste. Of this kind is

the scorzonera,* which became first known in the middle of the sixteenth century, in Spain, where it was considered as an antidote to the poison of a snake called there *scurzo*. A Moor, who had learnt this property of it in Africa, cured with the juice of the leaves and the roots a great many peasants bitten by snakes while mowing; but he would not discover the plant, that he might retain all the advantage to himself. Some persons, however, who followed him to the mountains, where he collected it, observed that it was the *scurzonera*, or *scorzonera hispanica*, so called from the name of the snake. Petrus Cannizer transmitted the plant, together with a drawing of it, to John Odo- rich Melchior, physician to the queen of Bohemia; and the latter sent what he had obtained to Matthioli, who at that time was not acquainted with it.† Soon after, the roots were extolled in a particular tract by Nicholas Monardes, as a powerful remedy for the poison of snakes.‡ It is probable, also, that these roots were first used in Spain as food, and about the beginning of the sixteenth century were carried thence to France. The anonymous author of the well-known work *Le Jardinier*

* Kerner, Tab. 91.

† Matthioli Epistol. Medicinal. v. p. 209; at the end of *Matthioli Opera*, Basilæ 1674. fol. The letters have no dates, but the first edition seems to have been printed in 1561.

‡ A translation of this Tract may be seen in *Clusii Exotica*, p. 15. It was printed for the first time in Spanish in 1569. See *Bayle Diction. Histor.* iii. p. 410; and *Haller's Biblioth. Botan.* i. p. 334.

François, who was a gardener, and dealt in trees and seeds at Paris, boasts of having been the first who introduced these roots into the French gardens.* The first edition of his book, which greatly contributed to improve gardening in France, was printed in 1616. At present, the roots of the *scorzonera* are to be found in most gardens, but no one places faith in their medicinal virtue; and when they are occasionally prescribed by any physician for a ptisan perhaps, the other kind, the *scorzonera humilis*, is preferred, though in the apothecary's shops the Spanish, taken from the gardens, is used in its stead. †.

Among our species of the *allium* genus, shallots, in consequence of their mild taste, are preferred. There can be no doubt that this name, as well as the French *echalotte*, is derived from *Ascalonia*; and the above species in the system is called *Allium ascalonium*. ‡ Theophrastus, § Pliny, || Columella, Apicius, and others, speak of a species called *ascalonia*, brought from the city of Ascalon, in Palestine, as we are told by Pliny, Strabo, and Stephanus. ¶ The last-mentioned author states it

* Haller's Biblioth. Bot. i. p. 421. *Lüder's Küchengarten-briefe Dritter Theilc.* Hannov. 1779. 8vo. p. 363.

† Murray, *Apparat. Medicam.* i. p. 160, according to the second edition.

‡ Kerner, Tab. 307.

§ Hist. Plant. vii. 4. p. 761. ed. Heinsii, p. 138.

|| Lib. xix. 6. sect. 32. p. 170.

¶ Steph. Byzant. de Urbibus, v. Ασκαλων, p. 122.

as a report, that the first bulbs were observed in that neighbourhood. These names are found in the oldest catalogues of the German garden vegetables.* There is sufficient reason also to conjecture that our shallots were the *ascaloniæ* of the ancients, and that they came originally from Palestine; especially as Hasselquist found the same species growing there wild. An important doubt, however, against this opinion arises from what is said by Theophrastus and Pliny; namely, that their *ascaloniæ* could not be propagated by bulbs, but by seeds: † on the other hand, our shallots, in Germany, and perhaps in every other part of Europe, never come to flower, and are obtained only by the bulbs; so that Linnæus procured the first flowers, through Hasselquist, from Palestine. But why should not all the other *allium* species be propagated by planting the bulbs?

* Caroli M. Capitulare de Villis, § 70, in *Brun's Beyträgen zu den Teutschen Rechten*. Helmst. 1799. 8vo. p. 40.

† *Cepæ fissiles*, or *scissiles*, or *schistæ*, are leeks, as Theophrastus tells us himself, which, when the leaves become yellow, are taken from the earth, and being freed from the leaves, are separated from each other, then dried, and in spring again put into the ground. If we believe that the *ascaloniæ* can be propagated only by seed, we must certainly read in Theophrastus *μονα γαρ ου σχιστα*, as Scaliger has already remarked.

KNITTING NETS AND STOCKINGS. STOCKING-LOOM.

IN the art of weaving, the woof is thrown or made to pass through the numerous threads of the warp, and is retained by them: but in knitting there is only one thread, which is entwined in so ingenious a manner that it produces a tissue approaching near to cloth both in its use and appearance, though it cannot be called cloth, because it is formed without warp and woof. I will not, however, quarrel in regard to names: the spider's web is produced by only one thread, but in a manner indeed which differs as much from weaving as it does from knitting; and it is not known with certainty whether Arachne found out the art of weaving cloth or of making nets.*

There are two methods of knitting, essentially different from each other; the one employed in making nets, and the other in knitting stockings. In the former the twine is knotted into meshes by means of a knitting-needle; whereas in the knitting of stockings the meshes are produced without knots. Hence it may be readily comprehended why knit stockings can be so easily, and so speedily un-knit, in order that the thread may be employed for new work; and why in nets this is

* Ovidii Metamorph. vi. 5—145. *Plin. Hist. nat.* vii. 56.

impossible. The knots which prevent it render it on the other hand possible for nets to be cut or torn asunder, without destroying more meshes than those immediately exposed to the force applied. One may easily see also the cause why things knit in the same manner as stockings can be stretched without being torn, and, like elastic bodies, again contract as soon as the action of the distending force ceases. On this account, no kind of cloth has yet been found fitter for gloves, stockings, garters, and bandages. When not too closely knit, single parts can be extended without injury, as the threads in the neighbouring meshes give way, and the meshes become narrow or contracted. This, on account of the knots, is not possible in knitting of the first kind; which however produces the best nets, as the meshes suffer the water and mud, together with the fish that are too small, to pass through them, and retain only the fish that are larger. A captured fish, in order to escape, must tear to pieces, after each other, as many meshes as are equal to the circumference of its body. Were the net formed in the same manner as a stocking, a single mesh, if torn, would suffer it to pass through.

I do not know whether those to whom the whole doctrine of curved lines is familiar, could give such a description of knitting as would be intelligible, without drawings, to those acquainted with these lines, but totally ignorant of knitting: at any rate

I shall not attempt one, * especially as those who stand in need of it may easily find a person to instruct them. For it is to be reckoned among the advantages of the present age, that a readiness in knitting is required as a part of female education in all ranks; and it may be easily acquired even by children, with the assistance of an expert and indulgent instructress. It is, however, astonishing that this art has not been banished by the refinement of modern manners, especially as so much of the time of young females is employed in the reading of novels and romances. But it is to be observed, that this occupation, which, with a little practice, becomes so easy that it may be called rather an amusement, does not interrupt discourse, distract the attention, or check the powers of the imagination. It forms a ready resource when a vacuity occurs in conversation, or when a circumstance takes place which ought to be heard or seen, but not treated with too much seriousness: the prudent knitter then hears and sees what she does not wish to seem to hear or to see. Knitting does no injury either to the body or the mind, the latter

* A description of net-making, by Duhamel, illustrated with good figures, may be seen in *Schauplatze der Künste und Handwerke*, xii. p. 1. See also *Krünitz Encyclopedie*, xiii. p. 620. An Englishman, named J. W. Boswel, invented a machine on which sixty-eight meshes, with perfect knots, could be knit at the same time: it could be adapted also to fine works, and to lace. A description of it may be seen in the *Transactions of the Society for the Encouragement of the Arts*, vol. xiv.

of which suffers from romances. It occasions no prejudicial or disagreeable position, requires no straining of the eye-sight, and can be performed with as much convenience when standing or walking as when sitting. It may be interrupted without loss, and again resumed without trouble; and the whole apparatus for knitting, which is cheap, needs so little room, and is so light, that it can be kept and gracefully carried about in a basket, the beauty of which displays the expertness, or, at any rate, the taste of the fair artist. Knitting belongs to the few useful occupations of old persons, who have not lost the use of their hands. Those who wish to reproach the fair sex for the time they waste in endeavouring to please the men, ought not to forget, that the former know how to occupy those moments which the latter devote, not to labour but to social enjoyment or pleasure, or which would be otherwise lost—the time in which the male sex are able to do nothing that is useful. No one, however, will seriously object this to the male sex, whose daily occupations tend so much to exhaust the spirits; but is it not to be regretted, that those who, in consequence of their situation, perform properly no work, who are scarcely under the necessity of thinking, and who rather become corrupted through idleness, do not employ their vacant hours in knitting, in order to gain money? What I mean to say is, should not servants, soldiers, shepherds, and the male children

of the peasants who are unfit for hard labour, learn to knit, that they might earn something for themselves and their families? A sale for knit articles, stockings, mitts, caps, nets, and fine lace, can never be wanting. My panegyric, however, on knitting is applicable, strictly speaking, to the second kind only, which surpasses the first in utility, but is a much more modern invention; for fishing and hunting were the oldest occupations, and mention of nets occurs in the earliest writings.

It is not improbable that the people who resided on the banks of rivers abundant in fish, endeavoured to catch them at first with baskets, such as those which most of the Indians know how to make, or with other vessels which suffered the water to run through them; but that in the course of time a piece of thin cloth was employed, and at a still later period, what was far more convenient, nets. Mention, however, of fishing and hunting nets occurs very often in the Scriptures;* and in some passages it is clearly proved that we are to understand by them such as were knit. But I shall leave commentators to determine whether gins composed of ropes or cords† are not

* Ezekiel, chap. xxvi. ver. 14, and chap. xlv. ver. 10.

† Of these noose-ropes I have treated at full length in *Vorrath kleiner Anmerkungen*, Leipz. 1795. 8. p. 1; but I shall here make some important additions, and shall be satisfied if they are not considered as misplaced. Many commentators on the Greek and Roman writers have fallen into mistakes, because they were not acquainted with the nature of these ropes. The use of them among

often meant where the translators have introduced nets. The former are certainly older than the latter; they were long used both in hunting and

the Parthians is confirmed by Suidas, under the word *σειραι*, p. 303; where he says that on that account they were called *σειροφοροι*. Josephus, *de bello Jud.* lib. vii. cap. 27. p. 985, asserts that they were employed by the Alani, and relates that Tyridates would have been caught in this manner, had he not quickly cut to pieces the rope. The use of them among the Hunns is mentioned by Sozomenus, *Hist. ecclesiast.* lib. vii. cap. 26. p. 748, where he speaks of Theotimus. To the same purpose is a passage of *Ammian. Marcell.* lib. xxxi. cap. 2. *Valerius Flaccus, Argonaut.* lib. vi. 133, speaking of the Auchates, a Scythian people, says: *Laqueis adducere turmas.* Under the same head may be comprehended the *retiarii* and *laquearii*, in the bloody spectacles of the Romans, whose method of fighting is said to have been found out by Pittacus. See *Diogen. Laert.* i. 74. p. 46: also the writers quoted on this passage by Menage, p. 45. To this subject belong the snares of the devil, pestilence, and death, in the Scriptures, and particularly in Psalm xviii. ver. 5. In consequence of my work, already mentioned, Mr. Böttiger wrote to me that the *laquei mortis* of Horace, *Carm.* iii. 24. 8, were hence to be explained, and not by a Hebraism, as some of the old commentators have imagined. That the case was the same also with the *lethi plagæ* in *Statii Sylv.* v. 1. 155, quoted by professor Mitscherlich, on which Barth says: *ex media sacra scriptura et psalmis ipsis loqui dicas.* Professor Tychsen pointed out to me a remarkable passage in Jones's *Poeseos Asiaticæ commentar.* Lipsiæ 1777, 8vo. p. 250, or in the English edition p. 302, quoted from the Persian poet Ferdusi, who died in the beginning of the eleventh century. The author there describes the single combat of the Persian general Sam and the leader of the troops of Mazenderan: *Cum vocem meam Kerkavi audivisset et strepitum clavæ meæ capita findentis, ad me, prælii cupidus venit, instar torvi elephantis, cum longo laqueo. Tortum in me laqueum paravit. Ego vero cum vidissem, periculum novi appropinquare, arcum regium manu cepi - - -* Also in the ordeals of the ancient Germans, when a man was obliged to combat with a woman, the latter had a rope with a noose, which she

in war, and are still employed among some savage tribes who are not acquainted with fire-arms.

That nets, however, should be invented at an early period needs excite no wonder, for they have been found in modern times among very rude nations. Wafer* saw some among the American savages which were made of the bark of a tree; and the Greenlanders make some of the same kind of the hair of the whale's beard, and of the sinews of other animals. I shall omit here what has been said in regard to nets in the works of the ancients, and particularly in those which treat on fishing and hunting. The Latins say *texere retia*; † and Pliny calls the yarn or twine of which nets were made *stamen*; ‡ yet I am inclined to believe, that both the Greeks and the Romans made their nets in the same manner as we do at present.

threw over her antagonist, who stood in a pit, in order that she might more easily overcome him. That such ropes are still employed among various nations is proved by Vancouver's *Voyage to the North Pacific Ocean*, Lond. 1779. 3 vol. 4to. In Hungary the wild horses, at present, are said to be caught by ropes of this kind.

* Wafer's *Reise nach der meereunge Darien*. Halle 1759. 8vo. *Anderson's Nachrichten von Island*, p. 233. The author says that the beards are cut into slips; but these slips were fish bone, which could be made into baskets but not into nets. The author certainly meant the hair on the beard, which in Holland is used for wigs.

† The Greeks say also ὑφανειν δικτυα.

‡ Plin. *Hist. nat.* xix. 1. sect. 2. *Pollux Onomast.* vii. 10. 35. p. 711.

Weaving, properly so called, is out of the question; and it appears that these words were used in a very general sense, because there was then no term of art to denote knitting. At any rate, I cannot believe that the far more ingenious process by which our lace-weavers prepare the net-formed scarfs used by military officers was then known, as Braun seems to think.* Meshes were called by the Latins *maculæ* and *nodi*; † but I as little understand what Pliny says: *retia succino nodantur*, as the supposed explanation of Hardouin: *retia nodos e succino habebant*. ‡ The author alludes here perhaps to some ornament added to those nets which were drawn round the boxes or seats of the senators. Some manuscripts read *notantur*; I should have preferred *ornantur*.

The art of making nets of fine yarn, silk, or cotton, by the process of knitting, and employing them as articles of dress or ornament, is not an invention of modern luxury. I remember to have seen in old churches retiform hangings, and on old dresses of ceremony borders or trimming of the same kind, which fashion seems alternately to have banished and recalled. That in the middle ages the mantles of the clergy had often coverings of silk made in the same manner as fishing-nets,

* De Vestitu sacerdot. Hebræorum. Amstelod. 1701. 4to. i. p. 100.

† Gratii Cyneget. 30. *Nemesiani Cyneget.* 301, 302.

‡ Hist. nat. lib. xxxvii. cap. 3. p. 771.

has been proved by Du Cange.* I suspect also that the transparent dresses used by the ladies, more than four hundred years ago, to cover those beauties which they still wished to be visible, were nets of this kind.†

Far more ingenious and of much later invention is that art which was undoubtedly first employed in making stockings, and on that account called stocking-knitting. That the Romans and most of

* *Rele*, id est ornamentum sericum ad instar retis contextum. *Acta S. Deodati*, tom. iii. Junii, p. 871. Cum peculiari quoque ornamento serico, in formam piscatorii retis, cooperiente albam, tunicellam atque dalmaticam a cingulo usque ad pedes, quod vulgò rete vocant. *Concilium Mexicanum*, an. 1585, inter *Hispan.* tom. iv. p. 340: Superpellicea rete aliove eleganti artificio elaborata, aut adeo contracta, ut infra genu dimittantur, ne induant clerici.

† In the *Limpurg Chronicle*, which may be found in *von Hontheim, Prodrömus Histor. Trevirensis*, Augustæ Vindel. 1757. fol. 2. p. 1084, is the following passage: The ladies wore new *weite hauptfinstern*, so that the men almost saw their breasts: and Moser also, who quotes this passage in his *Phantasien*, 2. p. 74, conjectures that the *hauptfinstern* might approach near to lace. I never met with the word any where else; but Frisch, in his *Dictionary*, vol. i. p. 268, says: *Vinster* in a *Vocabularium* of the year 1492 is explained by the words *drat*, *schudrat*, thread, coarse thread. May it not be the word *fenster*, a window? And in that case may it not allude to the wide meshes? *Fenestratum* meant formerly, perforated or reticulated; and this signification seems applicable to those shoes mentioned by Du Cange under the name of *calcei fenestrati*. At any rate, it is certain that the article denoted by *hauptfinstern* belonged to those dresses mentioned by Seneca in his treatise *de Beneficiis*, 59: *Vestes, si vestes vocandæ sunt, in quibus nihil est, quo defendi corpus, aut denique pudor possit; quibus sumtis, mulier parum liquido nudam se non esse jurabit.* Pliny says that such dresses were worn, *ut in publico matronæ translucant.*

the ancient nations had no particular clothing for the lower part of the body, is so well known, that it is unnecessary for me to repeat the proofs.* Their legs, however, did not suffer more from the cold than our hands when they are not covered by gloves, or than the feet of the Franciscans at present; and what is common is not indecent. It is well known that the northern nations first had hose or trowsers, which covered not only the legs but the thighs and loins; and it was not till a few centuries ago, that from this article of dress people began to make two; the upper part retained the old name, and the lower, that which covered the legs, was called in German *strumpf*, *truncus*, which word Maler in his Dictionary explains by *halbhosen*, half-hose, and *hosenstrumpf*. The diminutive *strümpfle* signifies, according to this author, hose that reach to the calf of the leg. The first stockings were of cloth, and made by the tailors; consequently they were not so commodious as our knit stockings, which, for the reason already mentioned, become closely contracted, without pressing the foot or impeding a person in walking.†

It is more than probable that the art of knitting stockings was first found out in the sixteenth century, but the time of the invention is doubtful; it

* Compare what I have said in the article on furs.

† See Muratori *Antiquitates Italicae medii ævi*. ii. p. 433. *Aquino Lexicon militare*, ii. p. 361.

is also uncertain to what people we are indebted for it, and the name of the inventor is entirely unknown. Savary appears to be the first person who hazarded the conjecture,* that this art is a Scottish invention, because the French stocking-knitters, when they became so numerous as to form a guild, made choice of St. Fiacre, a native of Scotland, to be their patron; and besides this, there is a tradition, that the first knit stockings were brought to France from that country. However this may be, it is certain that the first letter of foundation for this guild, named *the communauté des maitres bonnetiers au tricot*, is dated the 16th, or, as others say, the 26th of August 1527. Since St. Fiacre has already had the unmerited honour of being mentioned in this History of Inventions, I shall here remark, that he was the second son of Eugenius, who is said to have been king of Scotland in the beginning of the seventh century; that he lived as a hermit at Meaux in France, and that his name in the sacred calendar stands opposite to the 30th of August.† It must however be acknowledged, that this opinion of Savary rests only on a very slight foundation.

Somewhat more probable is an opinion, which

* Dictionnaire de commerce. Copenhag. 1759. fol. i. p. 388. 576.

† Gentleman's Magazine, vol. liii. 1783, p. 38. In the *Heiligen Lexicon*, St. Fiacre is improperly called the son of an Irishman of distinction.

has been long prevalent in England, and is supported by the testimony of respectable writers. Howell, whose *History of the world* was printed in 1680, relates, that Henry VIII, who reigned from 1509 to 1547, and who was fond of show and magnificence, wore at first woollen stockings; * till by a singular occurrence he received a pair of knit silk stockings from Spain. His son Edward VI, who succeeded him on the throne, obtained by means of a merchant named Thomas Gresham, a pair of long Spanish knit silk stockings; and this present was, at that time, highly prized. Queen Elizabeth, in the third year of her reign, that is in 1561, received by her silk-woman, named Montague, a pair of black silk knit stockings, and afterwards would not wear any other kind. †

* *Cloth-hose.* *History of the world*, 2. p. 222. *Anderson's History of Commerce.*

† Never wore cloth ones any more. I shall, however, transcribe the whole passage, because the book is scarce in Germany. The title is, *An Institution of general history, or the History of the world.* By William Howell. *The second edit.* Lond. 1680. fol. It consists properly of three volumes, but the two last form a second part. In the third volume, where the author speaks of the silk-trade in the oldest times, he says, p. 222: "Silk is now grown nigh as common as wool, and become the cloathing of those in the kitchin as well as the court; we wear it not onely on our backs, but of late years on our legs and feet, and tread on that which formerly was of the same value with gold itself. Yet that magnificent and expensive prince, Henry VIII, wore ordinarily cloth-hose, except there came from Spain, by great chance, a pair of silk stockings. K. Edward, his son, was presented with a pair of long Spanish silk

This information is confirmed by another account. It is related by Stowe, that the Earl of Pembroke was the first nobleman who wore worsted knit stockings.* In the year 1564, William Rider, an apprentice of Master Thomas Burdet, having accidentally seen in the shop of an Italian merchant a pair of knit worsted stockings, procured from Mantua, and having borrowed them, made a pair exactly like them, and these were the first stockings knit in England of woollen yarn.

From this testimony, it has been hitherto believed in England, that knit stockings were first made known there under Henry VIII; that they were brought from Spain to that country; and that the invention belongs, in all probability, to the

stockings by Thomas Gresham, his merchant, and the present was taken much notice of. Queen Elizabeth in the third year of her reign was presented by Mrs. Montague, her silk-woman, with a pair of black knit silk stockings, and thenceforth she never wore cloth any more." This circumstance is somewhat differently related by a German writer, *Joh. Joach. de Rusdorff, Consilia et negotia politica*, Francof. ad M. 1725. fol. p. 283, 284: In Anglia Elisabetha, felicissima illa et augustissima regina, octodecim plus minus annos sceptrum manibus, coronam capite gesserat, antequam tibialia serica pedes induta fuerat. Contigit tandem ut comes Darbiensis, quæ a eubieulis erat, et in gynæceao regio reatrix, reginae par tibialium bombycinorum Miliani in Italia confectorum, et ex reticulatis nexibus colligatorum strenae et munusculi loco in anni auspiciis offerret. Regina commoditatem et mollitiem experta, et commendans, deinceps demum uti coepit sericis tibialibus, ante illud tempus non nisi laneis in Anglia confectis utebatur.

* Annales, or A general chronicle of England, by J. Stow. Lond. 1631. fol. p. 869.

Spaniards. Were this really the case, one might conjecture that the first knit stockings known in England were of silk, though the imitations made by Rider were of wool. For under Henry VIII, Edward VI, and Elizabeth, silk stockings only are mentioned; and at that period silk, and not woollen articles, were imported from Italy and Spain. Did the invention belong to the Spaniards, I should be inclined to conjecture that these people obtained it from the Arabians, to whom we are indebted for many useful and ingenious arts. But at any rate the conjecture of Savary falls to the ground; for as the French had a stocking-knitters' guild so early as 1527, it is highly improbable that the English, forty years after, or about the year 1564, should have been unacquainted with the invention of their nearest neighbours, the Scots.

Some years ago, however, several learned men in England were led, by a singular circumstance, to collect information in regard to the antiquity of the art of knitting stockings. I here allude to the forgeries of Thomas Chatterton, who was born on the 20th of November 1752, and terminated his unfortunate life by suicide on the 24th of August 1770. This ingenious youth published some poems which he pretended to have been written by Thomas Rowley, who lived in the reign of Edward IV, that is about the year 1461. Many literary men denied the authenticity of these poems, though they possessed great beauty; proclaimed

Chatterton to be a second Psalmanasar; and justified their opinion by the circumstance of knit stockings being mentioned in them. This they said was an anachronism, as the invention of knitting stockings, according to Howell and Stowe, must be a century later than the supposed poet Rowley. Others, who supported the genuineness of these poems, endeavoured, on that account, to make the invention older, and collected information in regard to the history of it, from which I have made the following extract.*

In the beginning of the sixteenth century the people of Scotland had breeches, in the proper sense of the word, and wore a kind of stockings; for Hector Boethius, who was professor at Aberdeen in 1497, relates, that the Scots wore hose which reached only to the knee, consequently

* Of these poems there is an elegant edition in the library of our university, with the following title: Poems, supposed to have been written at Bristol in the fifteenth century, by Thomas Rowley, priest; with a commentary, in which the antiquity of them is considered and defended, by Jeremiah Milles. London 1782, 4to. The lines which allude to this subject are in the tragedy of Ella, p. 212:

She sayde, as herr whytte hondes whyte hosen were knytinge,
Whatte pleasure ytt ys to be married!

The whole history of these poems, and of their author Chatterton, may be found in the *Biographia Britannica*, by A. Kippis, the second edit. Lond. 1789, fol. iv. p. 573—619. In Bryant's *Observations on the poems of Thom. Rowley*, Lond. 2 parts, 8vo. 1781. In this work the genuineness of the poems is defended with great learning, but not proved.

stockings made of linen or woollen, and breeches chiefly of hemp.*

These particular articles of dress were usual at that time even in England; for in the year 1510 King Henry VIII appeared, on a public occasion, with his attendants, in elegant dresses, in the description of which breeches and hose are particularly mentioned.†

In the year 1530 the word *knit*, applied to stockings, must have been common in England; for at that time John Palsgrave, French-master to the princess Mary, daughter of Henry VII, published a grammar,‡ in which he stated that this

* In his Description of Scotland, according to the old translation, in Hollingshed and Harrison, first volume of the *Chronicles*, according to the edition of 1585 and 1586, fol. p. 21: "Their hosen were shapen also of linnen or woollen, which never came higher than their knees; their breeches were for the most part of hemepe."

† "The king and some of the gentlemen had the upper parts of their hosen, which was of blue and crimson, powdered with castels and sheafes of arrows of fine ducket gold, and the nether parts of scarlet, powdered with timbrels of fine," &c. - - - There is reason, however, to suppose that the upper and nether parts of the hose were separate pieces, as they were of different colours. This description stands in the third volume of *Hollinshed's Chronicles*, already quoted, p. 807, where it is said, speaking of another festival: "The garments of six of them were of strange fashion, with also strange cuts, everie cut *knit* with points of fine gold, and tassels of the same, their hosen cut in and tied likewise." What the word *knit* here signifies, might perhaps be discovered, if we had an English Journal of Luxury and Fashions for the sixteenth century.

‡ I cannot boast of having ever seen this grammar, *Eclaircissement de la langue Françoise*; but I shall transcribe the words relating to this subject, as they have been given by Dr. Milles, in his obser-

word in French was applied to the making of nets as well as of caps and stockings.

From a household book of a noble family in the time of Henry VIII, we learn that knit stockings, both for grown-up people and children, were sold at so low a price that it cannot be supposed that they were foreign articles.*

In the reign of Edward VI, various kinds of knit articles must have been made in England, as appears by some regulations relating to trade and manufactures issued in 1552.†

vations on Rowley's Poems, p. 213: 1st. I knit a knott - - *je noue*. 2d. I knytt as a matt-maker knytheth - - *Je tys—j'ay tysse—tystre*. He can knitt nets well - - *il scayt bien tystre des raytz*. 3d. I knitt bonnets or hosen - - *Je lasse*. She that sytteth knytinge from morrow to eve can scantly win her bread - - *Celle qui ne fait que laisser depuis matin jusqu' au soyre, a grans peyne peut elle gagner son payn*. 4th. I knytt or bind together - - *Je annexe*. In all probability the princess was accustomed to knit, and consequently was obliged to learn those French expressions which related to her work.

* Gentleman's Magazine, 1782, vol. lii. p. 229: From an authentic and curious household book kept during the life of Sir Tho. L'Estrange, Knt. of Hunstanton, in Norfolk, by his lady Ann, daughter of the lord Vaux, are the following entries:

1533. 25 H. 8. 7 Sept. Peyd for 4 peyr of knytt hose - viii s.

1538. 30 H. 8. 3 Oct. - - - - - two peyr of knytt hose - i s.

It is to be observed, that the first mentioned were for Sir Thomas and the latter for his children. The genuineness of this account is fully proved in the same volume of the *Gentleman's Mag.* p. 431.

† The act made on this occasion is not to be found in any of the old or new editions of the *Statutes at large*. It is omitted in that published at London, 1735. fol. ii. p. 63, because it was afterwards annulled. Smith, in *Memoirs of wool*, Lond. 1747. 8vo. i. p. 89, says it was never printed; but it is to be found in a collection of the acts of King Edward VI, printed by Richard Grafton, 1552, fol.

It nevertheless can be proved, that in the fifth year of the reign of Queen Mary, that is in 1558, there were many who wore stockings of cloth; for Dr. Sands, who was afterwards archbishop of York, sent for a tailor to measure him for a pair of hose.* This might serve to confirm the assertion of Stow, that stockings were not knit in England till six years after. But according to the

The following passage from this collection, which is so scarce even in England that it is not named in *Ames's Typographical antiquities*, is given in the *Gentleman's Magazine*, vol. liii. P. 1. p. 127: In this acte limitinge the tymes for buicing and sellyng of wolles, mention is made of chamblettes, wolstende, saies, stamine, *knitte hose*, *knitte peticotes*, *knitte gloves*, *knitte slieves*, hattes, coives, cappes, arrasse, tapisserie, coverlettes, girdles, or any other thing used to be made of woolle.

* This account is to be found in *Hollinshed's Chronicles*, Lond. 1587. fol. vol. iii. p. 1148. Dr. Sands at his going to bed in Hurleston's house, he had a paire of hose newlie made, that were too long for him. For while he was in the Tower, a tailor was admitted to make him a pair of hose. One came in to him whose name was Benjamin, dwelling in Birchin lane; he might not speak to him or come to him to take measure of him, but onelie to look upon his leg; he made the hose, and they were two inches too long. These hose he praied the good wife of the house to send to some tailor to cut his hose two inches shorter. The wife required the boy of the house to carrie them to the next tailor, which was Benjamin that made them. The boy required him to cut the hose. He said I am not the maister's tailor. Saith the boy, because ye are our next neighbour, and my maister's tailor dwelleth far off, j come to you. Benjamin took the hose and looked upon them, he took his handle work in hand, and said, these are not thy maister's hose, but Dr. Sands, them j made in the Tower.—A short history of this man is given in *Francis Goodwin's Rerum Anglicarum Henrico VIII, Edwardo VI et Maria regnantibus Annales*. Hagæ-Com. 1653. 12mo. p. 373.

testimonies already produced, this cannot be true. It is much more credible, that the clergy and old people, who are not ready to adopt new modes, wore some years later the old-fashioned stockings of cloth, which, in all probability, were similar to our gaiters

It might be mentioned as a further proof, if necessary, of breeches and stockings being considered, long before the reign of queen Elizabeth, as separate parts of dress, that in the catalogue then drawn up of the revenue of the bishop of St. Asaph, it is stated, that he received, as a perquisite, on the death of every clergyman who had a living, his best breeches and stockings.*

About 1577, that is, ten years after the period of the invention as given by Stow, knitting must have been common throughout all England, and practised even in villages. Harrison relates in his Description of that country, where he speaks of the principal indigenous trees, that the bark of the alder was used by the wives of the peasants for dyeing the stockings which they had knitted.†

* Item, his best coat, jerkin, doublet, and breeches. Item, his hose or nether stockings, shoes, and garters. These words are quoted in the *Gentleman's Magazine*, 1783, p. 38, from a work entitled *A Survey of the cathedral church of St. Asaph*. By Browne Willis. Lond. 1720, 8vo.

† This account may be found in the first part of *Hollinshed's Chronicle*, first printed in 1577, p. 213: The bark of the alder is not unprofitable to die black withall, and therefore much used by our countrie wives in colouring their knit hosen.

According to the well-known poet George Gascoigne,* the greatest ornaments in dress, about the year 1576, were kuit silk stockings and Spanish leather shoes.

About 1579, and not 1570 as stated in the Gentleman's Magazine, when Queen Elizabeth was at Norwich, several female children appeared before her, some of whom were spinning worsted yarn, and others knitting worsted yarn hose.†

The art of knitting stockings would be much older in Germany than in France or in England; and Chatterton, at any rate, would be freed from the charge of committing an anachronism, were it true, as Micrælius wrote, in the year 1639, that the consort of the duke of Pomerania, who died in 1417, when she could no longer sew or embroider, amused herself with knitting.‡ But it is very probable that this good man committed an

* In his satyre called *The steel of glass*: In silk knitt hose, and Spanish leather shoes. This satyre I never had an opportunity of seeing; but I know from Wood's *Athenæ Oxonienses, the second edit.* Lond. 1721, fol. i. p. 190, that it was written in 1576.

† In Hollinshed, as above, third part, p. 1290: Upon the stage there stood at the one end eight small women children, spinning worsted yarne, and at the other as manie knitting of worsted yarn hose.

‡ Joh. Micrælii erstes Buch des alten Ponmerlandes, Stetin 1639, 4to. p. 388: Duke Bogislaus VIII suffered himself at length to be overcome by love, and married Sophia, daughter of Procopius margrave of Moravia, who was a very prudent and moderate lady. In her old age, when her sight became bad, so that she was incapable of sewing or embroidering, she never put the knitting needle

anachronism, like Chatterton; and, in order to show the industry of the duchess, named those occupations which were usual in his own time.

In Germany, as far as I know at present, stocking-knitters occur, for the first time, about the middle of the sixteenth century, under the name of *hosenstricker*, a term which, in Lower Saxony, is still not uncommon. At Hamburgh the people say *hasenknitter*, and use the word *hase* for stockings.* In Berlin there were stocking-knitters about the year 1590.† In many countries they had a particular guild; and this is the case, at present, in the duchy of Wirtemberg, where they are entirely different from those who work at the loom, and who are called *stocking-weavers*. Each have their own regulations, in which it is ordered that the stocking-knitters shall wear no articles wove, that is knit, in a loom, and the stocking-weavers no articles knit with the hand.‡ That

out of her hands, as is written in our chronicles. The rhymes which she always had in her mouth are remarkable:—

Nicht beten, gern spatzieren gehn,
Oft im Fenster und vorm Spiegel stehn,
Viel geredet, und wenig gethan,
Mein Kind, da ist nichts Fettes an.

“ Never to pray; to be fond of walking; to stand often at the window and before the looking-glass; to talk much and do little; is not, my child, the way to be rich.”

* Richey Idioticon, p. 89.

† Nicolai Beschreibung von Berlin. Erste Ausg. p. 176.

‡ Weisser Recht der Handwerker. Stutgard 1779. 8vo. p. 16, and pp. 415, 416. The regulations respecting the Wirtemberg

knitting, however, may be left free, as an occasional occupation to every one, the following words are inserted in the regulations of the stocking-knitters: "Poor people, who, through want of other means, procure a subsistence by knitting stockings, and those who at the gates keep watch for themselves or others, and at the same time knit, shall be at liberty to wear whatever they make with their own hands."

The German terms of art which relate to knitting are older than the art itself; for they are all borrowed from the making of nets: *knütten*, *knüt-eisen*, *knütholz*, *knütspan*, *stricken* and *stricknadel*, and also *maschen*, are all terms which occur in the fishing-regulations of Brandenburg, for the year 1574, and no doubt earlier. The *tricoter* of the French had the same origin as the German word *stricken*: *Trica* was a lock of hair, a noose; and *tricare* signified to entangle, and deceive. *Lacer* is derived from *laqs*, a rope, a noose; and this comes from *laqueus*. The English word *stocking* is derived from *stock*, *truncus*, the trunk of a tree, a word still retained by the German foresters, who in the Low German speak of rooting out *stocks*.

Silk stockings, however, in consequence of their

hose- and stocking-knitters are added, by way of appendix, to the *Sammlung Wirtembergischer Handwerksordnungen*, Stuttgart 1758. 8vo. The regulations respecting the stocking-weavers of the year 1750 may be found in the *Sammlung*, p. 2041, and the boundaries of the two guilds are defined, art. 14. p. 2059.

high price were, for a long time, used only on very grand occasions. Henry II, king of France, wore such stockings, for the first time, at the marriage of his sister with the duke of Savoy, in 1559.* In the reign of Henry III, who ascended the throne in 1575, the consort of Geoffroy Camus de Pontcarre, who held a high office in the state, would not wear silk stockings given to her by a nurse, who lived at court, as a Christmas present, because she considered them to be too gay.† In the year 1569, when the privy-counsellor Barthold von Mandelsloh, who had been envoy to many diets and courts, appeared on a week-day at court, with silk stockings, which he had brought from Italy, the margrave John of Custrin said to him, “Barthold, I have silk stockings also; but I wear them only on Sundays and holidays. ‡ The celebrated Leonard Thurneisser, however, who lived at the court of Brandenburgh, about the end of the sixteenth century, wore silk stockings daily, and in general dressed very magnificently in silk and velvet. §

* This we are told by Mezeray in *Abrégé de l'histoire de France*, Amst. 1696. 12mo. vi. p. 298, where he speaks of the silk manufactories under Henry IV.

† Saintfoix *Versuch in der Geschichte von Paris*, v. p. 41.

‡ This account is given from written information in Möhsen's *Beitrügen zur Geschichte der Wissenschaften in Brandenburg*, Berlin 1783. 4to. p. 87.

§ Möhsen ut supra.

Knitting with wires, the method of which I have hitherto spoken, has always appeared to me so ingenious, that I conceived the inventor of it must have had a pattern to serve as a guide. This pattern I think I have discovered. Wire-workers, and other artists who use wire, exercised their ingenuity some centuries ago, more than at present, in making wire screens in various ways; and it must be confessed, that many of them produced articles which even at present, though not suited to the modern taste, deserve admiration. Works of this kind may still be found in old churches. The art of making them has often been considered as too difficult for human hands; and hence popular tradition has asserted, that the artists were assisted by the devil. A tale of this kind is still related, though no longer believed, to those whose curiosity induces them to view the wire screen which surrounds the baptismal font in St. Mary's church at Wisnar, and which is plaited or wove in so ingenious a manner, as if with ropes, that neither the beginning nor end of the wires can be observed.* A similar legend is told to strangers, when shown the screen around the pulpit in the cathedral of Lubec, which, according to the inscription, was made in 1572.† It is not improbable that among works of this kind,

* Zeiler's *Itinerarium Germaniæ*, i. p. 372.

† *Die beglückte Stadt Lübeck oder Morgenweg Beschreibung der Stadt Lübeck*, Lüb. 1697. 8vo. p. 162.

some may be found made with meshes, as if formed by knitting. Our pin-makers can construct some much more ingenious. That I might be better able in my technological lectures to convey to my pupils an idea of knitting, I made a drawing on the subject, and caused a pin-maker to weave for me a small screen of brass wire. This work is easy, because it is executed in a frame of strong but pliable wire. I suspect, therefore, that some one first tried to make an imitation of such a wire net with yarn, and in one expanded piece, for which only two or three small sticks would be necessary. Instead of having a frame, the inventor, it is probable, fastened to his clothes the stick on which the meshes were made, or on which he knitted; but afterwards employed a sheath to perform that service. Thus, most of the Wirtemberg stocking-knitters, at present, knit with two wires and a sheath. Hence their stockings, like those wove in the stocking-loom, are sewed or have a seam behind.

Among the master-pieces of the Wirtemberg stocking-knitters, a carpet of beautiful flower-work and figures is mentioned in their regulations.* It is milled, and when spread out measures three ells in length and one and a half in breadth. It is probable that some person, by repeated trials, found out the method of knitting in a circular

* Page 16.

form ; but for this purpose several wires would be necessary. In order to render this improved art of knitting similar to the old method, the meshes were so arranged that the stockings seemed to have a seam, for which however there was no occasion. The sheath, which was fastened to the left side, was long retained by our knitters ; but as it retarded the work, and as it was necessary to keep the body in an uneasy posture, injurious to the growth of young and industrious persons, means were devised to dispense with it and to knit with much less restraint. In this manner, the art was brought to its present perfection ; and it must excite no small astonishment when it is considered that it was invented all at once, and by one person.

The invention of the stocking-loom is worthy of more admiration, when one reflects that it was not a matter of accident, like most of the great discoveries, but the result of talents and genius. It is a machine exceedingly complex, consisting of two thousand parts, which, in a moment almost, can make two hundred meshes or loops, without requiring much skill or labour in the workman. I should here insert what Perrault has said with great propriety on this subject, had I not already given it in the fifth edition of my Introduction to Technology.* I shall only observe, that there are few descriptions of this machine ;

* Anleitung zur Technologie, p. 100.

and that those published do not fully answer the purpose.* My object is merely the question, Who was the inventor, in what country, and at what time did he live? and I can say, that after the most diligent research, it does not appear subject to any doubt, as some have hitherto believed.

Under the administration of Cromwell, the stocking-knitters of London presented a petition, in which they requested permission to establish a guild. In this petition they gave to the protector an account of the rise, progress, and importance of their art or trade; and there can be no doubt, that this well-written document contains the oldest authentic information in regard to this invention,

* The descriptions of the stocking-loom illustrated by figures, with which I am acquainted, are as follows: The first, but most imperfect, is in *Nottinghamia vetus et nova, or An historical account of the town of Nottingham*. By Charles Deering. Nottingham, 1751, 4to. in the Appendix, p. 364. The next is to be found in the second volume of the *Encyclopédie*, printed at Paris, 1751, fol. p. 94—113. The figures are in the first volume of the second part of the *Planches*, and make eleven plates, eight of which are full sheets. The third is in Jacobson's *Schauplatz der zueg-manufacturen*, Berlin 1776, 8vo. p. 515. The description is better than the preceding, but the figures are bad. The fourth is in *Sprengel's und Hartwig's Handwerken und Kuusten. Fünfzehnter Sammlung*, p. 90, Berlin 1777, 8vo; for the most part an extract only from the before-mentioned works, but with additions: the plates, however, are bad. The fifth is that given by Roland de la Platiere in *Encyclopédie methodique des manufactures, arts, et metiers*, tom. i. Paris 1785, 4to. p. 3; but the figures relate chiefly to new alterations made in the loom. The sixth is in *J. P. Lehmann Beschreibung des Strumpfstrikerstuhls*, Hannover, 8vo. 1802. This I have not seen.

which was then scarcely fifty years old. On that account, every thing must have been fresh in the memory of those by whom it was drawn up; every circumstance could easily be examined; and the petitioners must have been sensible that their misrepresentations, for which however they had no reason, could easily be contradicted. However unimportant my research may appear, it gave me much pleasure to find a copy of this petition in Deering's Account of Nottingham, already mentioned, in which the author has collected many authentic circumstances from the records of that town, where the loom was first employed and enriched many families, and whence the use of it was spread all over England and Europe.*

From these it appears that the real inventor was William Lee, whose name in the petition is written Lea, a native of Woodborough, in Nottinghamshire, a village about seven miles distant

* Nottinghamia vetus et nova, p. 90 and 301. The following passage occurs in the petition, p. 302: Which trade is properly stiled framework-knitting, because it is direct and absolute knit-work in the stitches thereof, nothing different therein from the common way of knitting (not much more antiently for publick use practised in this nation than this), but only in the numbers of needles, at an instant working in this, more than in the other by an hundred for one, set in an engine or frame composed of above 2000 pieces of smith, joiners, and turners work, after so artificial and exact a manner that, by the judgement of all beholders, it far excels in the ingenuity, curiosity, and subtilty of the invention and contexture, all other frames or instruments of manufaeture in use in any known part of the world.

from the town of Nottingham. He was heir to a considerable freehold estate, and a graduate of St. John's college Cambridge. It is reported, that being enamoured of a young country-girl, who during his visits paid more attention to her work, which was knitting, than to her lover and his proposals, he endeavoured to find out a machine, which might facilitate and forward the operation of knitting, and by these means afford more leisure to the object of his affection to converse with him. Love indeed is fertile in inventions, and gave rise, it is said, to the art of painting; but a machine so complex in its parts and so wonderful in its effects, would seem to require longer and quieter reflection, more judgement, and more time and patience, than can be expected in the case of those who are violently in love. But even if the cause should appear problematical, there can be no doubt in regard to the inventor, whom most of the English writers positively assert to have been William Lee.

Aaron Hill seems to make the stocking-loom younger, and relates the circumstance in the following manner. A student of Oxford was so imprudent as to marry at an early period, without money and without income. His young wife, however, was able to procure the necessaries of life by knitting; but as the natural consequences of love, an increase of family, was likely to render this soon insufficient, the husband invented a machine

by which knitting could be performed in a speedier and more profitable manner. Having thus completed a stocking-loom, he became by its means a man of considerable wealth.* If the relation here given be true, this premature marriage might be called, rather a stroke of genius, than an act of folly, as in many instances is the case. But Hill, in his account, gives neither names, date, nor proofs; and as he seems to have formed it from an imperfect remembrance of what he had heard or read in regard to Lee, it is not worthy of further examination.†

Deering says expressly, that Lee made the first loom in the year 1589; and this account has been adopted by Anderson and most of the English writers. In the stocking-weavers' hall, at London, is an old painting, in which Lee is represented pointing out his loom to a female knitter, who is standing near him; and below it is seen an inscrip-

* This account may be found in *An Account of the rise and progress of the Beech-oil invention*, By Aaron Hill, Lond. 1715. 8vo. p. 10. This small work was not known to Haller, else he would have mentioned it in his *Biblioth. botan.*

† Equally unworthy of credit is the following account, which may be found under the word *Stocking*, in Chambers's *Cyclopædia*, by Rces, Lond. 1783. 4 vol. fol. The editor, after relating the invention of Lee, for which he refers to the *Bibliotheca topograph. Britannia*, no. 7, says: This account of the invention, he adds, is most generally received, though it has also been attributed to a *Mr. Robinson*, curate of Thurcaston, in Leicestershire. The first frame, we are told, was brought into Hinckley, before the year 1640, by *William Iliffe*.

tion with the date 1589, which was the year of the invention.* Other accounts make it somewhat later. Thus Howell, after relating that Queen Elizabeth obtained the first stockings in 1561, says that thirty-nine years after the loom was invented by Lee, in which case the period would be 1600.† In the petition of the stocking-knitters it is stated, that the loom, at that time, had been found out about fifty years. It is to be regretted that this document has no date; but as Cromwell reigned from 1653 to 1658, the invention would fall in the beginning of the seventeenth century. It is more probable, however, that it belongs to the end of the sixteenth.

* Von Uffenbach says, in his *Reisen*, ii. p. 571, that he saw the painting. The inscription may be found in *A New View of London*. This work, which was printed at London, in 1708, in two octavo volumes, I have not been able to procure; but Mr. Beneke, our librarian, to whose extensive knowledge of the English literature I have been often indebted, showed me the inscription in a *Survey of London*, by Robert Seymour, Lond. 1733. fol. vol. i. p. 603: In the year 1589 the ingenious William Lee, Master of arts of St. John's college Cambridge, devised this profitable art for stockings (but being despised went to France) yet of iron to himself, but to us and others of gold; in memory of whom this is here painted.

† In his *History of the world*, already quoted, p. 171: Nine and thirty years after was invented the weaving of silk stockings, west-coats, and divers other things, by engines, or steel looms, by William Lee, Master of arts of St. John's college in Cambridge, a native of Nottingham, who taught the art in England and France, as his servants in Spain, Venice, and Ireland; and his device so well took, that now in London his artificers are become a company, having a hall and a master, like as other societies.

Lee instructed his brother James in the use of the loom, and took apprentices and assistants, with whom he carried on business, for some years, at Calverton, a village five miles distant from Nottingham. On this account, Calverton has by some been considered as his birth-place. He showed his work to Queen Elizabeth, who died in 1603, and requested from that princess some support or remuneration; but he obtained neither, and was impeded rather than assisted in his undertaking. Under these circumstances, Lee accepted an invitation from Henry IV king of France, who had heard of this invention, and promised to give a handsome reward to the author of it. He, therefore, carried nine journeymen and several looms to Rouen in Normandy, where he worked with great approbation; but the king being assassinated, and internal commotions having taken place, Lee fell into great distress, and died soon after at Paris. Two only of his people remained in France, one of whom was still alive when the before-mentioned petition was presented to Cromwell. Seven of them returned to England; and these, with a person named Aston, who at first was a miller at Thoroton, the place of his birth,*

* Of this Aston the following account is to be found in *The Antiquities of Nottinghamshire*, by Robert Thoroton, London 1677, fol. p. 297: At Calverton was born William Lee, Master of arts in Cambridge, and heir to a pretty freehold here; who seeing a woman knit, invented a loom to knit, in which he or his brother James

but afterwards an apprentice of Lee, by whom he had been left behind in England, where he made some improvements in the loom, laid the foundation of the stocking-manufactory in that country. The number of masters increased there in the course of fifty years so much, that it was found necessary to unite them into one guild; for which Cromwell, however, in consequence of reasons not known, refused the proper sanction; but in 1663 they received letters patent, which gave them certain privileges to the extent of ten miles round London.

In the year 1614, the Venetian ambassador, Antonio Correr, persuaded an apprentice, Henry Mead, by the promise of five hundred pounds sterling, to go with a loom to Venice for a stated time, and to teach there the use of it. Mead met with a favourable reception in that city, and was much admired; but the loom becoming deranged, and no person at Venice being able to repair it, when the time of his agreement was expired, he returned to England. The Venetians had not resolution enough to continue the attempt; and sent the damaged loom, together with some bad imitations of

performed and exercised before Queen Elizabeth, and leaving it to
 - - - Aston his apprentice, went beyond the seas, and was thereby
 esteemed the author of that ingenious engine, wherewith they now
 weave silk and other stockings. This - - - Aston added some-
 thing to his master's invention; he was some time a miller at Thoro-
 ton, nigh which place he was born (Ex relatione Johannis Story,
 gen.)

it, to London, where they were sold for a mere trifle.—Such is the account given in the petition before mentioned.

Zano, however, an Italian writer,* asserts, on the authority of information preserved in manuscript among family documents, that Correr carried two stocking-weavers with looms to Venice; that he immediately placed under them four apprentices, and when they went back to England sent with them a boy, who returned to Venice well instructed in the art, and who continued to carry on business there with great success. Giambattista Carli of Gemona, a smith who worked in steel, saw the loom at Venice, which had been made after the model of those brought from England and sold to Francesco Alpruni of Udina. In a short time a great many stockings were manufactured there, and sent for sale, chiefly to Gradisca in Austria. But, in consequence of the poverty of the Venetian stocking-knitters, an order was issued that Carli should make no more looms; and this productive branch of business at Udina was so much deranged, that the masters removed with their looms to Gradisca, where the inhabitants of Udina were obliged to purchase such stockings as they had occasion to use.

Some years after the stocking-loom had been in-

* Dell' Agricoltura, dell'arti, e del commercio. Lettere di Antonio Zanon. In Venezia 1763. 8vo. ii. p. 134.

troduced at Venice, Abraham Jones, who understood stocking-weaving and the construction of the loom, though never regularly taught, went with some assistants to Amsterdam, where he worked on his own account two or three years, till he and his people were carried off by a contagious disease. The looms, because no one could use them, were sent to London and sold for a low price. In the petition to Cromwell the masters state, with great satisfaction, that in this manner the trade had remained in England, and, that it may be exclusively retained in their native country, they wish for the establishment of a privileged company.

It appears to me, therefore, proved beyond all doubt, that the stocking-loom was invented by William Lee, an Englishman, about the end of the sixteenth century; and this is admitted by some French writers, such as Voltaire* and the editor of the first *Encyclopédie*, whom the author of the *Encyclopédie méthodique*, however, finds fault with. Other French writers, who are the more numerous party, wish to ascribe the honour of this invention to one of their own countrymen; but the proofs they bring are so weak that they scarcely deserve notice. Savary, perhaps, in the first person who

* Le Siècle de Louis XIV, according to the Berlin edition of 1751. 12mo. ii. p. 118: On sait que le ministère acheta en Angleterre le secret de cette machine ingénieuse, avec laquelle on fait les bas dix fois plus promptement qu' à l'aiguille.

publicly ventured to support this instance of Gallic vanity; at any rate he is quoted by the more modern writers as their authority, when they wish to contradict the English.

According to his account, a Frenchman, of whom however he knows nothing further, invented the stocking-loom; but not being able to obtain the exclusive privilege of using it in his own country, went with it to England. The utility of it being soon discovered there, it was forbidden, under pain of death, to carry the loom or a model of it out of the kingdom. But another Frenchman, respecting whom he is equally ignorant, having seen the loom, the form of it made so deep an impression on his memory, that on his return he copied it exactly; and from this loom all the others used in France and Holland were constructed. Savary adds: did the invention belong to the English, who are accustomed to pay due honour to those who discover useful things, they undoubtedly could tell the name of the inventor, which however they are not able to do. It is very strange that this should be written by a Frenchman, who himself did not know the name of the French inventor, or of the person who carried back the invention. No order to prevent the exportation of the stocking-loom was issued in England so early, else it would certainly have been mentioned in the petition presented to Crom-

well. It was not till the eighth year of the reign of William III, that is, 1696, when looms were every where common, that the exportation of them was forbidden;* probably, because the best were made in England, and it was wished that the gradual improvement of them should be kept secret. The penalty also was not death, but a fine and confiscation of the looms.

Some have endeavoured to give an air of probability to this assertion of Savary, by the relation of an apothecary, in the *Hotel-Dieu*, at Paris. This person is said to have declared, that the inventor was a journeyman lock-smith of Lower Normandy, who gave a pair of silk stockings, his own workmanship, to Colbert, in order that they might be presented to Louis XIV; but as the *marchands bonetiers*, who dealt in articles knit according to the old manner, caused several loops of these stockings to be cut by some of the servants at court, whom they had bribed for that purpose, they did not meet with approbation. The inventor was so hurt by this disappointment, that he sold the loom to an Englishman, and died an old man in the *Hotel-Dieu*, where the apothecary became acquainted with him.† It was necessary to expose the lives of many workmen, and even of some men of learning, in order to bring back a loom to

* Statutes at large, vol. iii. p. 224.

† Journal économique, Décemb. 1767.

France. Romè de la Platiere adds, that he heard at Nimes, that in the time of Colbert a person of that place, named Cavellier, carried the first loom to France; and that, in the course of fifty years, the number of the looms in that town and neighbourhood increased to some thousands. It appears much more certain that the stocking manufactory, as Savary asserts, was established at the castle of Madrid in the *Bois Boulogne*, near Paris, in the year 1656, under the direction of John Hindret.

I do not know at what time the first loom was brought to Germany; but it is certain that this branch of manufacture was spread, chiefly by the French refugees who sought shelter in that country, after the revocation of the edict of Nantes. Winkelmann says expressly, that they carried the first looms to Hesse.* This is not at all improbable, because our stocking manufacturers give French names to every part of their looms, as well as to their different kinds of work. Becher boasts of having introduced the loom at Vienna, and of having first constructed looms of wood.† At present, many wooden ones are made at Obernbau,

* Beschreibung von Hessen, 1797. i. p. 391.

† Narrische Weisheit und weise Narheit. Franckf. 1688. 12mo. p. 17. I shall in the last place remark, that Leibnitz, in a letter to Veget, in *Uhle's Sylloge nova Epist. varii arg.* iii. p. 82, through a lapse of memory calls the loom, of which he wishes for an accurate description, a Scotch invention.

in the Erzgebürge, and sold at the rate of twenty-eight dollars; whereas iron ones, of the most inferior kind, are sold in Vogtland for sixty or seventy:



H O P S.

MY object, in this article, is not to give a history of beer, because for that purpose it would be necessary to define accurately the different kinds of grain mentioned in the writings of the Greeks and the Romans; and this would be a tedious, as well as difficult, and to me a very unpleasant labour; as I should be obliged to controvert a great many received opinions. I shall only endeavour to answer the question, Where and at what time did hops begin to be used as an addition to beer? This subject has already engaged the attention of two learned men,* whose researches I shall employ and enlarge by my own observations.

Hops, at present, are so well known, that a

* One of these, in particular, is J. F. Trésenreuter, in *A Dissertation on Hops*, which was printed at Nuremberg, 1759, 4to, with a preface by J. Heumann, but without the author's name. From this has been taken the whole of what is said in the article *Hops* in the German Encyclopædia, though the editor, professor Murray, no doubt made some additions. I mention this, though I am under no obligation to that Encyclopædia, because many things have been inserted in it from my collections towards a History of inventions, without any acknowledgement.

formal description of them would be superfluous. I think it necessary, however, for the sake of perspicuity to state what follows.* This plant at present grows wild in the greater part of Europe, and in Germany is common in the hedges and fences. It clings to the trunks of trees, and often climbs round poles, if long enough, to the height of twenty or thirty feet. It is almost every where rough and sharp to the touch, and sometimes clammy. The leaves are generally divided into three and often into five indented lobes; but the upper ones are shaped like a heart, and undivided. The male plants bear flowers, like those of the currant-bush or of the male hemp; the female plants produce their flowers in cones, which are not unlike those of the fir, except that the latter are woody, while the former are foliaceous. These cones only are used for beer; on that account the female plants alone are cultivated, and from these they are picked and dried as soon as they begin to become pulverulent. They are transplanted or propagated by means of seed-buds, in hop-grounds properly prepared, where the cones become larger and better than those of the wild plants, which however are not entirely useless. They are added to beer to render it more palatable, by giving it an agreeable bitter taste; and, at the same time, to make it keep longer; and it must indeed be confessed, that

* See Kerner's *Abbildung der oekonomischen pflanzen*, tab. 433.

of the numerous and various additions which since the earliest periods have been tried, none has better answered the purpose, or been more generally employed.

Among the botanists of the last two centuries, who perused the writings of the Greeks and the Romans, and endeavoured to discover those plants which they meant to describe, many imagined that they found in them hops. But when one takes the trouble to examine, without prejudice, their opinions, nothing appears but a very slight probability; and some even of these learned botanists, such as Matthioli and others, have acknowledged, that it cannot be proved that the Greeks and the Romans were acquainted with our hops.

The plant which perhaps has been chiefly considered as the hop, is the *smilax aspera** of Dioscorides, † the same no doubt as that described by Theophrastus, under the name of *smilax*, without any epithet. ‡ That the description agrees, for the most part, with our hops cannot be denied; but it is equally true that it might be applied, with no less propriety, to many other creeping plants, and certainly with the greatest probability to that which in the Linnæan system has retained the name *Smilax aspera*. What the Grecian writer says of the fruit is particularly applicable to this plant; but,

* Σμιλαξ τραχεια.

† Dioscor. iv. 244. p. 294.

‡ Histor. Plantar. iii. 18. p. 267.

on the other hand, it differs from the fruit of the hop.

One might with more probability conjecture that hops occur in Pliny,* under the name *Lupus salictarius*. But the whole of what he says of this plant is, that it was esculent, and grew in the willow plantations. This is undoubtedly true of hops, for that the young shoots are eaten in spring as salad is well known; but the name *lupus* alone has induced the commentator to apply all this, though equally applicable to other plants, to our hop, which at present is called *lupulus*. Much more unfounded is the conjecture, that the hop is that wild plant which, according to the account of Cato, was used as fodder for cattle.† But the word, in manuscripts is differently written, and consequently uncertain; besides, there are many plants which might be employed in the place of straw.

It is certainly possible that hops might have been in use among the northern nations, at the time of these writers, without their having any knowledge of them. For the Romans were acquainted with beer only from the accounts given

* *Histor. natur.* xxi. 15. sect. 50.

† *Cato de re rustica*, xxxvii. p. 55. Unfortunately the reading in Pliny, xvii. 9. sect. 6, where he quotes the words of Cato, is equally uncertain. What Saumaise, *de homonym.* cap. 63, p. 80, says upon that passage affords no assistance.

of the Germans and their manners,* and they considered that beverage merely as an unsuccessful imitation of their wine. But I agree in opinion with Conring,† Meibomius, and others, that hops were not used till a much later period. The names *humulus* and *lupulus* also are of no great antiquity. The former is the oldest, and seems to belong to the people who first added this improvement to beer. The *humble* and *humle* of the Swedes and Danes; the *chumel* of the Bohemians; the *houblon* of the French and the Spanish, Hungarian and Persian appellations all seem to be derived from the same origin, as well as the Latin names of later times: *humelo*, *humolo*, *humulo*, *humlo*. *Lupulus* does not occur till a much later period. The German word, which the English also have adopted, appears first to have been written *hoppe*, from which was formed afterwards in High German *hopfen*, by converting, as it commonly does, the double *p* into the harder *pf*. Thus from *toppe* it has made *topf*, and from *koppe*, *kopf*, &c. As far as I know, this word is found, for the first time, in a dictionary which seems to be of the

* Most of the passages in ancient authors which relate to beer have been collected by Dithmar on *Tacitus de moribus German.* cap. 23. p. 138; and by Meibom *de cervisiis veterum* in *Gronovii Thesaurus antiq. Græcar.* ix. p. 548.

† Conring *de habitu corporum Germanic.* Helmstadii 1666. 4to. p. 79.

tenth century,* and which has *Timalus*, *Hoppe* and *Brandigabo Feldhoppe*. According to my conjecture, *timalus* has been erroneously printed for *humulus*; but in regard to *brandigabo*, I can give no explanation. It is derived perhaps from *brace* or *bracium*. The former was known to Pliny;† and the latter occurs in the same dictionary along with the translation, malt.

No mention is made of hops either in Walafrid Strabo, who died in 849, or in Æmilius Macer, who cannot have lived earlier than the year 850; in the laws of the old Franks, in which beer and malt are often mentioned, nor in the *capitulare de villis imperatoris*, which are ascribed to Charles the Great. Had beer been then used and brewed in Germany, it would certainly have been, at any rate, mentioned by the emperor. Haller says,‡ it is related by Isidorus that the experiment of adding hops to beer was first made in Italy. Were this the case, it would be the oldest mention of that circumstance, for Isidorus died in the year 636. It is, however, not only highly improbable that the use of hops should be discovered in Italy, which is a wine country, but it can be proved to be false. Not the smallest notice of it is to be

* This valuable monument of antiquity is to be found in (Nyerup) *Symbolæ ad literaturam Teutonicam, sumtilibus A. F. Suhm*. Havniæ 1787, 4to. p. 331. 404.

† Plin. lib. xviii. cap. 7.

‡ Histor. Stirpium, ii. p. 290.

found in the whole work of Isidorus; and in the *Bibliotheca Botanica*, when Haller had the book before him and extracted from it many things remarkable, he does not repeat this assertion.* The passage which has given rise perhaps to this error, appears to be that where the author describes a kind of beer called by him *celia*, and where the germination of corn, the shooting of malt, and the sweet wort made from it, together with its fermentation, are clearly mentioned, but not hops.† Some one perhaps thought that hops also ought to be supposed in this passage, else beer would not acquire that strong taste and intoxicating quality spoken of by Isidorus, who very properly ascribes both to fermentation. The same account has been repeated by Vincentius,‡ without any change or addition. But as Isidorus scarcely contains any thing which is not borrowed from earlier writers, I endeavoured to discover the source of that information, and at length found it in the history of Orosius,§ who, as is well known, lived in the fifth century.

* Biblioth. botan. i. p. 161.

† *Celia* a calefaciendo appellata. Est enim potio ex succo tritici per artem confecta. Suscitatur enim igne illa vis germinis madafactæ frugis; ac deinde siccatur, et post in farinam redacta, molli succo admiscetur, quo fermentato sapor austeritatis et ealor ebrietatis adjicitur, quæ fit in iis partibus Hispaniæ, cujus serax vini locus non est. *Originum* lib. xx. 3. p. 487.

‡ Vincent. Bellovac. *Speculum naturale*, lib. xi. 109. p. 856.

§ *Orosii hist.* lib. v. cap. 7. p. 370, edit. Coloniae, 1582, 8vo.

In the Latin translation of the works of the Arabian physician Mesue* is a description, but, as is commonly the case, a defective one, of a creeping plant, with rough indented leaves, under the name of *lupulus*, which indeed corresponds exceedingly well with our hops. The cones, in particular, are exactly described. The author, however, speaks there only of the medicinal qualities of the plant, and makes no mention of its application to beer. Mesue lived about the year 845, consequently is the first who uses the term *lupuli*. But we have only a wretched old translation of the writings of this physician. Who knows what the name of the plant was in the original? Is it not probable that the word *lupulus* comes only from the translator? This passage, therefore, can prove nothing.

It is, however, certain that hops were known in the time of the Carolingian dynasty, † for a letter of donation by King Pepin speaks of *humolaria*, which without doubt must have been hop-gardens. ‡ In like manner Adelard, abbot of Cor-

* Joh. Mesuæ Opera. Venetiis 1589, fol. De Simplicibus, cap. 24. p. 45, 46. The passage is thus translated by Sylvius: Quarta species volubilis est foliis citreoli modo asperis. Flore foliaceo squammatim compacto (quod sicut *ampullæ adherentes* male vertit interpres) lupulus vocatur.

† What is said in *Algem. Weltgeschichte*, liii. p. 481, that hops were first used in the eleventh century, is therefore undoubtedly false.

‡ Du Cange and Tresenreuter have quoted the word from *Doublet hist. Sandiony*. i. 3. p. 669.

bey, in the year 822, freed the millers belonging to his district from all labour relating to hops, and on this occasion employed the words *humlo* and *brace*, by which is to be understood corn and malt used for beer.* In the Frisingen collection of ancient documents, there are many which were written in the time of *Ludovicus Germanicus*, consequently in the middle of the ninth century; and in some of these, hop-gardens, which were then called *humularia*, are mentioned.† In the tax registers of the two following centuries, among the articles delivered to churches and monasteries, *modii* and *moldera humuli* are very often named.‡ Hop-fields and the delivery of hops occur much oftener in the thirteenth century, under the appellations *humuleta*, *humileta*, and *humularia*.§ In the *Sachsenspiegel*|| and the municipal law of Magdeburg (*Weichbildsrechte*),¶ there is an order in regard to the hop-plants which grew over hedges. I shall omit the still more numerous instances

* Tresenreuter quotes the word from *Dacherii Spicileg.* tom. i. p. 586.

† In C. Meichelbeek's *Histor. Frising.* I instrument. p. 359.

‡ See the works quoted by Tresenreuter, p. 15: *Pezii Thesaur. Aucddot.* i. P. 3. p. 68. 72. *J. C. Harenberg Histor. Gaudersheim.* p. 1350. *Eccard Origin. Saxon.* p. 59. *Leukfeld Antiquit. Poeldens.* p. 78.

§ F. G. de Sommersberg *Silesiac. rer. scriptor.* i. p. 829. 857. 801. *Von Ludwig reliq. histor.* v. p. 425. *Tresenreuter*, p. 20, quotes later information in the fourteenth century.

|| L. ii. art. 52.

¶ Art. 126.

where they occur in the fourteenth century, as well as the proofs that hops were then cultivated in many parts of Germany;* and it is perhaps true, as said by Möhsen, and after him by Fischer, on whose bare word, however, I do not entirely rely, that many towns in Germany were indebted for the great sale of their beer to the use of hops (which undoubtedly appears to be a German invention), and to their peculiar goodness. However, it is certain that this method of seasoning beer was adopted at a much later period by our neighbours the English, Dutch, Swedes, and others.

If the two passages above quoted, where the word *lupuli* occurs, be rejected because they are doubtful, I must consider this name of hops to be more modern than the word *humulus*; and if this be true, it is impossible to believe, with Du Cange, that the latter was formed from the first by throwing away the initial letter. As yet I had not found the name *lupulus* given to hops earlier than the thirteenth century.

About this time lived Simon of Genoa, commonly called *Johannes de Janua*, or *Januensis*, who also had the surname of *Cordus*. He was physician to Pope Nicholas IV; afterwards chaplain and sub-deacon to Pope Boniface VIII; and therefore flourished at the end of the thirteenth century. Of his writings none is better known, or

* Möhsen Geschichte der Wissenschaften in der Mark Brandenburg. Berlin, 1781, 4to. p. 210.

was formerly more esteemed, than a book in which he describes, in alphabetical order, all the substances then used in medicine, and on which, as he says himself, he was employed thirty years. In this dictionary, which is commonly considered as the first of the *materia medica*, there is an article under the head *lupulus*, copied however from the before-mentioned Latin translation of Mesue, but with the addition, that this plant by the French and Germans is named *humilis*, and that the flowers of it were used in a beverage which he calls *medo*.* This Italian, however, does not seem to have been properly acquainted with the subject; for he tells us himself,† that under the name *medo*, or mead, is understood a beverage made of diluted honey, for which hops are never employed. In Italy also, at that time, hops were not in use. About the same period Arnold de Villanova, in his commentary on the work on regimen, published by John of Milan, in the name of the celebrated

* I have before me, from the library of our university, an edition printed at Venice in 1514, fol. under the title of *Simonis Januensis opusculum, cui nomen Clavis sanationis*. Page 40, d. *Lupulus est secundum Heben Mesue species volubilis, et est habens folia similia foliis vitis asperrima; flos ejus est sicut ampullæ adherentes, simul et ipsa planta serpit in sepibus, a Gallis et Theutonicis humilis vocatur, ejus florem in medone ponunt*. For an account of the author and his works, which are now scarce, see Haller's *Bibliotheca botan.* i. p. 222. *Bibl. pract.* i. p. 437. The above passage is inserted in *Matthæi Silvat. Opus pundectar.*

† Page 64. c. Article *Ydromel*.

school of Salerno, mentions *lupuli*, and the use of them in brewing beer.*

Professor Tychsen, to whose friendship I have been frequently indebted for assistance in my researches, suggested to me the conjecture that *lupulus* perhaps is derived from *lupinus*, because Columella says that the bitter seeds of this plant were added, in Egypt, to beer in order to moderate its sweetness. This use is confirmed also by G. W. Lorsbach, from the Arabic historian Ebn Chalican.† At any rate, this proves that in Egypt at that time bitter things began to be added to beer. It is also well known, that in Italy lupines were rendered fit for the use of man as well as of animals, by macerating them in water;‡ and I am of opinion, that on this account

* *Medicina Salernitana cum Arnoldi Villanov. exegesi* 1594, 12mo. without the name of the place, p. 226: *urinam provocat; quæ proprietas claris maxime convenit cerevisiis, quibus plurimum incoctum est lupuli, qualis est Embecensis. Ea namque ob lupuli copiam celerrime penetrat et urinam provocat.* Was the *cerevisia Embecensis* our Einbeck beer, which formerly indeed had a very extensive sale? Those who wish to be acquainted with the history of this book may consult *Giannone's History of Naples*, ii. p. 128.

† *Jam siser, Assyrioque venit quæ semine radix,*

Secta que præbetur madido sociata lupino,

Ut Pelusiaci proritet pocula zythi. Columella, x. 116.

The root (radish?) therefore was sliced and put into the Egyptian beer along with steeped lupines, in order to render it more palatable. *Lorsbach über eine stelle des Ebn Chalican.* Marburg, 1789, 8vo. p. 21.

‡ *Plin. xviii. 14. sect. 36: Maceratum calida aqua homini quoque*

Varro required water to be in the neighbourhood of a farm-yard.* Lupines softened in water are still employed for making dough. But if *lupulus* was formed from *lupinus*, it must however be proved that the use of it for beer was common beyond the boundaries of Egypt. Even, if we admit with Schöttgen, that the poet employs *zythum* for beer in general, this beverage was never used in Italy, and I have met with no other mention of lupines in brewing.

In the breweries of the Netherlands, hops seem to have been first known in the beginning of the fourteenth century; for about this time we find many complaints that the new method of brewing with hops lessened the consumption of *gruit*, and also the income arising from *gruitgeld*. The word *gruit* seems to have many meanings: in the first place it signifies malt; but though I formerly considered this as the proper meaning, and though some approved my opinion,† I must confess that,

in cibo est. *Geopon.* ii. 39. p. 189, and the passages quoted there by Niclas: *Galen. de fac. simpl. med.* vi. 144: and *Alim. fac.* i. 30.

* *De re rustica*, i. 13. 3: in cohorte exteriori lacum esse oportet, ubi maceretur lupinum, item alia quæ demissa in aquam ad usum aptiora fiunt.

† W. G. von Moser in *Forstarchiv*, xij. p. 24, where he has inserted my history of floating wood, accompanied with some observations of his own. He quotes from an imperial diploma of the year 1332: *fermentum quod vulgariter dicitur Grut, braxare*. But I will not employ this as a proof that *grut* was a substance used to promote fermentation; for some centuries ago *fermentum* signified beer or any other fermented liquor.

on further examination, I am not able fully to prove it. In the second place, it signified a certain tax paid at each time of brewing. Thirdly, a certain addition of herbs used for beer in the fourteenth century: and in the last place, the beer brewed with it was itself sometimes called *gruit*.

That this word always denoted malt is impossible; for it is said that after hops were introduced, less *gruit* was used and sold than formerly had been the case. But how could hops be employed in the stead of malt? John, bishop of Liege and Utrecht, complained to the emperor Charles IV, that for thirty or forty years a new method of brewing, that is to say, with the addition of a certain plant called *humulus* or *hoppa*, had been introduced, and that his income arising from *gruit-geld* had been thereby much lessened. The emperor, therefore, in the year 1634, permitted him, for the purpose of making good his loss, to demand a *groschen* for each cask of hops; and this right was confirmed to bishop Arnold by Pope Gregory.* By this and similar accounts I am induced

* This document may be found in *Matthæi Analecta veteris ævi*, iii. p. 260. It has been inserted also entire by Tresenreuter, p. 34. I shall however only transcribe the few lines which relate to this subject: Nunc autem de novo triginta vel quadraginta annis nondum elapsis novus modus fermentandi cervisiam, videlicet per appositionem cujusdam herbæ, quæ humulus vel hoppa vocatur, per incolas in tantum invaluit, ut episcopus Trajectensis in magna parte emolumenti, quod ex distributione fermenti sibi cvenire consueverat, diminutionem patiat. More in regard to the word *gruta* may be found

to conjecture, that a beverage composed of different herbs was at that time prepared, and that the sale of this mixture and of *gruit* was converted into a so-called *regale*. Nay, it almost appears that *gruit* was a fermenting substance, indispensably necessary to beer, instead of the yeast used at present.

According to every appearance the ancient beer could not be long kept; and beer fit to be preserved seems to have come into use after the introduction of hops. The oldest writers who treat of the good and bad effects of hops, reckon among the latter, that they dried up the body and increased melancholy; but, among their good qualities, they praise their property of preserving liquors from corruption.* It was soon remarked also, that the keeping of beer depended a great deal on the sea-

in *Matthæus. Jungii Histor. comitatus Bentheimensis*, Hannoveræ 1773, 4to. ii. p. 84, deserves likewise to be consulted. Also Du Cange, under the word *Grutt* and its derivatives: and *Anton's Geschichte der Deutschen Landwirthschaft*, 2. p. 285; and 3. p. 326.

* St. Hildegard in *Physiæ* lib. ii. cap. 74: *Humulus calidus et aridus est, sed tamen modicum humiditatis habet, et ad utilitatem hominis non multum valet, quia melancholiam crescere facit, et mentem hominis tristem parat, et viscera ejus ariditate sua gravat. Sed tamen amaritudine sua quasdam putredines in potibus prohibet, quibus additur, ita quod tanto diutius durare possint - - - Petro Crescentio d'agricollura. In Venetia 1542, 8vo. lib. vi. cap. 56. L'umlo cioe ruvistico overo Vertico loquale fa fiori quali per la loro secchezza si conservano lunghissimamente in loro vertu, si che commune opinione e giamai non si corrompono - - - et conserva da corutione il licori ne quali si mescola. This writer lived in the thirteenth century.*

son in which it was brewed ; for Mr. Anton quotes from the Ilm statutes of 1350, that people were permitted to brew only from Michaelmas to St. Walpurgis' day ;* at other times it was forbidden, under certain penalties. At that period various kinds of beer seem to have been in use, and perhaps became fashionable in the stead of wine, coffee, and tea. Thus Mr. Anton quotes, from a Hervord document of the year 1144, *cervisia mellita* and *non mellita*. However, even at present, honey is used for many kinds of beer ; such for example as that brewed at Nimeguen, which has an extensive sale under the name of *moll*, a word derived no doubt from *mollig*, mild ; which is applied also to wine. In the same manner the English use liquorice.†

In England, the use of hops seems to have been introduced at a much later period ; but it is said that they were at first considered as a dangerous production, and that the planting of them was forbidden in the reign of Henry VI, about the middle of the fifteenth century.‡ This I will not venture to deny, though I very much doubt it. I have found no proof of it in any English writer, and I have searched in vain for the prohibition among the orders of that prince, in which however there

* A celebrated lady of the eighth century, said to have been a native of England, but canonised in Germany, where she was abbess of a nunnery at Heidensheim in Thuringia.—TRANS.

† Beckmann's Waarenkunde, i. p. 408.

‡ This has been said by a writer in the *Götting. gel. Anzeigen*, 1778, p. 323.

occurs one in regard to malt.* On the contrary many English historians assert that the use of hops was first made known in England by some people from Artois, in the reign of Henry VIII, or about the year 1524.† It is, nevertheless, true that this sovereign, in an order respecting the servants of his household, in the twenty-second year of his reign, that is, in 1530, forbade brewers to put into ale hops and sulphur.‡ But perhaps his majesty was not fond of hopped beer. Even at present, most of the dictionaries call ale, beer brewed without hops; and an English physician says expressly, that the difference between ale and beer is, that hops are not employed for the former.§ But according to the English instructions for brewing, hops are required for ale also.||

In the English laws hops are mentioned, for the first time, in the fifth year of the reign of Edward VI, that is, in 1552, at which period some privileges were granted to *hop-grounds*. The cultivation of hops, however, which, like the art of brewing,

* Statutes at large, vol. i. p. 591.

† Husbandry and trade improved, being a collection by J. Houghton. London 1727, 8vo. ii. p. 457. *Anderson's Hist. of Commerce*.

‡ *Archæologia*, or miscellaneous tracts relating to antiquity, vol. iii. p. 157: Injunction to the brewer, not to put any hops or brimstone into the ale.

§ *Hamburgisches Magazin*, xxxiii. p. 465.

|| For example, in *Crutwel's Evcry man his own brewer*. London 1768, 8vo. p. 80.

has in England been carried to the greatest perfection, was very limited even in the beginning of the seventeenth century; for James I, in the fifth year of his reign, that is, in 1603, found it necessary to forbid, under severe penalties, the introduction and use of spoilt and adulterated hops. At that time, therefore, England did not produce a quantity sufficient for its own consumption.

In Sweden, at least in the fifteenth century, hops seem not to have been very common;* for at that time sweet gale (*myrica gale*) was employed for beer; and so generally, that King Christopher, in 1440, confirmed the old law, that those who collected this plant before a certain period, on any common or on another person's land, should be subjected to a fine. A similar punishment, however, was appointed for the too early picking of hops; and the cultivation of them was so strongly enforced, that every farmer who had not forty poles with hops growing round them was punished, unless he could show that his land was unfit for producing them.†

* Instead of this plant, which grows wild in Sweden, another wild plant in Germany called *post*, and in the botanical system *ledum palustre*, was in old times used for beer by poor people in its stead; but it occasioned violent headachs. See *Linnæi Amœnitat. acad.* viii. p. 270.

† This law is said to have been made so early as the reign of Magnus Smeek; but it was confirmed by King Christopher in 1440, and by the command of Charles IX was printed at Stockholm, in folio, in 1608, in a work entitled *Swerikes Rijkets Landz-lagh*, a

But it was long doubted in Sweden, whether this plant would thrive in the cold climate of that country; in which however it grows wild. In the time of Gustavus I, who became king in 1523, Sweden was obliged to give for the foreign hops it used 1200 *schiffsfunds* of iron, which was about the ninth part of all the iron made in the kingdom. In the year 1558 the king complained, in an edict, that a pound of hops cost as much as a barrel of malt,* and on that account was desirous to en-

copy of which I have now before me from the library of our university. The passage which belongs to this subject stands in *Bygninga Balker*, cap. 49 and 50. p. XL. a: Flar man bryter Pors i annars mans mark - - - Hwar som bryter Pors i almenningiom häradz eller landz fore Olafs-messo, warder takin widh böte sex öra. Hemptar man wille humbla a bya almenningiom, häradz eller landz fore Bartols-messo - - - Hwilkin bonde eller landbo ey hafwer humbla gard medh 40 humbla stänger, som humbla wäxer widher, bote thre öra Svenska hwart aar. The following is the translation given in *Sueciæ regni leges provinciales a Carolo IX. publicatæ et a J. Loccenio in Latin. ling. traductæ*, Holmiæ 1672, fol. p. 104: Si quis myrtum aut myricam colligat in aliena silva, refundat damnum cum 3 marcis, si legitime convictus sit. Si quis difringat myrtum aut myricam in communi territorii vel provinciæ silva ante festum Olai, et in ipso facto deprehendatur, mulctetur 6 oris. Si quis colligat lupulum silvestrem in communi pagi - - - ante festum Bartholomæi, solvat. - - - Quicumque agricola vel colonus non habet hortum lupularium cum 40 perticis ad quas lupulus excreseat. In the *Wäst-Götha Laghbook äppa Carl XI befallning summan-fattat aff Georg. Stiernhielm*, Stockholm 1663, fol. is the following passage in *Fornämur Bolkär*, iii. 5. p. 50. b: Flar man bryter Pors i them skoge han a inkte i, böte. The same words almost occur in *Thingmala Bolkär*, x. 4. p. 82. But the antiquity of these laws is not certainly known. See *Dalin's Geschichte des königreichs Schweden*, ii. 677.

* Tal om Sveriges almänna hushällning under K. Gustaf I

courage the cultivation of the hop-plant. But his exertions were attended with so little effect, that even under the reign of Queen Christina, that is, in the middle of the seventeenth century, all the hops used in the kingdom were imported from Germany, and particularly from Brunswick and Saxony. The queen had some hop-plantations as rarities in her garden; yet the cultivation of hops was begun under this princess, and carried so far that German hop-farmers, who before had been accustomed to travel to Sweden every three years, to receive payment and take new orders, returned very much dissatisfied, and suffered a part of their hop-grounds to run to waste. Under Charles XI, however, who reigned from 1660 to 1697, the cultivation of hops was first brought to a state of considerable improvement.

In the year 1766, Linnæus hazarded a conjecture that hops, spinage, chenopodium, tarragon, and many other garden vegetables were brought to Europe by the Goths, during their periods of emigration, from Russia and particularly the Ukraine, because the old writers make no mention of these plants, and because in those districts they all grow wild at present.* It, however, appears certain, that hops belong to our indigenous plants, as they grow every where wild in Germany, Swisserland,

regering af grefve Nils Bielke. Stockholm 1776, 8vo, p. 18. *Dalins Geschichte*, iii. 1 p. 88.

* Linnæi Amœnitat. Academ. vii. p. 452.

England, and Sweden, and even in countries into which the cultivation of them has never yet been introduced, and where it cannot be supposed that they accidentally became wild by being conveyed from hop-fields and gardens. The want of information in works older than the emigrations of the northern tribes, is no proof that a plant did not then exist. At that time there was no Linnæus to transmit plants to posterity, as Hipparchus, according to the expression of Pliny, did the stars. Such vegetable productions only as had become remarkable on account of their utility or hurtful qualities, or by some singular circumstance, occur in the works of the ancients. Many others remained unknown, or at least without names, till natural history acquired a more systematic form; and even at present, botanists have often the satisfaction to discover some plant not before observed, or at any rate a new kind of mushroom or moss.

Is it probable that the Chinese even are acquainted with our hops? They have a kind of beer made from barley and wheat, which is called *tarasun*; and according to the account of J. G. Gmelin, who purposely made himself acquainted with the preparation of it, hops formed by pressure into masses, shaped like a brick, are added to it.* It is well known that the Chinese have also a kind of tea formed into cakes by strong pres-

* Gmelin's Reise durch Sibirien. Göttingen, 1752, 8vo. iii. p. 55.

sure. Our hops are compressed in the same manner in Bohemia; and in that state will keep without losing any of their strength for fifty years. They are put into a sack or bag of coarse canvass, and subjected to a press. A square sewed bag, each side of which is two ells, contains fifty bushels of hops prepared in this manner; and when any of them are required for brewing, the bag is made fast to a beam, and as much as may be necessary is cut out with an axe. The whole mass is of a brown colour, and has a resemblance to pitch, in which not a single hop-leaf can be distinguished.* Whether the Chinese conceived the idea of employing our common hops for the like purpose, is a question of some importance in regard to the history of them; but at present I am not able to answer it.



BLACK LEAD.

To ascertain how old the use of black lead is for writing might be of some importance in diplomatics, as the antiquity of manuscripts ruled or written with this substance, or of drawings made with it, could then be determined. What little I know on this subject I shall here communicate,

* Mehlers Landwirthschaft des Königreichs Böhmens, iv. 2. p. 45.

in order that others may be induced to collect more.

I allude here to pencils formed of that mineral called, in common, *plumbago* and *molybdæna*, though a distinction is made between these names by the new mineralogists. The mineral used for black-lead pencils they call *reissbley*, *plumbago*, or *graphites*; but under the term *wasserbley* and *molybdæna* they understand a mineral once considered to be the same as the former, but which, however like it may be in appearance, differs from it in being heavier, occurring much seldomer, and containing a new metal, almost of a steel-gray colour, exceedingly brittle, and named also *molybdæna*. *Plumbago*, which is the substance here meant, when exposed to an open fire is almost entirely consumed, leaving nothing but a little iron and siliceous earth. It contains no lead; and the names *reissbley* and *bleystift* have no other foundation than the lead-coloured traces which it leaves upon paper. The darker, finer, and cleaner the lines it makes are, the fitter it is for drawing and writing. These lines are durable, and do not readily fade; but when one chooses, they may be totally rubbed out. Black lead, therefore, can be used with more convenience and speed than any coloured earth, charcoal, or even ink.

It is well known that transcribers, more than a thousand years ago, when they wished their writing to be in a particular manner beautiful and regular,

drew fine parallel lines, which they followed in writing. These lines may be still clearly distinguished in old manuscripts. In many instances, they have only been impressed on the parchment by some hard, sharp body; but they often exhibit a leaden colour; from which one might suppose that they had been drawn with our plumbago, and consequently believe that the use of this substance is as old as we must consider, from certain marks, the oldest ruled manuscripts. But, on a little reflection, one will be convinced that this would be a very fallacious conclusion. For lines so like those made with plumbago, that the eye can scarcely perceive the difference, may be made with lead.* Were a chemist to determine this point, it would be necessary for him to collect and examine the small quantity of dust rubbed off; and even then his decision would be very uncertain.

It can be proved that the ancients drew their lines with lead; and this could be done with more convenience, as this soft metal was easily rubbed off by the parchment, which, being harder and rougher than our paper, had therefore more body. It is well known that, formerly, when people wished to draw lines, a small round plate of lead, which could not so readily cut the parchment or become bent as a leaden style, was employed.†

* Plin. lib. xxxiii. 3. sect. 19: Argento, ære, plumbo lineæ ducuntur.

† A plate of this kind was called *παραγραφος*, also *τροχαλος*, *γυρος*,

Old manuscripts, ruled with lead-coloured lines, have been pointed out by modern diplomatists. Our learned professor Schönemann, who was unfortunately hurried off by a premature death, has given a description of the *codex Berengarii Turo-nensis*, of the eleventh or twelfth century, and the *co-dex Theophyli presbyteri de temperamento colorum*, of the latter century, both preserved in the library of Wolfenbittel; and remarks that lines are drawn on the first partly with a style and partly in a light manner with lead; but he says of the other, that it exhibits very fine lines drawn with a black-lead pencil.* Le Moine quotes a document of the year 1387, which is ruled with black lead, and at the same time says, that the custom of ruling ceased about the year 1421 and 1424. The lines

κυκλοτηρης, which last appellation denotes the form. The Romans, at least those of later times, named this lead *præductal*. The ruler by which the lines were drawn was called *κανων* and *κανονισ*. Thus the ruled sheet which Suffenus filled with wretched verses is styled by Catullus *membrana directa plumbo*. Pollux has *παραγραφειν τη παραγραφιδι*. See *Salmasius ad Solinum*, p. 644, where some passages, in which these leaden plates are described, are quoted from the *Anthologia*. Of some of them I shall give here the translation: *orbiculare plumbum, quod semitam novit sculperc, recta radens in rectum extensam regulam*. Two others have been pointed out by H. Döring to illustrate some lines of Catullus, xxii. 7. p. 71. Compare also the annotations of Vossius on Catullus, p. 54; and *Hugo de scribendi origine*, ed. Trotz, Trajeeti ad Rhen. 1738. 8vo. p. 89, though these have all borrowed from Saumaise. *Pollux*, iv. 18. p. 358.

* Versuch eines Systems der Diplomantik. Hamburg 1802, 8vo. ii. p. 108 and 114.

therefore, after that period, became crooked and oblique.*

But the antiquity of black-lead pencils cannot be determined by the help of diplomatic documents. It might be traced out with more ease were it known by what mineralogical writer *plumbago* and the uses of it were first mentioned. The following is what I have remarked on this subject; but I suspect that there must be some older mention of it than any I have yet been able to find. I do not, however, believe that those who require more than bare conjecture will discover this mineral in the works of the Greeks and the Romans; for it cannot possibly be proved that it is to be understood under the terms *plumbago*, *galena*, *molybdæna*, and *molybdoides*, as has been confidently asserted by many, who, were it not superfluous, might easily be refuted. But in whatever obscurity these names may be involved, one can with certainty discover that they sometimes denote *galena*, or a real lead ore, or else some production of lead works.

The first author in whose writings I have, as yet, found certain mention of *plumbago* is Conrade Gesner, whose name I can never pronounce without respect. In his book on fossils, printed at Zurich in 1565, he says, that people had pencils for writing which consisted of a wooden handle,

* *Diplomatique-pratique*, a Metz, 1765, 4to. p. 62: Les lignes sont tirées au crayon de mine de plomb.

with a piece of lead, or, as he believed, an artificial mixture, called by some *stimmi Anglicanum*.* Such pencils must, at that time, have been scarce, because he has given a figure of them in a wood-cut. To judge by this, the pencil seems to have had a wooden sheath or covering.

Thirty years after, Cæsalpinus gave a more complete account of this mineral, which he calls *molybdoides*, because he thinks it was so named by Dioscorides. He says, that it was a lead-coloured shining stone, as smooth as if rubbed over with oil; it gave to the fingers an ash-gray tint, with a plumbeous brightness, and pointed pencils were made of it for the use of painters and draftsmen. He adds, that it was called Flanders' stone, because it was brought from the Netherlands to Italy.†

Three years after Cæsalpinus, a still better description was given by Imperati. The latter calls the black lead *grafio piombino*; and says, that it is much more convenient for drawing than pen and

* Stylus inferius depictus, ad scribendum factus est, plumbi cujusdam (factitii puto, quod aliquos stimmi Anglicum vocare audio) genere, in mucronem derasi, in manubrium ligneum inserti. *De rerum fossilium figuris*, p. 104.

† Puto molybdoidem esse lapidem quendam in nigro splendentem colore plumbeo, tactu adeo lubrico, ut perunctus videatur, manusque tangentium inficit, colore cinereo, non sine aliquo splendore plumbeo; utuntur eo pictores coticulis in cuspidem excisis, ad figuras designandas; appellant autem lapidem Flandriæ quia ex Belgio affertur. *De metallicis libri tres*. Noribergæ 1602, 4to. p. 186. The first edition of this book was printed at Rome, 1596, in quarto.

ink, because the marks made with it appear not only on a white ground, but, in consequence of their brightness, show themselves also on black; because they can be preserved or rubbed out at pleasure; and because one can retrace them with a pen, which drawings made with lead or charcoal will not admit.* This mineral is smooth; appears greasy to the touch, and has a leaden colour, which it communicates with a sort of metallic brightness. It can resist, for a long time, the strongest fire; it even acquires in it more hardness, and therefore has been considered as a kind of talc. Sometimes it is foliaceous, and may be crumbled to pieces in scales; but it is frequently found denser and stronger, and in this case writing-pencils are made of it. The first kind was mixed with that clay called *rubrica*, and manufactured into crucibles, which were exceedingly durable in the fire.† It is here seen that these Italians, at

* This, however, is not exactly the case. With ink somewhat thick one may indeed write on a piece of paper which has been rubbed over with black lead.

† Il grafio piombino si preferisce a tutte le materie que preparano il disegno, alla penna e l'inchostro, perciocche facilmente, usandovi industria, si cancella; e non volendo cancellarlo si conserva. Non da impedimento al maneggio della penna, il che fa il piombo per un modo, et il carbone per un' altro; si tirano con questo sottilissimi lineamenti, ne si puo stimar materia per inventioni da far in carta, que se le possa agguagliare; è untuoso al tutto, et al fuoco sommamente indurisce. Puossi ragionevolmente locare nel geno de talchi. *Dell' historia naturale di Ferrante Imperato. In Napoli, 1599. fol. p. 122.* In the same work, p. 678, it is said: La gleba piombina è di color bigio e di piombo, lubrica nell' esser maneggiata, e ch' imbratta le

that time, were well acquainted with this mineral. It has been reckoned a species of talc by Justi, by Wallerius in the first edition of his mineralogy, and also by others. Its durability in resisting heat is certainly manifested, when it is kept in a close fire and between coals. But it is proved by the experiments of the newer mineralogists, that in an open, strong, and long continued fire, it becomes almost entirely consumed.

Bartholomew Ambrosinus,* in the continuation of Aldrovandi's large work on natural history, printed at Bologna in 1648, uses the name *lapis plumbarius*. The short account which he gives of it has been borrowed from the two Italians last mentioned; but it deserves to be remarked, that

mani, quasi sustanza untuosa, nel quale imbrattamento si riconosee un splendor proprio di metallo. Posta la pietra alla violenza del fuoco lungamente la sostiene, stando essa nel suo essere intera, onde manifestamente si conosee convenir col geno de talehi; lascia per la sua lueidezza, e per la mezanita del colore, segnatura manifesta e nel bianco e nel nero, ritrovasi parte fogliosa que si risolve tutta in seame; parte consistente in forma soda, qual si taglia in fette lunghe, e se ne fa il grafio detto piombino. Meschiasi la fogliosa con la creta detta rubrica in materia de crugioli, vasi que per molto spazio di tempo resistono à fuoco potente. In the Latin translation, printed at Cologne in 1695, the above information is to be found, p. 133 and p. 768. In the former place *grafio piombino* is translated *plumbago*, and in the latter *gleba piombina* is translated *gleba plumbaria seu ccrussa*. As the original is scarce, it is to be regretted that the translator did not give the terms of art, as the author wrote them, along with the translation. At present, it is difficult to say to what the subject relates.

* Aldrovandi *musæum metallieum*, p. 167 and 177.

even then he thought it worth his while to give Gesner's figure enlarged.

In the works of Albertus Magnus, George Agricola, Encelius, Cæsius,* Kircher, and many other old mineralogists, I have found no mention of black lead. But as the advantageous use of it for crucibles was known to Imperati, and as the crucibles made at Ips, which till very lately were employed by all the mints in Europe, and even in other parts, derived their superiority from plumbago being mixed with the blue clay, and as these crucibles are introduced more than once by Agricola without any mention of the addition, it must either at that time have not been usual, or it must have escaped the notice of this diligent man. † How old then are the pits at Leizersdorf, which furnish plumbago for the crucibles of Ips or Passau? I know of one mineralogist only who has described that district, but on this subject he has given us no information. ‡

I am equally unacquainted with the time when the pits in Cumberland, which, as is well known, produce the best plumbago, were discovered. They

* Mineralogia, Lugduni 1636, fol. p. 257, where the author only remarks briefly, from *Bulengeri de pictura*, lib. ii. cap. 2, that *molybdæna* is employed for drawing.

† De natura fossil. lib. ii. p. 579 and 580, according to the edition of Basle, 1657, fol.

‡ I allude to a letter in the Hanoverian Magazine, 1771, p. 1442. It was written by J. A. F. von Beroldingen to Mr. Andreæ, apothecary at Hanover.

are situated on the Borrowdale mountains, about ten miles from the town of Keswick.* The families to whom these pits belong, according to an established regulation, can open them only once every seven years, and take out but a certain quantity of the mineral, in order to keep up the price, and prevent the pits from being exhausted. This production is called there *black lead*, *kellow* or *kil-low*, *wad* or *wadt*, which words properly mean black.† I have found no older information in regard to these pits than that of Merret, who wrote in the year 1667, and who calls this mineral *nigrica fabrilis*, because it had then no Latin name.‡ Pettus remarked, in 1683, that the pencils made from it were inclosed in fir or cedar.§ It is related by Robinson|| and others, that at first the

* Büsching *Erdbeschreibung*, iv. p. 741.

† In the Cumberland dialect, *killow* or *collow*, as well as *wad*, means black. Therefore when the manganese earth, which is found chiefly at Elton not far from Winster, and when burnt is employed as an oil-colour, but particularly for daubing over ships, is called *black wad*, that expression signifies as much as *black black*. See *Pennant's Tour in Scotland*, i. p. 42. *Gentleman's Magazine*, 1747, p. 583.

‡ *Pinax rerum natural.* London, 1667, 8vo. p. 218.

§ *Fleta minor.* The laws of art and nature, by J. Pettus. Lond. 1683, fol. The first half of this book is a translation of Erker; the other is a metallurgic dictionary. What belongs to this subject is the art. *Lead*.

|| *Essay towards a natural history of Westmoreland and Cumberland.* Lond. 1709, 8vo. p. 74. This and the preceding work were pointed out to me by professor Blumenbach, as well as the *Gentleman's Mag.* xxi. 1751, p. 51, where there is a map of this remarkable district.

country-people around Keswick marked their sheep with it. Afterwards the art was discovered of employing it for earthen-ware, and for preserving iron from rust. The last-mentioned author says also, that it is used by the Dutch in dyeing, in order to render black more durable, and that it is bought up by them in large quantities for that purpose. But this, perhaps, is only a pretence. I am inclined to think that they prepare from it black-lead pencils.

The greater part of the plumbago at present used in commerce, but which, as far as I know, is fit only for iron-black, comes from Spain, where it is dug up in the neighbourhood of Ronda, a town in Grenada, a few miles distant from the sea; but, in regard to the antiquity of these pits, I have found no information. In commerce, it is called *potloth*; and the mills, such as those at Bremen, where it is ground fine, are named *potloth* mills, an appellation which in all probability has been borrowed from the Dutch, among whom *potloot* signifies as much as potters' lead. From this word the French have made *potelot*, which, however, in many dictionaries is wanting. If I am not mistaken, this mineral was first found in France at a very late period, in Upper Provence, near Curban, and not far from the river Durance, between Sisteron and Gap, from which it is sent to Marseilles.

It appears to me probable, that in the sixteenth

century the use of plumbago was first introduced into Italy, a country which abounds with draftsmen and drawing-schools; where other minerals had been long used for drawing, and where the best kinds had been carefully sought out. It is likely, therefore, that some one may have made a trial with plumbago, induced by its appearance; and indeed nothing but a trial was necessary to show its superiority to charcoal, and to black and red chalk. I am inclined to think also, that the earliest mention of it will be found in the oldest Italian works on drawing, rather than in those on mineralogy, to the authors of which this substance first became known by its use. For a long time, all the black-lead pencils employed in Germany and in the neighbouring countries were made at Nuremberg. I shall here observe, that the very convenient method of wiping out writing made with a black-lead pencil, by means of gum elastic, was discovered about twenty or thirty years ago, and, as I believe, first in England.

After I had completed this article, professor Fiorillo, who as an artist has studied the masterpieces, and as a man of letters the writings of the Italians, communicated to me, at my request, the following information, which at any rate will form an additional fragment towards the history of drawing. The pencils first used in Italy for drawing were composed of a mixture of lead and tin fused together, and the proportion was two parts

of the former and one of the latter.* To obliterate a drawing or piece of writing, it was rubbed over with crumbs of bread. A pencil of this kind was called *stile*. Petrarch has immortalised a painter, named Simone Memmi, by a couple of sonnets, out of gratitude for a picture of his beloved Laura.† In these he says that the artist

* Il Riposo di Raffaello Borghini. In Fiorenza 1584, 8vo. p. 139: Ancora si puo disegnare con lo stile del piombo, che si fa due parti piombo, e una di stagno benissimo battuto col martello, e quando si volesse levare qualche segno non ben fatto, freghiuisi sopra con un poco di midolla di pane - - - Si puo etuandio disegnar con matita nera, levando i segni quando occorre rifargli con la midolla del pane; ma se alcuno volesse disegnare con matita rossa, bisogna habbia avvertenza non far prima le linee col piombino; perche vien poi il disegno macchiato; ma bisogna farle con i stile d'argento, e disegnar con la matita rossa con diligenza, perche non si puo con la midolla del pane tor via, come si fa della nera. Artists therefore used sometimes also silver pencils. The following is extracted from Philip Baldinucci's *Vocabulario Toscano dell' arte del disegno*, in Firenze 1681, 4to. p. 158. *Stile*. Una verghetta sottile, che si fa di due terzi di piombo en un terzo di stagno, e scrive par tirar le prime linee a chi vuol disegnar con penna; fannosene anche con argento; et il segno che si fa con tale strumento, con midolla di pane facilmente si cancella, par rifar poi altri segni, senza che il foglio rimango imbrattato, calcando piu o meno, o piu o meno tignendo il carta. Questa voce è proprissima di tale strumento, e usata ne' piu antichi tempi, leggendosi nella 6 Giorn. Nou. 5 di Gio. Bocc. là dove parla di Giotto le seguenti parole: Ebbe un' ingegno di tanta excellenza, che niuna cosa della natura fu, che egli con lo stile, e con la penna, e col pennello, non dipignesse sì simile a quella, che non simile, anzi piu tosto dessa paresse.

† These sonnets are the 57th and 58th. I have in my possession a scarce edition, in *Venetia appresso Nic. Misserini* 1624, in small

made the drawing with a *stile in carte*. The author here evidently alludes to a drawing-pencil, and not to a graver, as some have supposed. Boccacio, a scholar of Petrarch, celebrates an artist who was equally expert at drawing with the *stile*, the pen, and the pencil. Michael Angelo also, who died in 1564, says in a sonnet on Vasari, quoted by Fiorillo, *Se con lo stile e co' colori avete*. Such pencils were long used also in Germany; and formerly they were found at the most common writing-desks.

The use of red and black chalk seems to be more modern. The former is called by the Italians *matita rossa*, and the latter *matita nera*. This name is derived from *hæmatites*. Vasari celebrates Baccio Bondinelli, who died in the middle of the sixteenth century, because he could handle equally well *lo stile, e la penna, e la matita rossa e nera*.* Baldinucci says, that the best red chalk comes from Germany; good black chalk from

duodecimo or sixteens, where the sonnets stand p. 87. Let the reader compare only the following lines,

Quando giunse a Simon l'alto concetto
Che a mio nome gli pose in man lo stile,

with the expressions in the first sonnet,

Ivi la vide e la ritrasse in carte.

Of this Simon and his drawings an account may be found in *Fiorillo Geschichte der zeichnenden Künste*, Göttingen, 1798, 8vo. i. p. 269.

* *Vite de' Pittori*. In Roma, 1759, 4to. ii. p. 577.

France; but the very best from Spain, whence that of the first quality is obtained at present.*

I can, however, point out no mention of our plumbago in the works of the old Italian artists. Armenini, who wrote at the end of the sixteenth century, relates how pupils were taught to draw a hundred years before his time.† He says, that they made the first sketches with *piombo over cannella col lapis nero*, and afterwards filled them up with a pen. But when his whole description is read, there can remain no doubt that the substance here meant is black chalk. Baldinucci, who did not write till 1681, has introduced particularly into his dictionary *matita rossa, nera*, and also *lapis piombino*; and says that the last mentioned is an artificial production, which gives a leaden colour, and is employed for drawing. It is evident, therefore, that the author here alludes to plumbago, which was then very common. But when Bottari says ‡ that artists first began to use red and black chalk in the time of Vasari, whereas *lapis piombino* only was employed before that period, he has named *plumbago*, commonly used in his time, instead of the metallic pencil which

* Vocabulario, p. 92.

† De veri precetti della pittura, di M. Gio. Battista Armenini. In Ravenna, 1587, 4to. p. 53.

‡ In his observations on the before-mentioned work of Vasari, *Vite de' Pittori*, iii. p. 310: Da quel che dice Vasari, si raccoglie, que era cominciato l'uso della matita rossa e nera, che prima non si usava, se non il lapis piombino.

was called *stile*. If I am not mistaken, the Italians have no proper appellation for black lead, but call it sometimes *matita* and sometimes *pionbino*.

SAL AMMONIAC.

It is not very probable that Dioscorides, Pliny, and others who lived nearly about the same time, were acquainted with sal ammoniac, or mentioned it in their works; for no part of mineralogy was then so defective as that which is the most important, and which treats of salts. The art of lixiviating earths and causing saline solutions to crystallize was then so little known, that, instead of green vitriol, vitriolic minerals, however impure, were employed in making ink, dye-liquors, and other things. Places for boiling vitriol were not then established; and therefore Pliny beheld with wonder* blue vitriol, which in his time was made only in Spain, as a thing singular in its kind, or which had not its like. On this account those salts only were known which occur in a native state, or which crystallize as it were of themselves, without any artificial preparation, as is the case with bay salt. But that neutral salt, from the muriatic acid and volatile lixivious salt, occurs

* See vol. i. p. 289.

very seldom in a native state, and almost exclusively among the productions of volcanoes. I do not, however, suppose that this volcanic sal ammoniac was the first known, but that it was first considered to be sal ammoniac after that salt had been long obtained by another method, and long used.

But even if it should be believed that our sal ammoniac was known to the ancients, how are we to discover it with certainty in their writings? This salt has little or nothing by which these writers could characterize it. Neither its external form nor taste is so striking that it could be described by them with sufficient precision. The use of it also could not, at that time, be so important and necessary, as to enable us to determine whether they were acquainted with it; whereas, on the other hand, vitriol and alum can easily be distinguished among the materials for dyeing.

Nay, if this salt had been then made, as it is made at present in Egypt, and if any allusion to it were found, one might readily conjecture that sal ammoniac were really meant. But even though it must be admitted that traces of sublimation being employed occur in the writings of Dioscorides and others, who lived nearly at the same period, we are not authorised to suppose that the knowledge of it was sufficient for the preparation of this salt.

Besides, there are two properties with which the ancients might have accidentally become ac-

quainted, and which in that case would have been sufficient to make known or define to us this salt. In the first place, by an accidental mixture of quick-lime, the strong smell or unsupportable vapour diffused by the volatile alkali separated from the acid might have been observed. In the second place, it is very possible that the complete volatilisation of this salt on burning coals may have been remarked; for it had been long known that common salt decrepitates in the fire. This excited wonder; and in examining other salts people were accustomed to observe whether they possessed that property also. Had any one, with this view, thrown a bit of sal ammoniac on a burning coal, he must have seen with astonishment that instead of decrepitating it became entirely volatilised. For this experiment, however, very pure sal ammoniac would have been necessary. Had a little common salt been mixed with it, decrepitation would not have been altogether prevented; and if the sal ammoniac had been rendered impure by earthy particles, as is almost always the case with the volcanic, some earth at least would have remained behind on the coals.

The name *sal ammoniacus** is indeed old, but as those who, in consequence of the name, considered the *alumen* of the ancients to be our alum, and their *nitrum* to be our saltpetre, were in an error, we should be equally so were we to

* Ἄλς αμμωνιακος.

consider their sal ammoniac to be the same as ours. Our forefathers believed that the ancient writers were acquainted with all minerals, as well as with all plants; and when they discovered a new one, they searched in old books till they found a name which would suit it, or which at any rate had not been given to another. Our sal ammoniac, in all probability, acquired in the same manner its name, which is not often to be found in the writings of the ancients.*

When every thing they have said of it is collected and impartially examined, no proofs will be found that under that name they understood our sal ammoniac. On the contrary, one will soon be convinced that *sal ammoniacus* was nothing else than impure marine salt. As the ancients were not acquainted with the art of separating salts, of refining and crystallising them, they gave to each variety or kind in the least different, which was distinguished either by the intermixture of some foreign substance or by an accidental formation, a particular name; and considering the wants of that period, this method was not so bad. For among the impure saline substances, there were always some which were found to be fitter than others

* It is indeed a matter of indifference whether the name be derived from *αμμος*, *arena*, or rather from *Ammonia*, the name of a district in Libya, where the oracle of Jupiter Ammon was situated. The district had its name from sand. An H also may be prefixed to the word. See *Vossii Etymol.* p. 24. But *sal armoniacus*, *armoniacus*, sal armoniac, is improper.

for certain purposes. On this account they distinguished with so much care *misy*, *sory*, *chalcitis*, and *melanteria*, instead of which we use a substance contained in all these minerals, that is to say, vitriol. Our apothecary shops, however, have at present the lixivious salt under the name of various plants, from which it is extracted, with different degrees of purity.

When this is known, it will excite no wonder that the *sal ammoniacus* of the ancients was nothing else than our common salt. Dioscorides and Pliny speak of it expressly as a kind of this salt; and Columella,* in a prescription for an eye-salve, recommends rock salt, either Spanish, Ammoniacal, or Cappadocian. Pliny says, † that *sal ammoniacus* was found in the dry sandy deserts of Africa, as far as the oracle of Ammon. It is stated, both by him and Dioscorides, ‡ that this salt

* De re rust. vi. 17. 7: Montanus sal Hispanus vel Ammoniacus vel etiam Cappadocus.

† Lib. xxxi. cap. 7. sect. 39: Quo exemplo inter Ægyptum et Arabiam etiam squalentibus locis, cœptus est inveniri, detractis arenis; qualiter et per Africæ sitientia usque ad Hammonis oraculum. Is quidem crescens cum luna noctibus. Nam Cyrenaici tractus nobilitantur Hammoniaco et ipso, quia sub arenis inveniatur, appellato. Similis est colore alumini, quod schiston vocant, longis glebis, neque perlucidis, ingratus sapore, sed medicinæ utilis. Probatur quam maxime perspicuus, rectis scissuris. Insigne de eo proditur, quod levissimus intra specus suos, in lucem universam prolatus, vix credibili pondere ingravescat. Causa evidens - - -

‡ Lib. v. cap. 126. p. 376: Inter salis genera efficacissimum fossile. Et in hoc ipso genere communiter quidem laudatur calculis vacans, candidum et pellucidum, densum et æquabili compage; pe-

can be split or broken into smooth pieces; and the former adds, that the best are white and transparent; that it, however, has an unpleasant taste, but can be used in medicine. In like manner later physicians, when they wish to prescribe common salt, recommend in particular the ammoniac. Thus Aetius, who lived in the fifth century, remarks, that when fossil, or as we say at present native salt, is employed, ammoniac or Cappadocian ought to be chosen.*

From what is said by Pliny it may with certainty be concluded, that this salt was dug up from pits or mines in Africa; for he relates, that it appeared wonderful that a piece of it, which in the pit was very light, became, on exposure to the open air, much heavier. Without repeating the explanation which he gives of this phænomenon, I shall only remark, that many kinds of rock salt, taken from the mines of Wieliczka, experience the same change in the air; so that blocks which a labourer can easily carry in the mine, can scarcely be lifted by him after they have been some time

culiariter vero natione ammoniacum, quod quidem et findi facile potest, et rectis est fissuris: τὸ Ἀμμωνιακὸν τῶ γενεῖ, εὐσχίστον τε καὶ εὐθίως τὰς διαφύσεις ἔχον.

* Aetii tetrabiblos, per J. Cornarium, Basilæ 1549. fol. lib. i. serm. 2. cap. 43. p. 79: Sal omnis et fossilis et marinus (ἀλες ορυκτοὶ καὶ οἱ θαλαττοὶ) eandem in genere vim habent. Differentiâ in eo est, quod ex terra effossi substantia magis sit coacta - - - Fossilis generis optimus est Ammoniacus et Capadocius: καλλιστοὶ ἐν τοῖς ορυκτοῖς εἰσὶν οἱ ἀμμωνιακοὶ καὶ οἱ καππαδοκικοὶ. Edit. Manutii. Venetiis 1534. fol. p. 29. a.

exposed to the air. The cause here is undoubtedly the same as that which makes many kinds of artificial salt to become moist and to acquire more weight. In this case, there will be a superabundance of acid, which is not completely saturated with alkali; or such a salt will contain muriate of lime, which is called *sal ammoniacus fixus* *. This saline substance can attract from the atmosphere so much moisture, that it deliquesces in it to the so called oil of lime. I must, however, confess that our sal ammoniac becomes moist in the air, but only when it is pure, which is never the case with that found in a natural state.

Synesius, who was born in Egypt in the fifth century, in the Pentapolitan town Cyrene, and who resided as bishop in Ptolemais, the capital of the district, says, in a letter wherein he describes many rarities of his native country, that what was called *sal ammoniacus*, † both according to its ap-

* This name was first used by Js. Holland.

† Est, per sacram vestem juro, est apud nos terrestre sal, quod minore intervallo ab Austro distat, quam ab Aquilone mare; hoc Ammonis sal a nobis appellatur. Lapide hoc a friabili alitur atque tegitur, quem crustæ in modum insidentem cum detraxeris, facili negotio manibus ac sarculis altius proscindi subjecta tellus potest. Id porro quod effoditur, sal est, cum visu ipso, tum alia gustandi voluptate jucundissimum: τούτους Λιμμῶνος καλούμεν τούς αλας. πέτρα δε αυτοίς φαφαρά και τρέφει και κρυπτει, ην όταν αφελής επιβεβλημένην ὡσπερ εφέλικιδα, ραστώνη πολλή και χερσι και σκαλισιν αρουν το βαθος. το δε αναχωνηνυμενον ἄλες εισιν, ιδειν τε ηδεις, και γευσασθαι την αλλην ηδουην. Synesii Opera, ed. Petavii. Lutetiæ 1612. fol. p. 284. ep. 147.

pearance and taste, was a salt of a good quality, fit for use; that it lay under a soft kind of stone which covered it like a crust, and that it could be easily dug up when this stone was removed.

Herodotus, Strabo, Arrian, and others, speak of rock salt which was dug up in Ammonia, and carried thence as an article of merchandise.* The first mentions a hill of salt; and we are told by the last, that native salt was brought to Egypt as a present to the king and others, from the neighbourhood of the oracle of Ammon, by the priests of that place, in boxes made of palms worked together. Many pieces were three inches in length; and because this substance was purer than bay salt and as clear as crystal, it was particularly employed in sacrifices. This salt is certainly that which, under the name of *sal ammoniacus* †, was sent from Egypt to the king of Persia, like the water of the Nile, as is related by Athenæus from an historian long since lost ‡.

* Herodotus, lib. iv. cap. 182. p. 361. ed. Wessel. *Strabo*, lib. i. p. 84. ed. Amstelod. 1707, fol. *Arrian. de expedit. Alexandri*, lib. iii. p. 161. ed. Blancardi, Amstel. 1668. 8vo: Gignit etiam hoc solum (circa sedem oraculi) suapte natura salem fossilem (αλες αυτοματος ορυκτοι) quem quidem non nulli sacerdotes Hammonis in Ægyptum portant. Quum enim in Ægyptum proficiscuntur, salem in cistulas ex palma contextas conditum, regi aut alteri cuiquam muneri ferunt. Sunt autem frusta oblonga (quædam enim longitudinem trium digitorum excedunt) puraque instar crystalli. Hoc genere salis et Ægyptii, et alii quibus divinus cultus curæ est, in sacrificiis utuntur, quod sale marino sit purior.

† ἄλις ἀμμωνιακος.

‡ Athen. lib. ii. cap. 29. p. 67. Deinon in historia Persica pro-

It is also certain that the old Arabian physicians, Avicenna* and Serapion,† who both lived in the eleventh century, under the name *sal ammoniacus*, understood nothing else than rock salt. The former says that it ought to split easily, and to be clear and transparent like crystal; and the latter states that this salt is cut from the solid rock, and that it is sometimes clear as crystal, sometimes reddish, sometimes blackish, sometimes of another colour, sometimes hard, and sometimes friable, or, as the translator expresses it, pulverulent. All these colours and properties are not uncommon in rock salt, and always proceed, no doubt, from an admixture of ferruginous earth. Serapion says that this salt was obtained from Corasini. I shall leave it to others to determine where this country was situated. He often names it, and says that *mala granata* and *bezaar* were obtained from it. But who knows how the name was written in the original? And the Arabian author

didit, ex Ægypto Nili aquam et Ammoniacum salem ad regem mitti.

* Avicennæ Canon medicinæ, Venetiis 1608, fol. ii. 2. cap. 625, p. 393: Sal ammoniacus est melior, qui est ut borax, clarus crystallinus. But the reader ought to examine how Saumaise has improved this translation in *de homonymis*, cap. 3. p. 191.

† Serapionis Lib. de Simplic. cap. 403. p. 271. edit. Brunfelsii, Argentorati 1531. fol: Sal armoniacus est albus et rubeus, et extrahitur a lapidibus duris, claris, et est salsus mordicans multum, et defertur ex Coraseni, et sunt ei multi colores, nam ex eo est niger et pulverulentus, et albus, sed pulverulentus et albus, clarus sicut crystallus.

perhaps did not mention the place where the salt was dug up, but that from which, in his time, it was procured.*

In regard to the purpose to which the ancients applied their *sal ammoniacus*, it appears that it required only common salt and not sal ammoniac. It is oftenest mentioned by the physicians, because it was the purest table salt that could then be procured. On that account it has been praised by Scribonius, † who lived in the first century, and by Aetius who lived in the fifth, as well as by Avicenna, Serapion, and others. I have, however, not yet met with it in the writings of Hippocrates or Galen. In the works of the Greek agriculturists it occurs in a recipe for the preparation of a cement employed to close up wine vessels. ‡ According to a recipe of Apicius, in his book on cookery, § *sal ammoniacus* was to be roasted. By these means this rock salt lost its water of crystallisation and became stronger. On this account, in Transylvania, Siberia, and other countries, before it is brought to the table it is pounded and roasted. Of our sal ammoniac, however,

* I am fully of opinion that a town named in the new maps *Kesem*, and which lies in Arabia Felix, opposite to the island of Socotora, is here meant. It has a good harbour. See *Büsching's Erdbeschreibung*, xi. p. 702, where the name *Korasem* also occurs.

† Scribonii Largi Compositiones, ed. J. Rhodii. Patavii 1655. 4to. § 45. p. 36. § 60. p. 43. § 71. p. 47. § 175. § 203.

‡ Geopon. lib. vi. cap. 6. p. 440.

§ Pallad. i. tit. 41.

were it roasted, very little would remain. But whether the *ammonium* which Palladius recommends for a cement* be that salt, I will not pretend to determine. On the other hand, I have no hesitation to contradict the old commentator on Ovid, who, in a passage where the poet recommends *sal ammoniacus* in making a cosmetic water, † understands the resin or gum of that name. Ovid, however, had no intention that young women should lacker themselves.

For the reasons, therefore, already mentioned, I am convinced that the *sal ammoniacus* of the ancients was rock salt, and not our *sal ammoniac*. The oldest commentators also on these writers had no idea of any other than rock salt; and it was not till a later period, when our *sal ammoniac* was introduced into commerce, and acquired that name, that the most learned commentators began expressly to remark, that the new *sal ammoniac*, notwithstanding its appellation, was different from the *sal ammoniacus* of the ancients. As this could not then be obtained, people used the former, which they considered only as an artificial substitute for the latter, though it was incapable of supplying its place. But in more modern times, when our *sal ammoniac* became common, and physicians and mineralogists no

* De Arte coquinaria, i. cap. 27. p. 40.

† Medicamina faciei, 94: Cumque Ammoniaco mascula thura sale.

longer took the trouble to read the works of the ancients, some of them, if not the greater part, spoke in such a manner as if our sal ammoniac had been the *sal ammoniacus* of the ancients; and it was then generally believed that it had been, at any rate, known and used since the time of Dioscorides and Pliny.

No one has maintained this with greater confidence and zeal than F. I. W. Schröder,* whose judgement, however, was perverted by alchemistic conceits. According to his assertion, the Egyptians practised from the earliest periods the art of making sal ammoniac, but they kept it a secret; and he obscurely hints at the purpose for which these great chemists used so much salt. He refers, on this occasion, to what Pliny says of *flos salis*,† in which he thinks he can find the martial sal ammoniac flowers of our chemists, or the so called *flores salis ammoniaci martiales*. Those who cannot make this discovery he declares to be ignorant and blind. This decision, however, when the character of the person who gives it is considered, cannot dissipate a single doubt. It is certain that what Dioscorides and Pliny call *flos salis* has never yet been defined. It was moist, oily, and saline; and in the vessels, in which it was sent from Egypt, was gray at the top, saffron-

* Bibliothek für die höhere Naturwissenschaft und chemie. Leipzig 1775. 8vo. i. p. 219.

† Lib. xxxi. cap. 7. sect. 42.

coloured at the bottom, and emitted a bad smell. The most ingenious conjecture was that of Cordus,* who thought that it might be *sperma ceti*; but though I should prefer this opinion to that of Schröder, I must confess that, on the grounds adduced by Matthioli and Conrade Gesner, it has too much against it to be admitted as truth.

The first distinct traces of our sal ammoniac which I have yet met with, are to be found in the works of the Arabians.† In a writing of Geber, there is a prescription how to purify sal ammoniac by sublimation; and in another a receipt for making it; so that there can be no doubt that the

* Liber de holosantho in C. Gesner's treatise *De omni rerum fossilium genere*. Tiguri 1565. 8vo. p. 15. Gesner's *Corollarium*. This treatise has not been mentioned by Hardouin and the other editors of Pliny.

† What a respectable people the Arabs! we are indebted to them for much knowledge as well as for many inventions of great utility; and we should thank them still more were we fully acquainted with the benefit which we have derived from them. What a pity that their works should be suffered to moulder into dust, without being used! What a shame that those acquainted with this rich language should meet with too little encouragement to instruct many scholars! The few translations which exist have been made by persons who were not sufficiently acquainted either with languages or the sciences. On that account they are, for the most part, unintelligible, uncertain, in many places corrupted, and besides exceedingly scarce. Those even who obtain them are in the same state as if they had made their way with great trouble to a treasure, which they can at length perceive, at a distance, through a narrow grate. Had I still twenty years to live, and could hope for an abundant supply of Arabic works, I would learn Arabic. But ὁ βίος βραχύς ἢ δε τεχνῆ μικρή.

author was acquainted with our salt. But this furnishes very little towards the history of it. The period when that celebrated chemist lived is uncertain. If, as Leo says,* he flourished a hundred years after Mahomet, that is to say, in the eighth century, his works must have been interpolated with many additions, which criticism has not yet been able to separate. Many of them cannot be of great antiquity; and the uncertainty is increased by some of the editions differing from each other in important passages. Whole sections, which some have, are wanting in others; and the titles and order of the books and sections are different almost in each. When the same circumstances are found in several editions, it is observed that they essentially differ.† What, therefore, is now

* *Africae descriptio*, iii. p. 136. b.

† I have now before me the following editions, which I shall mark with the letters of the alphabet, in order that I may quote them more briefly. By these means perhaps I shall do a service to those who turn their attention to this part of bibliography.

Geberi de alchimia, libri iii. Argentorati 1528, small folio. A.

Das Buoeh Geberi von der Alchimia. Strasburg 1529, fol. Is a translation of the preceding. B.

Alchemiae Gebri libri cum reliquis. Bernae sumptu Petrei, 1545, 4to. C.

Verae alchemiae artisque metallicae doctrina. Basiliae 1561, fol. p. 112—201. D.

Artis chemicae principes, Avicenna atque Geber. Basiliae 1572, 8vo. p. 472—767. E.

Gebri summa perfectio, das ist, Geber Büchlin von der gebenedeyten und allerhöchsten volkoimmenheit. Strassburg 1625, 8vo. F.

Gebri chimia - - - edita a G. Hornio. Lugd. Bat. 1668, 12mo. G.

found in the writings of Geber, as they are called, was certainly not all known in the eighth century.

The same uncertainty prevails in regard to the chemical works of Avicenna, who lived in the beginning of the eleventh century, and who certainly treats of sal ammoniac.* But when these are

Gebri summa - - - Gedani apud B. L. Tancken 1682, 8vo. H. Mangeti bibliotheca chemica. Genevæ 1702, fol. i. p. 519—564. I.

Geberi chymische-schriften - - - von Phileletha. Frank. u. Leipz. 1710, 8vo. K.

Bibliothèque des philosophes chimiques par R. (Joh. Mangin de Richenbourg.) Paris 1741. 8vo. i. p. 85—384. L.

Neuer Abdruck der letzten Uebersetzung. (K.) Wien, 8vo. M.

The following is found only in E, p. 480. I, p. 559. H, p. 206. K, p. 250. M, p. 283. De salis armoniaci præparatione. Sal armoniacus fit ex quinque partibus vel duabus urinæ humanæ et parte una sudoris ejusdem, et parte una salis communis, et parte una cum dimidia fuliginis lignorum, vel baculorum habitis simul coctis usque ad consumptionem hujusmodi, sublima salcm armoniacum verum et utilem, hunc iterum in sudorem dissolve et congela, et sublima a sale communi semel; et est præparatum. Vel teratur primo cum præparatione salis communis mundati, postea sublimetur in alto alutel, donec totaliter fuerit extractum purum; postea solvatur super porphydum sub divo, si de ejus aqua habetur facere, vel servetur ipsum sublimatum et purum sufficienter. The same thing is repeated word for word in E, p. 715.

What follows occurs only in D, p. 113. G, p. 220. Mundatio salis ammoniaci. Teratur primo cum præparatione salis communis mundati. Postea sublimetur in alto aludele, donec totaliter fuerit extractum purum. Postea solvatur super porfidum, sub dio, si de eo vis aquam facere, vel servetur ipsum sublimatum et purum sufficienter. It is seen that there is here an essential variation from the preceding.

* Pag. 370: Sal armoniacus est unus de quatuor spiritibus, et sublimat se sicut mercurius, et ideo vocant eum spiritum, quia ita

compared with the medical works of this author, which are subject to no doubt, it is evidently perceived that the former must have been the production of a very different and much younger writer. In the works of the physician Avicenna, *sal ammoniacus* means always rock salt. It is worthy of remark, that Avicenna the chemist says, that sal ammoniac comes from Egypt, India, and Forperia.

We know with more certainty that Albucasis, or Bulcasis, was acquainted with sal ammoniac, as well as the method of preparing it, which he describes, and also the preparation of medicines in general, in his book often printed under the title of *Liber seroitoris*.* However unintelligible the

ascendit sicut spiritus. - - - Non debes mittere in calcem, si non est sublimatus, et in hunc modum se sublimat. Accipe de bono sale armoniaco tres libras, mitte in cucurbita, aut in aludel, postquam feceris eum pulverem et pastatum cum urina puerorum et da ignem - - - donec cognoscas quod sublimatum est—Pag. 145: Sal armoniacum est in multis modis unum quod venit de Ægypto, aliud de India, aliud quod venit de Forperia. The work from which this is taken was published, for the first time, by Minos Celsus Senensis, in the *Artis chemicæ Princip.* without the least mention being made in regard to the nature of the original, and, as far as I know, was never reprinted. For the treatises of Avicenna in *Mangati biblioth. chem.* in *Theat. chem.* and in *De alchemia opuscula*, Francof. 1550, 4to. are entirely different.

* This book is often printed along with Mesue. See *Haller's Bibliotheca botan.* i. p. 201. *Biblioth. chirur.* i. p. 137. *Bibl. pract.* i. p. 407. *Küstner's Biblioth. medica*, p. 137. 634. I have now before me from the library of our university, the following edition, which is not mentioned by Haller: *Mesue cum expositione*

translation often is, one can easily discover in what manner sublimation was formerly performed in earthen vessels. But the period when this Arabian writer lived is doubtful, though it is generally admitted that he died in the year 1192.

But whence did Europe obtain this salt, in the twelfth and succeeding centuries?—When and in what manner was the preparation of it found out in Egypt? For what purpose was it first used by our ancestors? I have not yet met with any information to enable me to answer these questions, though it is probable that it might be found in old books of travels, and particularly in the works of Arabian writers. In the valuable, but not altoge-

Mondini - - - Lugduni 1525. fol. The passage relating to this subject is at the end of the whole book. *Modus faciendi salern armoniacum: Accipe lapides, qui inveniuntur in sterquiliniis balnearum; qui incendantur cum igne sordieiei illius lacu et sunt lapides nigri, qui coagulantur ex virtute salsedinis, quæ est in illa sordieie. Accipe ergo ex illis et tere bene et pone in olla amplum habente oroficium, et pone super os ejus paropsidem terream vitreatam; et perfora fundum ejus, luta labia ollæ et paropsidis simul et facias ei furnum discrete; ita quod possit olla in medio manere, et sint omnia ex terra, quæ possit sustenere ignem magnum, et luta os furni cum argilla, et accende ignem sub olla, et aspice foramen, quod est in paropside. Si videris inde egredi aquam vel vaporem exire, dimitte foramen apertum, sicut est, donec egrediatur tota humiditas illa et incipiat fumus egredi albus similis sali armoniacæ; tunc oportet quod claudas foramen bene et augeas ignem tota die. Deinde dimitte furnum infrigidari, et quando erit infrigidatus, detege vas, et frange paropsidem et aufer salern qui est in ea cum facilitate et serva. Professor Retzius, who quotes this passage in the *Acta societ. med. Havniensis*, i. p. 41, says: *Quid sibi velint hi lapides nescio, nisi ipsa erint excrementa coagulata.* This conjecture is indeed highly probable.*

ther intelligible book of Pegoletti,* from which I have learned many things respecting the trade of the fourteenth and fifteenth centuries, nothing is said in regard to the place where it was obtained, but that it was procured in white, hard, and opaque cakes. It is mentioned in the custom-house tariff of Pisa for the year 1408.

Biringoccio, who lived in the end of the fifteenth and beginning of the following century,† knew nothing more than that, according to report, it came from Cyrene or Armenia. Cæsalpin, his cotemporary, gave, for the preparation of it, a prescription which is undoubtedly borrowed from the Arabians.‡ This author says, very properly, that it is obtained in white transparent cakes; blackish on the outside; but adds, erroneously, that it comes from Germany, though the same thing has been repeated by Brasavolus and Matthioli. Porta says, with more truth, that it comes

* Della decima, iii. p. 298. 373; and iv. p. 59. 191.

† *Pirotechnia*, 1550, 4to. p. 36. a.

‡ Est sal acutissimus, vel potius nitrum, quo chimistæ utuntur ad sublimationem argenti vivi et solutiones metallorum. Fit autem quinque partibus urinæ humanæ, et parte una salis communis, et parte dimidia fuliginis lignorum, his simul coctis usque ad consumptionem humiditatis, reliquum sublimatur in salem Armoniacum, hunc iterum in sudore dissolvunt et congelant et a sale communi sublimant, et est optime præparatus, ut chimistæ docent. Adfertur ex Germania candidus translucens, figura placentæ nigredine quadam obductus, acerrimi saporis. Sunt qui in Armenia fieri testantur ex urina chamelorum, unde armeniacus vocatur. *De metallicis*. Noribergæ 1602. 4to. p. 51.

from the East. He asserts also, that he was the first person who found real *sal ammoniac* on volcanic mountains, and he wishes that his discovery might be confirmed by skilful naturalists.* This may serve as an additional proof, were such necessary, in opposition to those who think that the first real sal ammoniac introduced into commerce was the volcanic. Imperati considers Porta's observation as generally acknowledged, but without naming him. The former has described, in a fuller and more correct manner than any of his predecessors, the properties of sal ammoniac; † and he states, as does also Agricola, ‡ that it is entirely dissipated in the fire. He adds, that it promotes

* Fumus sulphuris in sal ammoniacum congelatur, ut in Phlegæis montibus excerpimus et in salem coegimus, nil ab orientali differentem, et sic ammoniacus sal, qui hucusque ignotus delituit, nostris regionibus habetur, scilicet sulphuris sal, et oleum hoc, aqua est salis sulphuris sive ammoniaci. Optarem scire, solertioris investigationis viros, si hoc mecum inventum comprobant. Excerpsimus enim ora, ex quibus sulphuris fumus exhalabat, in aquam calidam dissolvimus, et per pendentem liciniam purgavimus, mox aquam in auram solvendo, salem habuimus ascendentem, et nil (ut spero) ab ammoniaco diversum. *Magia natur.* lib. x. cap. 20. p. 442. Porta was born in 1545, and died in 1615.

† E' di sustanza volatile che posta à fuoco in breve spatio di tempo tutto si risolve in cossalazione; - - - conveniente allo scioglimento dell' oro muove et aiuta la generation del color celestino; anzi il suo fumo nella fiamme dà l'istesso colore amenissimo; adoprasì nelle saldature di ferro, che si fanno con stagno, oprando che lo stagno alla sustanza del ferro si unisca. Lib. iii. cap. 8. p. 383. See the *Latin translation*, p. 423.

‡ Ammoniacus subditicius in igne totus consumitur. *De natura fossil.* lib. iii. p. 212.

the production of a celestial blue colour, and in all probability he here alludes to a solution of copper.

Without attempting to examine at what time the art was discovered of converting the nitric acid into aqua regia by the addition of sal ammoniac, I shall only remark that, at any rate, it was known in the sixteenth century; for Imperati says that sal ammoniac is employed in the solution of gold; and Biringoccio,* who is older, recommends nitrous acid prepared with sal ammoniac for dissolving metals, and particularly gold. I will not either determine how old the use of this salt is in soldering and tinning; but I must observe, that it was known to Agricola † and Imperati. I however doubt whether it was very common, because Biringoccio ‡ recommends borax for that purpose, without so much as mentioning sal ammoniac; though it is possible that I may have overlooked it.

We are now arrived at the modern history, which I shall give in as brief a manner as I can, because it has been already fully treated on by

* Lib. ix. cap. 6. p. 131. b: aqua forte fatta con sal armoniaco. Also lib. ix. cap. 10. p. 141. b.

† De natura fossil. lib. iii. p. 215: Sale ammoniaco utuntur artifices, qui ex ferro acus conficiunt, cum earum capita plumbo incoquant candido. There were therefore iron pins with tinned heads.

‡ Page 135. a. and b. page 136 and 375.

others.* What was long ago shown by the celebrated Mr. Boyle † was proved in the year 1716 by Geoffroy the younger, that sal ammoniac was composed of the muriatic acid and volatile alkali, and that it could be thence prepared in Europe by sublimation. ‡ In the same year the jesuit Sicard gave the first certain account of the sal ammoniac manufactories at Damayer, in the Delta, and described in what manner this salt was prepared there, by sublimation in glass vessels, from the soot of the burnt dung of camels and cows, which is used in Egypt for fuel, with the addition of sea salt and urine. § In the year 1719, the Academy of Sciences at Paris received from Lemere, the French consul at Cairo, an account of the process employed; but it contained no mention either of sea salt or of urine. || Afterwards this information was in part confirmed, and in part rectified and enlarged, by Paul Lucas, ¶ Granger, or, as he was

* Abhandl. der Schwed. Akadem. xiii. p. 251. *Hildt Handlungszeitung* 1795, p. 267. 285. 270. 291. 300.

† See the proofs quoted in *Gmelin's Geschichte der chemie*, ii. p. 69.

‡ *Memoires de l'Acad.* 1720. p. 195. Basil Valentine had before taught how to separate the volatile alkali from sal ammoniac by means of the fixed alkali.

§ *Nouveaux mémoires des missions de la compag. de Jesus*, ii.

|| *Memoires de l'Acad.* 1720. p. 191.

¶ *Dritte Reise nach der Levante.* Hamburg 1721, 8vo. i. p. 208.

properly called, Tourtechot,* Shaw, † Poccocke, ‡ Norden, § Hasselquist, || Niebuhr, ¶ and Mariti.**

Several writers have asserted that sal ammoniac comes also from the East Indies. It is mentioned by Tavernier among the wares which, in his time, were brought from Amadabat, in the territories of the Mogul, to Surat; †† and Geoffroy states, that when the trade of Marseilles was interrupted by the plague, the French obtained from Holland sal ammoniac, which was shaped like a truncated cone, and was given out to be Indian. ‡‡ Pomet §§ also says, that some of the same kind was formerly procured from Venice and Holland. But Gaubius asserts that he was never able to hear of any such sal ammoniac in Holland; ||| nor is it to be found in the price currents of the East India company. I am almost inclined to suspect that these trun-

* Göttingische Sammlung der Reisen, iii. p. 427. Memoires de l'Acad. 1735. p. 107.

† Reisen. Leipzig 1765, 4to. p. 416.

‡ Beschreibung des Morgenlandes. Erlangen 1754, 4to. i. p. 400.

§ Reise. Breslau 1779, 8vo. p. 251.

|| Abhandl. der Schwed. Akad. xiii. p. 266. Reise, p. 577.

¶ Reise nach Arabien, i. p. 153.

** Viaggio da Gerusalemme par le coste della Soria. Livorno, 1787, 8vo. i. p. 239.

†† Reisen, ii. p. 114.

‡‡ Mem. de l'Acad. 1723, p. 221, where a figure is given of it. Geoffroy *Materia medica*, i. p. 213.

§§ Materialist. ii. p. 506.

||| Gaubii *Adversaria*. Leidæ 1771, 4to. p. 138.

cated cones were formed by the merchants from broken pieces or fragments of the Egyptian sal ammoniac, by solution and imperfect crystallisation or sublimation. In this manner the merchants at Marseilles convert the refuse of the Egyptian sal ammoniac into cakes by a new sublimation, in order that it may become more saleable, though it is not readily purchased by artists. Gaubius, however, has described a kind of sal ammoniac which he obtained from India, with the information that it was made in Indostan from the soot of animal dung; but in my opinion this requires further confirmation.

Where and at what time the first works for making sal ammoniac were established in Europe, I am not able to determine. The account given by Thurneisser, that the first sal ammoniac was made in the Tyrol in the ninth century, is truly ridiculous. It is not worth the trouble to inquire where he or Paracelsus found this foolish assertion; but I shall transcribe the passage, which Möhsen also has quoted,* from the original, now become scarce.† One might be almost induced

* Beyträge zur Geschichte der Wissenschaften in der Mark Brandenburg, p. 76.

† Μεγάλη χυμια vel Magna Alchymia das ist ein Lehr und unterweisung - - - durch Leonh. Thurneissern. Berlin 1583, fol. p. 53. Und sol der aller erste, der solehe salz nach conterfeyt und gemacht hat, gewesen seyn Hans von der Zeit, welcher umb das jahr Christi 834 aus dem Dörflein *Charras*, das in Tyrol oberthhalb dem Markt Imbst ligt, als ein geschickter bergmann, zum grossen Kayser

to believe, that in the time of Boyle there were manufactories of sal ammoniac in Europe.* But, perhaps, there may be no other foundation for all this than the before-mentioned assertion of Cæsalpinus, that this salt came from Germany. At Bamberg, the Germans were long accustomed to boil the sediment of the salt-pans with old urine, and to sell it cheap for sal ammoniac; and Weber asserts that some of the same kind is still made at Vienna. The hundred weight costs from twenty to thirty florins, but the refuse may be purchased for a mere trifle.† If I am not mistaken, the first real manufactories of sal ammoniac were established in Scotland; and the oldest of these, perhaps, was that erected by Dovin and Hutton at Edinburgh in 1756, and which, like many in England, manufactures this salt on a large scale.‡ Among the newest undertakings of this kind is

Carlen gen Ach ist kommen, und als ein berühmter und künstlicher mann, ein zeugmeister worden ist, der auch 361 jahr gelebt, und viel guter stücklein in der *Alchymia* (wie *Paracelsus* in andern theil seines büchlein *Corda sursum* mildet) erfunden hat, wie man dann noch heute zu tag, in seinem Johansen von der Zeyt geschriebenen Samlungbuch, mit sehr alten und uns diser zeit frembden Deutschen worten zu sehen haben mag.

* Though the sal-armoniac that is made in the East may consist in great part of camel's urine, yet that which is made in Europe (where camels are rarities) and is commonly sold in our shops, is made of man's urine. *Natural History of the human blood*, iv. p. 188.

† J. A. Weber Nützliche wahrheiten für Fabrikanten. Wien 1787, 8vo. p. 211.

‡ History of Edinburgh, by H. Arnot. Edinb. 1779, 4to. p. 601.

Gravenhorst's manufactory at Brunswick, and that which in the neighbourhood of Gottenburg manufactures sal ammoniac from the refuse left in making train oil; but in regard to the present state of them I have obtained no information.*

F O R K S.

AT present forks are so necessary at table among polished nations; that the very idea of eating a meal without them excites disgust. The introduction of them, however, is of so modern a date that they have scarcely been in use three centuries. *Tam prope ab origine rerum sumus*, says Pliny,† in speaking of a thing which, though very new, was then exceedingly common. Neither the Greeks nor the Romans have any name for these instruments; and no phrase or expression which, with the least probability, can be referred to the use of them, occurs any where in their writings. But had forks been known, this could not have been the case, since so many entertainments are celebrated by the poets or described by other writers; and they must also have been mentioned by Pollux, in the very full catalogue which he has given of articles necessary for the table.

* Neue Abhandl. der Schwed. Akad. xii. p. 275.

† Hist. natur. xiv. 4. sect. 5.

The Greek word *creagra** signified indeed a fork, but not a fork used at table. It meant merely a flesh-fork, or that instrument employed by cooks to take meat from a boiling pot, as is proved by the connexion of the words in all those passages where it occurs.† It is mentioned by Pollux, and by Anaxippus, in Athenæus,‡ among the utensils of the kitchen; and the scholiast on Aristophanes says, that this fork had a resemblance to the hand, and was used to prevent the fingers from being scalded. Suidas quotes a passage where the word denotes a hook at the end of a long pole, with which people, even at present, draw up water-buckets from wells and other deep places. This instrument, therefore, appears sometimes to have had only a hook, but sometimes two or more prongs.§ *Creagra* occurs once in Martianus Capella, a Latin writer, but in a passage which is not intelligible.

Equally inapplicable to our forks are the words *furca*, *fuscina*, *furcilla*, *fuscinula*, and *gabalus*, which are given in dictionaries. The first two were undoubtedly instruments which approached nearly to our furnace and hay forks. The trident of Neptune also was called *fuscina*. The *fur-*

* Κρεαγρα.

† The scholiast on the *Equites* of Aristophanes, 769, p. 208, says: κρεαγρα ειρηται απο του τα κρεα επι τοις λεβησιν αγρευειν και ανασπαν.

‡ Athen. lib. iv. p. 169.

§ Suidas quotes a passage from an epigram where this κρεαγρα is called σιδηροδακτυλος.

cilla even was large enough to be employed for a weapon of defence, as is proved by the expressions *furcillis ejicere* and *expellere*. *Fuscinula*, which in modern times is used chiefly for a table fork, is not to be found even once in any of the old Latin writers. The old translation of the Bible only explains the word *κρεαγρα* by *fuscinula*. *Gabalus*, according to every appearance, has given rise to the German word *gabeln*, but it denotes the cross or gallows, which last word Vossius deduces from it.*

A learned Italian, who asserts also that the use of forks is very new, is of opinion, that the Romans often used *ligulæ* instead of forks.† This I shall not deny; but the *ligula* certainly had more resemblance to a small spatula, or tea-spoon, than to our forks. According to Martial, many spoons at the other end seem to have been *ligulæ*.‡ But the two epigrams must be read in conjunction, so that the second may appear a continuation of the

* How *crux* or *gabalus* and *furca* were different from each other and yet often combined, is explained in *Lipsius de Cruce*, lib. iii. p. 98. Brunsvigæ 1640. 8vo.

† Hieron. Baruffaldi *Schediasma de armis convivalibus*. In Salengre, *Novus Thesaurus Antiquit. Roman.* iii. p. 742.

‡ Mart. Epigr. xiv. 120. *Ligula Argentea*.

Quamvis me ligulam dicant equitesque patresque,
Dicor ab indoctis lingula grammaticis.

121. *Cochlearia*.

Sum cochleis habilis, sed nec minus utilis ovis;
Num quid scis potius cur cochleare vocer?

first; for the epithets *habilis* and *utilis* can be applied to no other term than *ligula*. Besides, it is certain that the titles of the epigrams, or at least the greater part of them, were not added by the poet but by transcribers. The name also, which originally was *lingula*, gives an idea of the form. We read likewise that this instrument was used for scumming, for which purpose nothing is less fit than a fork.*

I have, I know not how, a great unwillingness to represent the tables of our ancestors as without forks; yet this was certainly the case: and when we reflect on their manner of eating, it will readily be perceived that they could much easier dispense with the use of them than we can. All their food, as is still customary in the East, was dressed in such a manner as to be exceedingly tender, and therefore could be easily pulled to pieces. It appears, however, that people, though not in the earliest periods, employed the same means as our cooks, and suffered meat to lie some time that it might be easier dressed. We often read that cooks, in order to provide an entertainment speedily, will kill an animal, and, having cleaned and divided it, roast it immediately, and then serve it up to their guests. But it is well known that the flesh of animals newly killed, if cooked before it has entirely lost its natural warmth, is exceedingly

* Plin. hist. natur. xxi. 14. Columella, ix. 15. 13. That the *ligula* was smaller than the *cochlear* is proved by Martial, viii. 23:

tender and savoury, as we are assured in many books of travels.

Formerly all articles of food were cut into small morsels before they were served up; and this was the more necessary, as the company did not sit at table, but lay on couches turned towards it, consequently could not well use both their hands for eating. For cutting meat, persons of rank kept in their houses a carver, who had learned to perform his duty according to certain rules, and who was called *scissor*, *carpus*, *carptor*, and by Apuleius is named *diribitor*.* This person used a knife, the only one placed on the table, and which in the houses of the opulent had an ivory handle, and was commonly ornamented with silver.†

Bread also was never cut at table. In former times it was not baked so thick as at present, but rather like cakes, and could easily be broken; hence mention is so often made of the breaking of bread. Juvenal, when he wishes to describe old bread, does not say that it could not be cut,

* See this word in *Pitisci Lexicon Antiq. Rom.*

† Clemens Alexandr. *Pædagog.* lib. ii. p. 161: το μαχαιριον το επι-τραπεζιον, αργυροηλον - - - εξ ελεφαντος πεποιημενον την λαβην. Posidonius relates in Athenæus, iv. 13. p. 151, that the Gauls used to take roast meat in their hand and tear it to pieces with their teeth, or to cut it with a small knife which each carried in his girdle. This was told as a thing uncommon to the Greeks. Baumgarten, who quotes this passage in *Algem. Weltgeschichte*, xvi. p. 657, adds, that Posidonius said also that the Gauls had bread so flat and hard that it could be easily broken. But this circumstance I cannot find in Athenæus.

but that it could not be broken.* The ancient form of bread is still retained in the paschal cake of the Jews, and in the *knæckbröd*† of the Swedes. The latter, which is almost as brittle but not so tender as biscuit, is not cut when used, but broken.

The Chinese, who also use no forks, have however small sticks of ivory, which are often of very fine workmanship, and inlaid with silver and gold. A couple of these is placed before each guest, who employs them for putting into his mouth the meat which has been cut into small bits.‡ But even this resource was not known two centuries ago in Europe, where people, as is still done by the Turks, every where used their fingers. As a proof, I shall not quote passages where mention is made of persons putting their hands or fingers into the dish;§ for such a mode of speaking is yet employed, though forks, as is well known, are in common use. I shall refer only to one passage in Ovid, which admits of no doubt,|| and where the author would certainly have mentioned these instruments, or rather have communicated to his

* Sat. v. 65.

† This word, according to Weidigren's Dictionary, signifies thin cakes, hard and crisp. TRANS.

‡ Samlung aller Reisebeschreibungen, vi. p. 148, 149.

§ Homeri Odys. xiv. 453: *ὁ δ' ἐπ' ονειᾶθ' ετοιμὰ προκειμένα χεῖρας ἰαλλόν.* Hi autem ad cibos paratos appositos manus porrigebant.

|| Carpe cibos digitis; est quiddam gestus edendi;

Ora nec immunda tota perunge manu.

De Arte Amandi, iii. 755.

pupils in the art of love a precept which at present is given to children, had the former been taught when young how to make use of forks.

Had they been used by the Romans, they must necessarily have occurred among the numerous remains of antiquity which have been collected in modern times. But Baruffaldi and Biörnstähl,* who both made researches respecting them, assure us, that they were never able to find any. Count Caylus, † and Grignon ‡ only assert the contrary. The former has given a figure and description of a silver two-pronged fork, which was found among rubbish in the Appian Way. It is of exceedingly beautiful workmanship, and at one end terminates in a stag's foot. Notwithstanding the high reputation of this French author, I cannot possibly admit that every thing of which he has given figures is so old as he seems to imagine. Grignon found in the ruins of a Roman town in Champagne some articles which he considers as table forks; but he merely mentions them, without giving a description sufficient to convince one of the truth of what he asserts, which, in regard to a thing so unexpected, was certainly requisite. One fork was of copper or brass; two others were of iron; and he says, speaking of the latter, that they seem to have served as table forks, but were coarsely made. I

* Briefe auf seinen Reisen, i. p. 268.

† Recueil d'Antiquités, iii. p. 312. tab. lxxxiv. 5.

‡ Bulletin des fouilles, i. p. 17. ii. p. 131.

however doubt whether he conjectured right in regard to the use of them.

As far as I know, the use of forks was first known in Italy towards the end of the fifteenth century; but at that time they were not very common. Galeotus Martius, an Italian, resident at the court of Matthias Corvinus, king of Hungary, who reigned from 1458 to 1490, relates in a book which he wrote in regard to the life and actions of this prince, that in Hungary, at that time, forks were not used at table, as they were in many parts of Italy,* but that at meals each person laid hold

* *Galeoti Martii de dictis et factis regis Matthiæ liber.* This work has been thrice printed, and may be found also in *Schwandtneri Scriptor. rerum Hungar.* tom. i. p. 548: Est consuetudo, non ut modo apud nos, ut singuli ex singulis, sed omnes ut ex una patina accipiant; nec ibi ullus in assumendo bolo, aut carnis inorsu, furcilla utitur, ut nunc in Italia transpadana in usu frequenti est. Quisque enim mensam ante se paniceam habens, ex communi patina, quod placet assumit; frustillatimque sectum, digitis ad os applicat. Hungari non habent in frequenti usu escarum structores; unde fit, ut cum maxima difficultate, in illa Hungarorum copia et mensa opipara, quis se a manuum vestisve iniquatione tueatur; guttatim enim aliquando crocinum jus defluens, sordidum hominem reddit. Croco enim et - - - in maxima copia utuntur - - - A jure autem et crocino, præsertim ungues et digitos, quibus escam apprehendimus, fieri crocinos, nullus ambigit. Sed rex Matthias, omnia manibus pertractans, nunquam se sordibus, quamvis locutioni intentus - - - Oculis meis, non sine admiratione, vidi loquentem regem, aut aures carmini vel sermoni maxima attentione præbentem, esculenta usque pertractantem, et nunquam coinquinatione turpatum; quod profecto mirum est, cum alii, summa cum attentione et diligentia, non possint aut manuum aut vestimentorum sordes præcavere.

of the meat with his fingers, and on that account they were much stained with saffron, which was then put into sauces and soup. He praises the king for eating without a fork, yet conversing at the same time and never dirtying his clothes.

That in France, at the end of the sixteenth century, forks even at court were entirely new, is proved by a book, already quoted in a preceding volume of this work, entitled *l'Isle des Hermaphrodites*.* It will, therefore, excite no wonder that in the same century forks were not used in Sweden.†

But it must appear very strange that Thomas Coryate, the traveller, should see forks for the first time in Italy, and in the same year be the first person who used them in England, on which account he was called, by way of joke, *Furcifer*.‡

* Ils ne touchoient jamais la viande avec les mains; mais avec des fourchettes ils la portoient jusques dans leur bouche, en allongeant le col, et le corps sur leur assiette, laquelle on leur changeoit fort souvent; leur pain mesme estoit tout destranché sans qu'ils eussent la peine de la couper, et croy qu'ils eussent fort désiré qu'on eust trouvé un invention qu'on n'eust point doresnavant la peine de mascher. Car à ce que j'en pouvois voir, cela les travailloit fort aussi que beaucomp d'entre eux avoient des dents artificielles, qu'ils avoient ostées devant que se mettre à table. *Description de l'Isle des Hermaphrodites*. A Cologne, 1724. 12mo. p. 105.

† Dalin *Geschichte des Reiches Schweden*, iii. 1. p. 401.

‡ Coryate in the year 1608 travelled, for five months, through France, Italy, Swisserland, and a part of Germany. An account of this tour was published by him, in 1611, under the singular title of *Crudities*, a new edition of which appeared in 1776. Of the latter

In many parts of Spain, at present, drinking-glasses, spoons, and forks are rarities ;* and even

a German translation was begun in 1798, with the same title (*Cruditäten*) ; but I believe that a part of it only was printed at Berlin. The passage to which I allude I shall quote from the original ; but I must first remark that this Englishman travelled afterwards to the East Indies, and in 1615 wrote in that country some letters which may be seen in *Purchas his Pilgrims*, vol. ii. and translated into Dutch in *Naaukeurige versameling der gedenk-waardigste Reysen na Oost en West-Indien - - - zedert het jaar 1611 tot 1616. Te Leyden 1707, 8vo* ; also in the edition of the *Cruditities* published in 1776. A more particular account of this singular character may be found in the *Biographia Britannica*, second edit. vol. iv. p. 273. In page 90 of the *Cruditities* the author says : Here j will mention a thing that might have been spoken of before in discourse of the first Italian towne. J observed a custome in all those Italian cities and townes through the which j passèd, that is not used in any other country that j saw in may travels, neither doe j thinke that any other nation of Christendome doth use it, but only Italy. The Italian, and also most strangers that are commorant in Italy, do alwaies at their meales usc a little forke when they cut their meat. For while with their knife which they hold in one hand they cut the meate out of the dish, they fasten their forke, which they hold in their other hand, upon the same dish ; so that whatsoever he be that sitting in the company of any others at meale, should unadvisedly touch the dish of meate with his fingers from which all at the table doe cut, he will give occasion of offence unto the company, as having transgressed the lawes of good manners, insomuch that for his error he shall be at least brow beaten if not reprehended in wordes. This forme of feeding j understand is generally used in all places of Italy ; their forkes being for the most part made of yron or steele, and some of silver, but those are used only by Gentlemen. The reason of this their curiosity is, because the Italian cannot by any meanes indure to have his dish touched with fingers, seeing all men's fingers are not alike cleane. Hereupon j myselfe thought good to imitate the

* Fischer's *Reise nach Madrid*, p. 238.

yet, in taverns, in many countries, particularly in some towns of France, knives are not placed on the table, because it is expected that each person should have one of his own; a custom which the French seem to have retained from the old Gauls. But as no person would any longer eat without forks, landlords were obliged to furnish these, together with plates and spoons.

Among the Scots highlanders, as Dr. Johnson asserts, knives have been introduced at table only since the time of the revolution. Before that period every man had a knife of his own as a companion to his dirk or dagger. The men cut the meat into small morsels for the women, who then put them into their mouths with their fingers. The use of forks, at table, was at first considered as a superfluous luxury; and, therefore, they were forbidden to convents, as was the case in regard to the congregation of St. Maur.

The English, Dutch, and French have adopted the Italian names *forca* and *forchetta*, given to our table forks; though these appellations, in my opinion, were used at an earlier period, to denote large instruments, such as pitch-forks, flesh-forks,

Italian fashion by this forked cutting of meate, not only while j was in Italy, but also in Germany, and oftentimes in England since j came home, being once quipped for that frequent using of my forke by a certain learned Gentleman, a familiar friend of mine, one Mr. Laurence Whitaker, who in his merry humour doubted not to eall me at table *furcifer*, only for using a forke at feeding, but for no other cause.

furnace-forks ; because in the low German, *forke* is a very old name given to such implements. The German word *gabel*, which occurs first in dictionaries for these large instruments, is of great antiquity, and has been still retained in the Swedish and Dutch. It appears to have been used for many things which were split or divided into two ; at any rate, it is certain that it is not derived from the Latin word *gabalus*.

LOTTERY.

AT present two kinds of lottery are employed in Europe. One is called the Italian or Genoese lotto, or merely the lotto ; the other is the common lottery, well known in England. Of the former, which has been long proved to be attended with great deception, and must soon be universally acknowledged to be hurtful, I do not mean here to treat, but only of the latter, which, at any rate, may be honourable or harmless, if we do not take into account the delusion it occasions to credulous and ignorant people, by exciting hopes which have little probability in their favour. I however do not promise a complete history of this invention : it experienced so many changes before it acquired its present form, that to give a full account of them would be tiresome to me as well as to the reader.

I shall not either, as some have done, reckon among the first traces of lotteries every division of property made by lot, otherwise it might be said, that Joshua partitioned the promised land into lottery-prizes, before it was conquered. In my opinion, the peculiarity of lotteries consists in this, that numbers are distributed gratuitously, or, as in our public lotteries, for a certain price, and it is then left to chance to determine what numbers are to obtain the prizes, the value of which is previously settled. The various conditions and changes invented by ingenuity to entice people to purchase shares, and to conceal and increase the gain of the undertakers, are not here taken into consideration, because they do not appear to be essential.

In the whole history of antiquity, I find nothing which has a greater resemblance to our lotteries than the *congiaria* of the Romans; and I am inclined to think that the latter furnished the first hint for the establishment of the former. Rich persons at Rome, as is well known, and particularly the emperors, when they wished to gain or to strengthen the attachment of the people, distributed among them presents, consisting of eatables, and other expensive articles, which were named *congiaria*. In general, tokens or tickets called *tesseræ** were given out, and the possessors of these, on presenting them at the store or magazine of the donor, received those things which

* And in Greek *συμβολα*.

they announced. In many cases these tickets were distributed *viritim*, that is, to every person who applied for them; and, in that case, these donations had a resemblance to our distributions of bread, but not to our lott eries, in which, chance must determine the number of those who are to participate in the things distributed.

But in the course of time it became customary to call the people together, and to throw among them, from a stage, the articles intended for distribution, in the same manner as money is scattered among the populace at the coronation of the emperor, and on other solemnities. Such things, in this case, were called *missilia*, and belonged to those who had the good fortune to catch them. But as oil, wine, corn, and other articles of the like kind, could not be distributed by throwing them in this manner, and as some articles were so much injured by the too great eagerness of the people, that they could be of little or no use, tokens or tickets were thrown out in their stead. At first these were square pieces of wood or metal, but, sometimes also balls of wood, inscribed with the name of the article which the possessor was to receive from the magazine.* Like

* Many have written at considerable length on the *congiaria*, yet the difference between the *missilia* and *tesseræ* has not been sufficiently explained. The first, or at least the best account, is in *Turnebi Adversaria*, xxix. 9. p. 637. In the following passage in the Life of Nero by *Suetonius*, xi. 11. p. 21, the articles which were thrown among the people are called *missilia*; but in regard to corn,

bank notes they were payable to bearer; and those who had obtained *tesseræ* were allowed to transfer or to sell them to others. This is proved by a passage in Juvenal,* where allusion, however, is made only to the *tesseræ frumentariæ*, which were not thrown out, but distributed.

the term *tesseræ* is expressly named: Sparsa et populo missilia omnium rerum per omnes dies; singula quotidie millia avium cujusque generis, multiplex penus, tesseræ frumentariæ, vestis, aurum, argentum, gemmæ, margaritæ, tabulæ pictæ, mancipia, jumenta, atque etiam mansuetæ feræ; novissime naves, insulæ, agri.

The passages, as far as I know, where a description is given of the manner in which the *tesseræ* were thrown out, are to be found in Dio Cassius. I shall here transcribe the translation according to the edition of Reimarus, xlix. 43. p. 600: Tesseræ quasdam, *συμβολα τετινα*, in theatrum desuper in capita spectatorum projecit, quibus huic pecunia, vestis illi, aliud quid alii obveniebat. lix. 9. p. 912: ludis gymniciis tesseræ, *συμβολα*, projecit in vulgus, et rapientibus plurima quæ in iis perscripta erant tribuit. lxi. 18. p. 998: Jaciebat ad plebem parvos globulos, *σφαιρια μικρα*, quorum singuli aliquid eorum inscriptum continebant, et pro ea quam quisque rapuerat tessera ei largiebatur. lxvi. 25. p. 1098: Sed et plebi utile fuit, quod Titus parvos globos ligneos, *σφαιρια ξυλινα μικρα*, de superiore loco jaceret in theatrum, qui tesseram continebant, *συμβολον εχοντα*, alieujus esculenti vestisve aut vasis argentei aut aurei, equorumque et jumentorum et peedum ac mancipiorum. Quos globos qui rapuisset, attulissetque ad dispensatores munerum, quod inscriptum erat consequiebatur. The wooden balls, like those of the Lotto, appear to have been hollow, and to have contained the ticket or written order. lxvii. 4. p. 1104: Spectatoribus multa largiebatur in sphaeris parvulis. lxix. 8. p. 1156: Dona in teatro et circo viris et mulieribus separatim per globulos (missiles) sparsit, *δωρα δια σφαιριων - - διερριψε*. Those desirous of knowing how these *tesseræ* were formed, and of what they were made, may consult *Hugo de prima scribendi origine*, Trajecti ad Rhen. 1738. 8vo. cap. 15. p. 229.

* Juven. Sat. vii. 174: Summula ne percat qua vilis tessera venit Frumenti.

Imitations of these Roman *congiaria*, but indeed on a very reduced scale, have been employed in modern times by princes and princesses, in order to amuse themselves with distributing small presents to their courtiers. For this purpose, various trinkets or toys are marked with numbers; these numbers are written upon separate tickets, which are rolled up and put into a small basket or bason. Each of the company then draws one out, and receives as a present the article marked with the same number. These small *congiaria* were formerly called in German *glückstöpfe*, or *glückshäfen*; and in the course of time the present lotteries took their rise from them.

In Italy, where commerce, as is well known, was first formed into a regular system, and where the principal mercantile establishments and useful regulations were invented, the merchants or shopkeepers, even in the middle ages, were accustomed, in order that they might sell their wares in a speedier manner and with more advantage, to convert their shops into a *glücksbude* where each person, for a small sum of money, was allowed to draw a number from the *glückstöpfe* (jar of fortune), which entitled him to the article written upon it. At first governments gave themselves very little trouble about this mode of selling merchandise. But as the shopkeepers gained excessive profits, and cheated the credulous people by setting on their wares an extravagant price, which

was concealed by the blanks, these *glückshäven* were forbidden, or permitted only under strict inspection, and in the course of time on paying a certain sum to the poor, or to the sovereign. In Germany they are still retained at many of the annual fairs; but in most countries they are subject to many limitations.

From these *glückshäfen* were produced our lotteries, when articles of merchandise were no longer employed as prizes, but certain sums of money, the value of which was determined by the amount of the money received, after the expenses and gain required by the undertakers were deducted, and when the tickets were publicly drawn by charity-boys blindfolded. As these lotteries could not be conducted without defrauding the adventurers, it was at first believed, through old-fashioned conscientiousness, that it was unlawful to take advantage of the folly and credulity of the people, but for pious or charitable purposes.

Lotteries were then established by private persons, and in the course of time even by governments; and the clear gain was applied to the purpose of portioning poor young women, of redeeming slaves, of forming funds for the indigent, and to other objects of beneficence. It was also hoped that these public games of hazard would banish other kinds still more dangerous; and no one suspected that the exposing of tickets for sale, and the division of them, so that one could pur-

chase an eighth or even a smaller share, would maintain and diffuse the taste of the public for gambling. This, however, increased; and the profit of lotteries became so great, that princes and ministers were induced to employ them as an operation of finance, and to hold the bank which always enriched the undertakers. People were then forbidden to purchase tickets in foreign lotteries, that the money won from the adventurers might pass into the sovereign's treasury, or at any rate be retained in the country; and in order that tickets might be disposed of sooner and with more certainty, many rulers were so shameless as to pay the salaries of their servants partly in tickets, and to compel guild companies and societies to expend in lotteries what money they had saved.*

Of the oldest lotteries among the Italians I have not been able to find any account. Varchi,† who

* This abuse of lotteries was mentioned by the states of Wirtemberg, in the year 1764, among the public grievances; and in 1770, the duke promised that it should be abolished.—I must here mention, to the honour of our prince and government, (*the author alludes to Hanover,*) that since lotteries were found necessary in this country, not a farthing of the profit has gone to the treasury of the prince, but the whole has been employed for pious or charitable purposes.

† Avevano i Fiorentini per far danari in tutti que' modi, e per tutti que' versi che sapevano e potevano, fatto un lotto de' Beni de' Rubelli, al quale si metteva un ducato per polizza, e per che non v'intervenissero fraudi, come spesse volte ne' maneggi di cosi fatte cose suole accadere, eletto commessari sopra i lotti, Simone Ginori e

wrote about the year 1537, relates, that during a great scarcity of money at Florence, in 1530, a lottery was established for the benefit of the state, and that the price of a ticket was a ducat. He however does not employ the term lottery, but uses the words *un lotto*, and calls a ticket *polizza*, a term which, as is well known, is generally used in regard to insurance. Le Bret says, that at Venice, in 1572, the inspection of lotteries was entrusted to the *provveditori del commune*; but as he does not mention the historian from whom this account is borrowed, the word which he translates lottery cannot be known. We nevertheless learn from his account, that this game was established at Venice in the middle of the sixteenth century, and placed under the inspection of the government.*

It is certain that the chance game which gave

Cristofano Rinieri, cominciassi a trarre pubblicamente ne modi soliti agli diciotto, e se ne cavarono semila secento fiorini d'oro. *Storia Fiorentina di M. Benedetto Varchi*. In Colonia 1721. fol. lib. xi. p. 366. This account may be found also in *Thesaur. Antiquit. et hist. Ital.* p. 384.

The *Vocabulario della Crusca*, which has not the word *Lotteria*, makes twice mention of the word *Lotto*, from the comedy *la Fiera* of Buonarruoti, which this poet, a brother's son of the celebrated artist of that name, made known in the year 1618. I sought for the passages in the following edition, *La Fiera, commedia di Michaelangelo Buonarruoti, coll' annotazioni dell' abate Salvini*. In Firenze 1726. fol. See iii. 4. 5. p. 165. b. duolmi un giulio, Ch'io gettai via nel mettere a un lotto; and iv. 4. 2. p. 226. b.

* Staatsgeschichte der republik Venedig. Leipsig und Riga 1769. 4to. i. p. 624.

rise to lotteries was brought from Italy to France, under the name of *blanque*, a word formed from the Italian *bianca*. The greater part of the tickets drawn were always white paper, *carta bianca*, consequently blanks; and because that word occurred oftenest in drawing, it gave rise to the general appellation. Hence also is derived the phrase *trouver blanche*, to obtain nothing, to get a blank, or to lose. At the time Pasquier wrote,* that is, in the last half of the sixteenth century, the name *numero* was also usual, because the numbers of the tickets, which were then called *devises*, were announced in the time of drawing. This name, instead of *nombre*, confirms the Italian origin. As each person in the time of drawing was attentive to his number, the phrase *entendre le numero* was applied to those who knew, or did not forget their numbers. Hence the expression, as Pasquier remarks, *il entend le numero*, which is still said of those who know their own interest, or understand how to pursue it. Frisch and others, therefore, in their dictionaries, have derived it improperly from the numbers with which merchants marked their goods.

In France also, the first *blanques* (lotteries) had no other prizes than articles of merchandise; and on that account they were set on foot only by merchants. But in the year 1539, Francis I en-

* Les recherches de la France. Paris 1665. fol. viii. 49. p. 729.

deavoured to turn them to his own advantage, by imitating the public establishment of them, usual at Venice, Florence, and Genoa. He permitted these games of chance under the inspection of certain members of the government, with a view, as was pretended, of banishing deceptive and pernicious games of chance, on condition, that for every ticket, *devise* or *mise*,* a *teston de dix sols six deniers* should be given to the king. But however small the sum required may have been, this *blanque* was not filled up in the course of two years, and the king was obliged to recommend it by an order issued in the month of February 1541; yet it is not known whether it was ever completed.†

In the years 1572 and 1588 Louis de Gonzague, duke de Nivernois and Rethelois, established a *blanque* at Paris, for the purpose of giving marriage portions to poor, virtuous young women,

* This word is still used in Germany by the writers on *Tontines*; such, for example, as Michelsen.

† Both the orders may be found in *Traité de la Police, par De la Mare*, Paris 1722. fol. i. p. 502. 504. In the first it is said: Pour faire cesser les dits inconveniens, et abolir et éloigner l'usage pernicieux, dont ils ont procedé et procedent, ne se trouveroit meilleur moyen que de permettre et mettre en avant quelques autres jeux et ébatemens esquils nous, nosdits sujets et choses publiques ne pussent avoir ne recevoir aucun interest; nous proposons entre autres celui de la *Blanque*, long-temps permis ès villes de Venise, Florence, Gennes, et autres citez bien policées, fameuses et de grande renommées, avec conditions honnestes et louables statuts et ordonnances, et articles utiles et necessaires pour l'entretienement d'icelle.

belonging to his estates. No lottery was ever drawn with so much ceremony and parade. Before the drawing, which began every year on Palm Sunday, mass was said; the servants employed were obliged to swear that they would act in a faithful and impartial manner; and even Sextus V gave to those who should promote this good work remission of their sins. The prize tickets were inscribed as follows: *Dieu vous a élue*, or *Dieu vous console*. The former ensured to the young woman who drew it 500 francs, which were paid to her on her wedding-day; the latter was the inscription of blanks, but suggested the hope of being more fortunate the year following.*

This example induced ladies of quality, from time to time, to establish similar *blanques* (lotteries) for benevolent purposes. Some destined the profit to the building or repairing of certain churches and convents. Three ladies, whose names history has not thought proper to communicate, set on foot a lottery containing a certain number of tickets at forty sous each, and employed the gain in redeeming, by means of the Mathurines, or Patres, as they were called, persons who had fallen into slavery among the Turks. On one occasion a *blanque* or lottery of a very singular nature was instituted by some ladies, in order

* The whole establishment is particularly described in *Histoire et recherches des antiquités de la ville de Paris, par Sauval*. Paris 1724. fol. p. 69.

to raise a fund for their spiritual guide or confessor, who had been chosen bishop, but had no property, that they might purchase for him a carriage and horses, with every thing necessary to support his ecclesiastical dignity. Each of these grateful ladies was obliged to procure or present to him the article announced by the ticket she had drawn, *pour le remercier, par cette petite largesse, pour le bon ordre qu'il avoit apporté à leurs consciences.*

But these games of chance occur much oftener in the French history, as the means employed to make valuable presents to ladies, and other persons of distinction. The largest, in all probability, is that by which Cardinal Mazarine endeavoured to increase his splendour, and render himself more popular among the courtiers. The tickets were distributed as presents; each was a prize, and the prizes were rarities of various kinds, and of different values. This, says the historian, was perhaps the first time that fortune did good to all and hurt to no one.*

That these games of chance became in the middle of the seventeenth century lotteries, in the proper sense of the word, is unanimously asserted by all the French historians who have touched on this subject, though in some circumstances they differ from each other. In the year 1644, Laurence Tonti came from Naples to Paris, and during a scarcity of money, which then prevailed, proposed

* Sauval, p. 71. 73. 76.

that kind of life-rents, or annuities, which at present are named after him *Tontines*, though they were used in Italy long before his time. But after tedious disputes in regard to his proposal, which was at length rejected, he gave in its stead a new plan for a large *blanque*, or lottery, which in 1656 obtained the royal approbation. It was to consist of 50,000 tickets, each at two *Louis d'ors*, so that the whole receipt would amount to 1,100,000 livres; but it is to be recollected that a *Louis d'or*, at that time, was only eleven livres. Of this sum, 540,000 livres were to be deducted for building a stone bridge and an aqueduct. The expenses of the *blanque* were estimated at 60,000 livres, and the remaining 500,000 were to be divided into prizes, the highest of which was 30,000 livres. But this *blanque royale*, for so it was called, was never filled up, and consequently never drawn. On this account it was found necessary to construct a wooden bridge, in the room of that which had been burnt. As complaints were often made by mercantile people, in regard to the disposal of merchandise in this manner, which had been hitherto permitted, and as this practice had evidently injured the *blanque royale*, the former, in the month of January 1658, was entirely forbidden.

In the year 1660, when the conclusion of peace and the marriage of Louis XIV were celebrated, the first lottery on the plan of Tonti was set on

foot at Paris. It was drawn publicly under the inspection of the police. A ticket cost only a *Louis d'or*, and the highest prize was 100,000 livres. This was won by the king himself; but he would not receive it, and left it to the next lottery in which he had no ticket. This was soon followed by several others. On that account, in the year 1661, all private lotteries were expressly forbidden under severe penalties, and this prohibition was repeated in 1670, 1681, 1687, and 1700.† Since that time there have been no other lotteries but the *loteries royales*, the profits of which were, in general, applied to public buildings, as was the case in regard to the magnificent church of St. Sulpice, and on that account they met with great support.

Sauval, and some others, ascribe the introduction of lotteries to a person from Lyons, named de Chuyes, who by profession was a gold-beater, but had a great knowledge of trade. He afterwards undertook long sea voyages, and published a book entitled, *La guide des chemins de Paris, redigée par ordre alphabetique*. His name, however, does not occur in any of the king's patents, but that only of Tonti.

* Dictionnaire de Commerce, par Savary. Art. *Lotterie*.

† All the orders here quoted may be found in De la Mare. Those desirous of being fully acquainted with the nature of the first Parisian lotteries, and the method of drawing them, may consult *Histoire de la ville de Paris, par Felibien*. Paris 1725. fol. ii. p. 1462.

This de Chuyes, according to Sauval, first proposed the name *lottery*, then usual in Italy, which, however, the other persons concerned did not approve. In particular, the well-known de Vaugelas, who had been chosen director of the undertaking, and who thereby hoped to pay his debts, strongly opposed it, and recommended the title *blanque royale*, though, in consequence of the many deceptions practised in the old games of chance known under that name, it was not likely to become popular. This much is certain, that the name lottery was first used in France, about the year 1658. For the order before mentioned of 1656 has the name *blanque*, but in that of 1658, the word lottery occurs for the first time, and in that of 1661 we find *espece de blanque et loterie*, and in that of 1670, *loteries et blanques*.

It is certain that the name was much earlier used in Italy and other countries, though Varchi employs only the word *Lotto*. I am acquainted with no older mention of the name Lottery than that in the passage quoted by Menage, from a letter of Christopher Longolius, or, as he is called by the French, Longueuil. It certainly seems to show that lotteries, in the first half of the sixteenth century, were new; but I doubt much whether it can be proved from it that the name is of French, and not Italian extraction, as Menage thinks, because Longolius generally gave himself out as a Frenchman, though he was born at Mechlin in

1490. As the name is much newer in France, and as the letter was written from Padua, where Longolius died in 1522, it is far more probable that the name had its origin in Italy.*

In the last place, this letter was written a short time before Longolius's death; for he mentions the election of Pope Adrian, which took place the same year.

The name lottery has been used also by Simon Majolus, who describes the oldest manner in which it was conducted;† but I have not been

* Christ. Longolii Epistolarum libri iv. Basilæ 1570. 8vo. iii. 33. p. 239. The letter is addressed to Octavius Grimoaldo, who lived, I think, at Venice, and had written, it seems, to Longolius, that he was unwilling to venture his money in the lottery. That Longolius had in his hands money belonging to Grimoaldo is proved by the letters iii. 3. iii. 7. 20: Nova ista aleæ ratio plane nostra est, et a nobis Loteria quasi vasculiam dicas appellatur; ab argenteo scilicet vasorum ad abaci ornamentum apparatus, qui ita inter eos, quorum in sortem conjecta sunt nomina, distribuitur, ut cuique aliquod vas obtigerit. Quod autem eo ludi genere te minime delectari significas, nec committendum putasti, ut pecuniam tanto periculo exponeres meam, agnosco prudentiam et tuam erga me benevolentiam, qui nihil de rationibus nostris statuas, quod non sit periculo vacuum. This derivation of the word *Loteria* is undoubtedly false, as Menage has already remarked, in his dictionary, Art. *Lot*. He there says, Je n'ay point lu ailleurs que *lot* signifiait *de la vaiselle*. Et je croy Longueuil s'est mal expliqué, et qu'il a voulu dire qu'on appelloit *Loterie* la vaiselle d'argent d'un buffet, parceque de son tems on mettoit ordinairement a la loterie la vaiselle d'argent d'un buffet.

† Dier. canicul. Offenbaci ad M. 1691. fol. tom. ii. colloq. 2. p. 287. a. Est in usu frequenti Europæ contractus quidam, quem vulgo vocant *Loteriam*. Iste vel privatim fit vel publice; privatim pro arbitrio eujusque; quando aliquis equum, vel quid simile statuto pretio (verbi gratia pro 50 aureis) exponit sortiendum cui obtingat, et

able to find at what time this Italian ecclesiastic wrote; though, in all probability, about the end of the sixteenth century. However, it is still doubtful whether he was the author of the words to which allusion is here made; for it is known that the greater part of the *Dies Caniculares*, published under his name, was written by Petrus Draudius, who died in the year 1630.*

The word *Lot*, in many ancient as well as modern languages, and particularly in the English, Swedish, Danish, and Dutch, has the same signification as *sors*, and is evidently the *lotto* of the Italians, and the *los* or *loos* of the Germans; consequently there is no proof that the word lottery is of French extraction, as Menage has supposed.†

In England the first lottery was proposed in the

deinde in hanc summam plures symbolam quisque conferunt, et aleam jaciunt, quis equum sit habiturus, vel etiam privatim plures annuli libri, specula, vel alia supellex proponitur, inter familiares eodem modo collatis symbolis (quæ vocant *Lota*) sortienda, vulgo vocant *la raffe* aut *riffe*. Quidam vocant *ludum ollæ*; opinor propter urnam seu ollam, in quam sortes jaciuntur. Publice vero cum instituitur, opus est principis vel reipublicæ consensu; suntque hoc in contractu, sive publice sive privatim fiat, multa consideranda, ut justitia contractus et perfectio illibata maneat.

* Placcii *Theatrum* anonym. et pseudon. 2. p. 431. *Reimanns Einleitung in die Historiam litterariam*, v. p. 800.

† See Du Cange, Art. *Lot*. Muratori, *Antiquit. Ital. mediæ ævi*, ii. p. 1240. *Von Ludewig gelehrte Anzeigen*, Halle, 1743. 4to. i. p. 230. Among the oldest German words in *Lipsii Epistolæ ad Belgas*, Cent. 3. 44. p. 49, stands *Los*, *sors*. The *t* is often changed into *s*. Thus *nut* in the English and Low German, *noot* in the Dutch, and *nöt* in the Swedish, are the same as the German *nuss*.

years 1567 and 1568, and, as the historian says, was drawn day and night,* from the 11th of January 1659, to the 6th of May the same year. It contained 400,000 tickets, at ten shillings each. The prizes consisted partly in money, and partly of silver plate and other articles. The neat profit was to be employed in improving the English harbours. The Antiquarian Society of London have still in their possession the original scheme, as it was then printed;† from which it appears that the name lottery was at that time used in England. In the year 1612 a lottery was drawn for

* The convenient machine and apparatus, by which the drawing is much forwarded at present, were not then known. A description of them may be found in *Savary's Diction. de Commerce*, and in *Von Uffenbach's Reisen*, ii. p. 596.

† This, as well as what follows, may be found in the *Gentleman's Magazine*, vol. xlvi. an. 1778. p. 470, from which it has been copied into the *Encyclopedia*, Philadelphia, 1798. 4to. x. p. 297. I shall here transcribe the whole title of the scheme: A proposal for a very rich lottery general, without blanks, containyng a great number of good prizes, as well as of redy money as of platc, and certain sorts of merchandises, having been valued and prized by the commandment of the quecn's most excellent majesties order, to the intent that such commodities as may chance to arise thereof, after the charges borne, may be converted towards the reperation of the havens and strength of the realme, and towards such other public good workes. The number of lotts shall be foure hundred thousand, and no more; and every lott shall be the sum of tenne shillings sterling, and no more. To be filled by the feast of St. Bartholomew. The shew of prizes are to be seen in Chcapside, at the sign of the Queene's Armes, the house of Mr. Dericke, goldsmith, servant to the queene, 1567. 8vo. Printed by Hen. Bynneman. See also *Maitland's History and Survey of London*, 1756. fol. i. p. 257. *New History of London*, by J. Northouck, Lond. 1773. 4to. p. 257.

the benefit of the English colonies; the largest prize in which, being silver plate to the value of 4,000 crowns, fell to the share of a tailor. In the reign of Queen Anne lotteries were forbidden as hurtful; but soon after they were again permitted, under a variety of conditions. In 1630 one was allowed to the undertaker of a water-conduit, and Anderson says* that this is the first time that lotteries are mentioned either in the *Fædera* or *Statutes*.

A lottery was drawn at Amsterdam in 1549, the profit of which was employed in building a church steeple;† and another was drawn at Delft, in 1595.‡ I was informed by Professor Fiorillo that there is still preserved at Amsterdam, in the Hospital for old men, *oude mannen huys*, a beautiful painting by David Vinckenbooms, eight feet in height and fourteen in breadth, which represents the drawing of a lottery in the night-time. The artist is said to have been born in the year 1578.

This game of chance must have been known also at an early period in Germany; for, in the year 1521, a lottery was established by the council at Osnaburg,§ and is mentioned in a work published

* History of Commerce.

† Commelin Beschryving der Stadt Amsterdam, i. p. 440. In the year 1561 the profit on a lottery was employed for enlarging the Orphan House. See *Pontani rerum Amstelodamens. hist.* Amstelod. 1611. fol. lib. ii. c. 2. p. 69.

‡ Beschryving van Delft, 1729. fol. i. p. 474.

§ Klock, de *Ærario*, lib. ii. cap. 118.

in 1582; but the prizes consisted only in articles of merchandise.* The citizens of Hamburg having proposed a lottery, according to the Dutch manner, for the purpose of building a house of correction, the magistrates gave their approbation in the month of November 1611, and in 1615 it was drawn.† At Nuremberg the first lottery seems to have been drawn in the year 1715. At any rate, Mr. Von Murr, in his Description of the remarkable things in that city,‡ mentions an engraving with the following title: “Representation of the *Lotto publico*, which was drawn in the large hall of the council-house, at Nuremberg, anno 1715.”§ It is certain that we are not here to understand the so called Italian *lotto*, but a common lottery, as the former was not introduced into Germany till a much later period. At Berlin the first lottery was drawn in the month of July 1740. It consisted only of one class of prizes, as was probably the case with all lotteries at first. It con-

* Sigismundi Suevi *Glückstöpfe, wie die bey der jetzigen Welt im Brauch sind.* This work I have never yet been able to meet with; but I have seen another of the same author, who was a clergyman at Lauben, and called himself *Freistudiensis*, entitled, *Geitzwagen.* Görlitz, 1579 and 1585. 8vo.

† *Nucleus recessuum et conventuum Hamburgensium.* Altona, 1705. fol. Art. *Lottery.*

‡ *Beschreibung, der Merkwürdigkeiten in Nürnberg,* 1801. 8vo. p. 352.

§ *Vorstellung des Lotto publico, welcher auf dem grossen Rathhause Saal zur Nürnberg gehalten worden, anno 1715.* J. A. Delzenbach del. et sculpsit.

tained 20,000 tickets, each of which cost five dollars; so that the whole income amounted to 100,000 dollars. There were 4,028 prizes, the largest of which was a house worth 24,000 dollars.*

The ill-famed Italian or Genoese lottery was, as its name shows, an invention of the Genoese, and arose from the mode in which the members of the senate were elected; for when that republic existed in a state of freedom, the names of the eligible candidates were thrown into a vessel called *seminario*, or, in modern times, into a wheel of fortune; and during the drawing of them it was customary for people to lay bets in regard to those who might be successful. That is to say, one chose the names of two or three *nobili*, for these only could be elected, and ventured upon them, according to pleasure, a piece of money; while, on the other hand, the opposite party, or the undertaker of the bank, who had the means of forming a pretty accurate conjecture in regard to the names that would be drawn, doubled the stakes several times. Afterwards the state itself undertook the bank for these bets, which was attended with so much advantage; and the drawing of the names was performed with great ceremony. The *venerabile* was exposed, and high mass was celebrated, at which all the candidates were obliged to be present.

A member of the senate, named Benedetto Gen-

* Versuch einer historischen Schilderung der Residenzstad Berlin. Berlin, 1798. 8vo. v. i. p. 19.

tile, is said to have first introduced this lottery, in the year 1620; and it is added, that the name of Gentile having never been drawn, the people took it into their heads that he and his names had been carried away by the devil, in the same manner as Schwartz, the inventor of gunpowder, as a punishment for this unfortunatè invention. But at length, the wheel being taken to pieces in order to be mended, the name, which by some accident had never been drawn, was found concealed in it.* Hence it may be easily seen how this game of chance was formed, by introducing numbers instead of the names of the nobility.

However, if I am not mistaken, it continued to be peculiar to the Genoese till nearly the middle of the eighteenth century. But as all travellers spoke of this *lotto di Genua*, and many wished to try their fortune in it, the Genoese, for their own benefit, established in many large towns commissioners, whose business was to dispose of tickets, and to pay the prizes to those who had been fortunate.

As an immoderate spirit of gambling was thus excited at Rome, Pope Benedict XIII, who sat on the papal throne from 1724 to 1730, forbade the Genoese lottery, under the pain of banishment to those who gambled in it, and to those who received the money. As this threat, however, did

* Labat *Reisen nach Spanien und Welschland*, Frankf. und Leipzig, 1759. 8vo. ii. p. 96. *Volkmann Nachrichten von Italien*, iii. p. 839.

not remove the evil, the succeeding pope, Clement XII, who died in 1740, followed the example of our German princes, and caused a lottery to be established even at Rome.* Since that time, permission for the same purpose has been renewed from year to year.†

It was not till a much later period that the Genoese lottery was introduced into Germany. According to the account of J. A. Kalzabigi, who had made himself known in Italy by many projects, and was appointed a Prussian privy-counsellor of commerce and finance, the first was drawn at Berlin on the 31st of August 1763.‡ In 1769, one was established in the principality of Anspach and Bayreuth, where it was continued till the year 1788. In 1774, a person named Wenceslaus Maurer came to Neufchatel, with permission from the king, and established a *Lotto* there, much against the will of the prudent inhabitants; but some one having won a capital prize, for which the undertakers ought to have paid 30,000 francs, after

* Le Bret, in *Algemeiner Welthistor.* xlvi. 3. p. 235. In *Raccolta d'opuscoli scientifici*, in Venezia 1735. tom. xii. p. 243, we find: *Alex Januensis Romam traductæ ratio, auctore Golmaro Marsigliano, elegiacon.* The poet has here taken a great deal of trouble to explain in Latin verse the terms *amben*, *ternen*, &c., together with the gain assigned to them. Those who wish to know how far the present establishment differs from the original form may consult this poem.

† A permission may be seen in *Grellmann's Staats-Anzeigen von Italien*, i. 1. p. 20.

‡ *Versuch einer histor. Schilderung der Stadt Berlin*, v. 1. p. 257.

procrastinating as long as they could, under various pretences, they at length became bankrupts, and made their escape from the country.*

These pernicious lotteries continued till the end of the eighteenth century, when they were almost every where abolished and forbidden. They are now permitted only in a very few states, which are not able to give up the paltry income derived from them. To the honour of the Hanoverian government, no *Lotto* was ever introduced into it, though many foreigners have offered large sums for permission to cheat the people in this manner. Those who wish to see the prohibitions issued against the *Lotto*, after making a great part of the people lazy, indigent, and thievish, may find them by the help of the index in Schlötzer's *Staats-Anzeigen*.

Si son execrable mémoire
Parvient à la posterité,
C'est que le crime, aussi bien que la gloire,
Conduit à l'immortalité.

BOLOGNA STONE.

THE Bologna stone, in consequence of its property of shining in the dark, which was observed by accident, has given rise to many laborious re-

* Beschreibung des fürstenthums Welsch-Neuenburg und Valengin. Berlin 1783. 8vo. p. 104.

searches and experiments, and to writings almost without number, which have not so much enlarged our knowledge of light, as proved that all the hypotheses hitherto offered by philosophers for explaining it, if not entirely false, are at least insufficient and uncertain. The history of this stone, therefore, though not unknown, deserves to be here repeated, especially as many parts of it require to be rectified.

As a complete description of it would be superfluous to mineralogists, it may be sufficient to remark, that this kind of stone is found in plates or single pieces, which in general are more or less of a conical form, have a dirty white or semi-transparent water-colour, and a foliaceous structure, which is observed on its being broken, though the stone, considered in another direction, appears to be fibrous. The surface of single pieces is uneven. But what distinguishes this species from the gypseous spars, to which it bears the greatest resemblance, is its extraordinary weight; and this it has in common with all ponderous spars, to which, according to its component parts, it belongs.

This stone is found on different eminences around Bologna, and particularly on the hill of Paderno,*

* Poter, whom I shall have occasion to name hereafter, says,—*In agro vulgo monte Paterno, et in agro vulgo Pradalbino - - - in rivulo quodam innominato prope Ronchariam, verius Ronchriam.* Some later writers, such as Linnæus, have mentioned these places, without telling us where they are to be found. They are situated in the neighbourhood of Bologna, but are not marked in any map.

which is situated at the distance of about a German mile from the city, loose, and scattered about between gypseous stones, in a marly earth, some of which is still seen adhering to pieces in my possession. It is found most readily after heavy rains, particularly in the streams which run down the sides of the hill; and it is there collected by persons who sell it at Bologna. In the year 1730, when Keysler was there, a pound of it could be purchased for a *paolo*. Some have asserted that this stone is found in many other parts of Italy; but of this I have seen no proof. Kircher, however, says that he found it between the aluminous stones of Tolfa;* but this is improbable, and has not been confirmed by any other writer. What Estner states,† that for several years past it has been found in the neighbourhood of Rimini, is more probable.

I shall take this opportunity of remarking, that the Bologna stone, according to its external characteristics, heaviness and hardness excepted, has a great similarity to those gypseous spars or selenites which were first described by Lehman,‡ and at the time, perhaps, by him alone; according to whose account, it is mentioned also by Vogel§

* *Magnes. Colonix Agrip.* 1643. 4to. iii. 4. p. 481.

† *Versuch einer Mineralogie.* Wien. 1797. 8vo. ii. 2. p. 1183.

‡ *Versuch einer Geschichte von Flötz-Gebürgen.* Berlin 1756. 8vo. p. 229.

§ *Mineralsystem.* Leipzig 1762. 8vo. p. 160.

and by Wallerius,* under the name of *Selenites globosus*: on the other hand, it has not been mentioned by the newer systematics under any particular appellation. In the county of Mansfeld it is found in detached masses or single pieces, more or less conical; and, to judge from the earth purposely left on the specimens in my possession, which were picked up in the neighbourhood of Sangershausen, in a yellowish red sandy clay. The pieces, many of which are round balls, two or three inches in diameter, and others longish rolls, have, externally as well as internally, a dark isabella colour, appear foliated on the fracture, or seem to consist of cuneiform radii, which meet in the centre of the ball. Many are hollow in the inside; and in this case the ends of the cunei or needles, which have between them a granulated gypsum mixed with a little clay, project into the cavity. Lehman says that the leaves, when placed in a heated stove, emit a hesperus, that is, shine; and this circumstance made Wallerius doubtful whether this selenite did not belong to the sparry fluors; but it is undoubtedly a gypsum. When the raw stone is put into acids, a very faint effervescence is observed; but when burnt pieces are employed, this effect is much stronger. It does not crack or break in the fire; but if exposed only a short time to a red heat it becomes totally opaque, whiter, and void of all lustre; it is also more fri-

* Systema Mineralog. Holmiæ, 1772. 8vo. i. p. 162

able, and crumbles to dust in water, exactly in the same manner as bastard *lapis specularis*. The luminous appearance in a warm stove I did not observe in the few pieces which I subjected to experiment. I was desirous to make this remark, because the mineralogists before-mentioned place globular selenite along with the Bologna stone, to which, however, it does not belong.

To render it capable of shining in the dark, a piece particularly heavy, foliaceous and pure, must be selected. After being made red-hot, it is pounded and reduced to a fine powder, which, by means of a solution of gum-tragacanth, is converted into a kind of paste, and formed into small cakes. When these are dried, they are brought to a state of ignition between coals, and then suffered to cool; after which they are preserved from the air and moisture in a close vessel. If one of these cakes be exposed a few minutes to the light, and then carried into a dark place, it will shine like a burning coal. It appears therefore to attract the light, or to be, as it were, a light-magnet. This power of emitting light becomes lost in the course of time; but it may be restored at first by heating, and afterwards by exposure again to ignition. I shall pass over the rules necessary to be observed in the numerous experiments made with this stone, as well as the consequences deduced from them. The former may be found in works on chemistry, and the latter in those on natural philosophy.

All the Italian writers who first describe this remarkable phænomenon, give the following account of the discovery. At the beginning of the seventeenth century there was at Bologna a shoemaker, who, having quitted his trade, applied to chemical labours, and particularly to the art of gold-making. I do not know whether those who have made the very just remark, that many shoemakers go beyond their last into the province of other arts or sciences, have mentioned among the already numerous instances this shoemaker of Bologna, whose name was Vincentius Casciorolus; but he certainly deserves a niche in the temple of fame; because it may with truth be said of him, that he kindled up a light to the learned; whereas the shoemaker of Görlitz, Jacob Bœhm, darkened or extinguished the existing light to the learned as well as the unlearned, so that the minds of many are still left in obscurity.

In the year 1602 Casciorolus came to Scipio Begatello of Bologna, who at that time was particularly well known by his attachment to the art of gold-making, and showed him this stone, under the mystical name of *lapis solaris*, which, on account of its weight and the sulphur it contained, as well as of its attracting the golden light of the sun, seemed to be fit for converting the more ignoble metals into gold, the *sol* of the alchemists. He showed it also to J. A. Maginus, the professor of mathematics; and the latter, who, in all proba-

bility, was no adept, sent both the natural and prepared stones to princes and learned men, and perhaps contributed more than any other person to make known this singular discovery.*

It, however, appears as if the Italian chemists concealed the preparation of this stone, or were not all acquainted with it. It was always said to be a secret known only to a few individuals in Bologna. Misson,† who was there in the year 1690, asserts that Bartholomew Zanichelli was the only person at that time in possession of it. In 1666 it was announced in the Philosophical Transactions,‡ that a clergyman, who exclusively possessed the art, had died, without communicating it to any one. Niceron,§ Lemery,|| and many others say,

* Fortunii Liceti *Litheosphorus, sive de lapide Bononiensi*. Utini 1640. 4to. p. 13. He calls the shoemaker *Casciorolus*, which seems to be wrong, as Lemery and others write his name *Cascariolo*. Liceti refers to the letters of Ovidio Montalbani, of which I can only give the title from Fantuzzi: *Epistolarum variarum ad eruditos viros de rebus in Bononiensi tractu indigenis, ut est lapis illuminabilis et lapis specularis, calamonastos, &c.* Bonon. 1634. 4to. Among the oldest accounts are those in *Petri Poterii Pharmacopœia spagyrica*, ii. 27, in *Poterii opera omnia edita a F. Hoffmanno*, Francof. ad M. 1698. 4to. p. 632. In this work the alchemist is called *Scipio Bagatellus*, a name which does not occur in Fantuzzi *Notizie degli scrittori Bolognesi*.

† Misson's *Travels*, German edit. Leipzig 1713. 8vo. p. 1068.

‡ An. 1666. n. 21. p. 375.

§ *Memoires des hommes illustres*, the German translation, vol. ii. p. 384.

|| *Cours de Chymie oder der vollkommene Chymist*. Dresden und Leipz. 1734. 8vo. p. 321.

that Homberg, during his residence at Bologna, had again discovered it, after many experiments; and that Lemery learned it from him and made it publicly known.

This, however, cannot be altogether true; for in the year 1622, P. Potier, or Poterius, a French chemist, who lived at Bologna, taught the preparation of it in his work already quoted, as did Kircher* in 1641, and the jesuit Casati† in 1686; though the process then employed was indeed not the best or most convenient; the proper method being first found out, after many accurate experiments, by the German chemist Marggraf, who showed also how similar light-magnets or luminous stones can be prepared from most of the ponderous spars and sparry fluors.‡

But, even at present, those who prepare this stone for sale at Bologna talk in such a manner as if the secret were known to them alone. This was

* Magnes, p. 481.

† De Igne. Francof. et Lips. 1688. 4to. p. 350.

‡ Marggrafs Chymische Schriften, ii. p. 119. This author says the cakes must be only as thick as the back of a knife; but that which I obtained in the year 1782 from Bologna, was an inch English measure in diameter, and two lines in thickness. It still weighs, after the brass box in which I long preserved it, between cotton, in a luminous state, has become black, and itself has lost its virtue, three drams. In colour it has a perfect resemblance to the star which Marggraf prepared from German stones, and presented to Professor Hollman, and which is now in my possession. It is contained in a capsule of tin plate, over which a piece of glass is cemented.

the case, in 1771, with the director of the institute in that city.* Keysler purchased a piece as large as a dried fig pressed flat, for about two or three *paoli*.

I shall embrace this opportunity of bringing to recollection, from De Thou's history of his own times, a relation which indeed contains many things incredible, and in all probability exaggerated, yet seems to be too well confirmed to be altogether rejected as false. If this be admitted, it may then be conjectured that, about the year 1550, either the Bologna stone, or what at present is called *phosphorus* and *pyrophorus*, was known to a few individuals. In the above year, when Henry II king of France made his solemn entrance into the town of Boulogne, on its restoration by the English, a stone from India, which was not hard, which had a luminous appearance like fire, and which could not be touched without danger, was presented to him by a stranger. For the truth of this account De Thou refers to the testimony of J. Pipin, in a letter to Ant. Mizaud, who asserts that he himself saw the stone.† Morhof, who seems inclined to

* Ferber's Briefe aus Wälsehland, p. 75.

† Dum rex Bononiæ esset, allatus est ad eum ex India orientali ab homine inognito, sed, ut apparebat, moribus barbaro, lapis stupenda specie et natura, videlicet lumine et fulgore mirabiliter coruscantibus, quique totus veluti ardens incredibili splendore micabat, et jaetis quoquo versus radiis ambientem aerem luce, nullis fere oculis tolerabili, latissime complebat; erat et in eo mirabile quod terræ impatientissimus, si cooperiretur, sua sponte et vi facto impetu con-

consider this stone as that of the philosophers,* remarks that this passage is found in the first Paris edition in octavo,† and in the Franckfort re-impressions, both in folio and octavo; as is the case in the copy which I possess,‡ but not in the other editions. He quotes also the words from the letter to Mizaud, which must be printed somewhere, but in what work I do not know. It appears that the historian inserted it almost without any change.

festim evolabat in sublime; contineri vero includive ullo loco angusto nulla hominum arte poterat, sed ampla liberaque loca duntaxat amare videbatur; summa in eo puritas, eximius nitor, nulla sorde aut labe coinquinatus; figuræ species nulla ei certa, sed inconstans et momento commutabilis, cumque esset aspectu longe pulcerrimus, contractari tamen sese impune non patiebatur, et diutius contra adniten- tibus aut obstinatius eum eo agentibus, incommodum afferebat; quod multi multis spectantibus sunt experti; si quid fortassis ex eo enixius conando detrahebatur, nam durus admodum non erat, nihilo minor fiebat. Hujus virtutem ac vim esse ad quam plura cum utilem, tum præcipue regibus necessarium aiebat hospes, qui miraculum ostenta- bat, sed quam revelaturus non esset, nisi ingenti pretio prius accepto. Hæc ut in literis Jo. Pipini oculati rei testis, qui in familia A. Mo- morantii M. E. medicinam faciebat, ad Ant. Mizaldum et ipsum iu- signem medicum pridie Ascensionis Bononiæ datis perscripta sunt; ista trado et amplius discutienda physiologis relinquo.

* Polyhist. i. 1. 13. 26. p. 127.

† Lib. v. p. 453.

‡ Lib. vi. p. 286 and 217.

FOUNDLING HOSPITALS.

CHILD-MURDER is so unnatural a crime, that mankind can be brought to the commission of it only by the greatest desperation, for which unfortunately there is too much cause. To parents who are just able by incessant labour to procure those things indispensably necessary to support life, the birth of every child increases the fear of starving or of being reduced to beggary. Those who have secured to them a scanty subsistence, but who live amidst the torments of slavery, wish to the new-born child, which at any rate is doomed to death, a speedy dissolution, before it can know that it has had the misfortune to be brought into the world, in order that they may not bequeath to it their poverty. A young female who has acquired by education the most delicate sense of honour and shame, finds herself, on the birth of an illegitimate child, exposed at once to the utmost disgrace and contempt. Her misfortune, though viewed with an eye of pity by the compassionate, excites the hatred of the greater part of her relations and friends, by whom she was before loved and respected, and who endeavoured to render her happy; and often amidst the most poignant feelings, and an agitation bordering on madness, she sees no other means of saving her honour than

the total concealment of her error by destroying the child: a resolution which, notwithstanding the vigilance of the laws, is too often attended with success. A young woman who at this moment finds herself suddenly despised and neglected by her admirer, who gained her affections by the most powerful of all means, love and confidence, and obtained from her what she cannot recover, is often induced, in a fit of despair, to vent her fury on the consequences of her seduction—the child of her seducer.

These misfortunes of mankind are among the disadvantages attending civilised society, which always render marriage more difficult as well as burthensome, and thereby make it impossible to gratify one of the most powerful impulses of nature. In the savage state, parents require no more for themselves and their children than what they can easily obtain. The inhabitants of Terra del Fuego, who live at the greatest distance from all culture, find shell-fish and esculent plants sufficient to appease their hunger; never are their thoughts disturbed by care for the maintenance of a child. The black slaves in St. Domingo say, that “it is only the white man who begs;” and indeed in this they are right*. Beggars exist only where they

* The negroes in St. Domingo cannot bear to be thought poor, or to be called beggars. They say none but white men beg; and when any one asks alms at the door, they observe to their master, “There is a poor white man, or a poor Frenchman, begging.” Labat had a

are established by religion and governments which command them to be fed. But the transition from living by one's own industry to beggary is, in consequence of the shame attending it, most painful and insupportable to those who with the greatest exertion and waste of strength, amidst the privation of every comfort, are exposed with their children to the horrors of famine. On the other hand, to those who, in our states, are obliged to eat the bread of mendicity, children are a blessing; because as long as they are incapable of running alone, they increase their alms by exciting greater compassion, and afterwards by begging in the streets*.

It is not therefore poverty already reduced to the state of beggary, but the dread of being at length overwhelmed notwithstanding every exertion to swim

negro who gave away a small part of his property, merely that he might have the proud satisfaction of being able to say, "There, white man; there is an alms for you." See *Algemeine Historie der Reisen*, xvii. p. 444. But, in all probability, there will be beggars even in St. Domingo, if the negroes are so fortunate as to establish the freedom which they have obtained at the expense of so much blood, and to form a negro state.

* During a great scarcity at Hamburgh, when bread was distributed to the poor, one woman told another, to whose request no attention had been paid, that she brought her child with her, and pinching it so as to make it cry excited compassion, and by these means received bread. The latter begged the other to lend her the child for the like purpose, and having made it cry obtained bread also; but when she returned and wished to restore the child with thanks, the mother was not to be found, and therefore she was obliged to keep the child.

against the stream, that occasions child-murder. The same is the effect of slavery which excludes the possibility of even hoping for a change to a better condition. The serfs of a hard-hearted land-proprietor, who however acted according to the established laws, entered into a resolution to get no children, that they might not be under the necessity of putting any of them to death.* The sense of honour becomes stronger the more the manners approach towards a certain degree of refinement; and it is proved that it is this cause which, in most instances, gives rise to child-murder. In vain have legislators endeavoured to prevent this crime by capital punishment, more cruel than the crime itself. But indeed it is difficult, or rather impossible, to proportion punishment to delinquency or the just degree of guilt.

It needs excite no wonder that many states where the Christian religion was not introduced, and even the Jewish, made no law against child-

* In the course of nine years not a single individual announced an intention of marrying. The young people supplied their wants in another manner. Hence arose a scarcity of men, who cannot be purchased in Europe, as in the West Indies. The proprietor, therefore, was obliged to sell his estate. The purchaser improved the condition of his serfs, and marriages became common among them. See *Büsch vom Geld-umlauf*. vi. 3. § 35. p. 393. La dureté du gouvernement peut aller jusqu' à détruire les sentimens naturels, par les sentimens naturels mêmes. Les femmes de l'Amérique ne se faisoient-elles pas avorter, pour que leur enfans n'eussent pas des maîtres aussi cruels? *Montesquieu, Esprit des loix*. Amsterd. 1758. 12mo. ii. p. 402.

murder, though the atrocity of it was never denied*. To render this crime less frequent, men fell upon the way of exposing children, in the hope that they might be found by benevolent persons, who would educate and maintain them. Parents imagined that in this manner less violence was offered to humanity; and they could more easily be induced to resign their children to chance than to become their murderers. They consoled themselves with the possibility, proved by various examples, that the exposed children might be saved, and be more fortunate than their parents†. To promote this, they deposited them in places where a great many people might be expected soon to pass, and where the child would consequently be found before it should perish by cold and hunger or be devoured by ravenous animals.

With this view they made choice of the market-places, temples, places where two or more highways met, wells, the banks of rivers or the sea shore, from which water was brought or which were the usual places of bathing; and even, when the children were placed in the water, means were con-

* See an Enquiry by Michaelis, why Moses did not introduce into his laws any thing in regard to child-murder, in the *Götting. Magaz. der Wissenschaften und Litteratur*, iv. 2. p. 84; and copied thence into *Krönitz Encyclopædic*, xxxvii. p. 809.

† The cause of children being exposed in this manner has been assigned and ably examined by *Lactantius*, vi. 20, 21: from whose remarks one will readily comprehend how parents could be so hard-hearted.

trived that they should at any rate float some time, without being injured. For this purpose they were placed in small chests, trays, or close baskets, or wrapped up in water-proof bandages.* At Athens children were commonly exposed in that place called *cynosarges*, which was one of the *gymnasia*.†

* Many preparations for this purpose may be seen quoted in *J. J. Hofmanni Lexicon Universale. Art. Exponendi mos.*

† In Lipsii Epist. ad Belgas, i. 85. p. 85, the following passage occurs: Mitiores illi, qui in publico aliquo urbis loco exponerent, ut fas saltem ab homine tolli, vel in servitutum. Athenis aut juxta eas, hoc fuisse Suidas indicat. *Κυνοσαργες*, inquit, *τοπος εν τη Αττικη* [*εν η τους νοθους των παιδων εταπτον*]: *Cynosarges* locus in Attica, ubi spurios infantes ponebant. Et causam addit, quia Herculis ibi templum, qui et ipse inter spurios fuit. But the words which I have enclosed in brackets are not to be found in Suidas, either i. p. 230, where under the head *Αντισθενης* he speaks of the Gymnasium; or p. 869, where the proverb *ες κυνοσαργες* is explained; or ii. p. 398, where this is repeated. He only says that illegitimate children were there instructed. Lipsius refers to *Stob.* 476, *Dioc.* 71; but where he found this quotation I am unable to conjecture; at any rate I have met with nothing in Stobæus relating to this subject.

In *Joach. Stephani lib. de Jurisdictione veterum Græcorum cap.* 13, which may be found in *Gronovii Thesaur. Antiquit. Græcar.* vi. p. 2736, the following passage occurs. Fuit teste Suida hæc schola, ceu *βρεφοτροφειον* (*cynosarges*) non procul a porta civitatis constructa, in quam infantes expositi a matribus pudicitiae prostratae celandæ gratia recipiebantur, et liberalibus studiis informabantur, quæ expositio infantum Athenis multum invaluerat. If this could be proved, it would shew that the children were not only exposed there, but educated at the public expense. I have, I confess, taken a great deal of pains to obtain proofs, but none are to be found in Suidas; nor does any thing like what is said by Lipsius and Stephen occur in the numerous passages collected by Menage in regard to *cynosarges*, in his notes to Diogenes Laertius, vi. 5. 13. p. 230; or in *Erasmii Adagia*, where the author explains the wish *ad cynosarges*.

At Rome the most usual place was that pillar called *columna lactaria*, which stood in the market where kitchen vegetables were sold.*

When the exposure of children in civilised states began to be condemned as unlawful, it was however suffered to pass unpunished, even under the first Christian emperors. Legislators only endeavoured by regulations of every kind to render it less common, and to provide for the maintenance of children; until at last, through horror at the cruelty of it, but without thinking of the causes or attempting to remove them, they conceived the unfortunate idea, in order to guard against this crime, of declaring it to be murder, and punishing it as such. It became then much safer for parents to bury children, or to throw them into the sea, than to run the chance of exposing themselves to the utmost shame and punishment, when they were searched out and discovered. In Greece, but not at Thebes in Bœotia,† the exposure of children was permitted and common, and therefore many of the Greek historians mention the contrary as a

* Festus de Verborum significatione, p. 203: Lactaria columna in foro olitorio dicta, quod ibi infantes lacte alendos deferabant. Barth in *Adversar.* viii. 5, p. 368, thinks that in this passage we ought to read *deserebant*. But P. Victor, who lived about the end of the fourth century, says, in *Commentar. de urbe*: Forum olitorium, in eo columna est lactaria, ad quam infantes lacte alendos deferunt. To what part of present Rome this place belonged, has been determined by Adler in *Beschreibung der Stadt.* Altona 1781. 4to. p. 332.

† Aristot. *Polit.* vii. 16. p. 892.

foreign but meritorious custom. Strabo,* on this account, praises the Egyptians, and Ælian † extols the laws of the Thebans against the killing and exposing of children. This cruel practice was equally common at Rome. Romulus, however, who was himself a foundling, endeavoured to restrain it, and his order was confirmed in the twelve tables; but as population, luxury, scarcity, and dissipation increased, it became customary for those who had more children than they wished, to expose some of them. Many deposited with them rings and other costly ornaments; and those who were poorer, trinkets of little value, partly to entice people to receive the children, and partly that, by describing these appendages, when the children were grown up, or their own circumstances had become better, they might be able to recover them.

Even at present, in many places, the children carried to foundling hospitals are accompanied by tokens, which are carefully preserved, as is the case in the *Spedale degl' innocenti* at Florence, ‡ where a piece of lead imprinted with a number is hung round the neck of each babe, in such a manner that it cannot be easily removed, and occasions no inconvenience in the wearing. By these means,

* Lib. xvii. p. 1180. edit. Amstel. 1707.

† Variæ histor. ii. 7. p. 69.

‡ Baldinger's Neues Magaz. für Aerzte, xii. 2. p. 154.

one can obtain information there, even at a late period, in regard to each child.*

It is mentioned by Tacitus,† as a circumstance deviating from the Roman manners, that the old Germans considered child-murder as a crime; and where he speaks of the peculiarities of the Jews, he does not fail to relate the same thing of them.‡ Dionysius of Halicarnassus bestows the like praise on the Aborigines.§

When the morals of mankind began to be improved under the influence of Christianity, its followers endeavoured by every means in their power to banish from among them this cruelty, on account of which they so bitterly reproached the Romans.|| The first Christian emperors, however, did not venture to forbid it as a crime; though Constantine called exposure a kind of murder, and wisely exerted himself to remove the causes of it. By an order issued in the year 331, he endeavoured to deter parents from it, as he there deprived them of all hope of being able to claim or recover exposed children, even if they should make good the

* Such appendages or tokens were called *γυρισματα*, *crepundia*. Instances of their use may be found in *Heliodor. Æthiop.* iv. 7. . 174, 175. ed. Francof. 1531. 8vo. also in many comedies.

† *De Moribus German.* cap. 19.

‡ *Histor.* v. 5. p. 354.

§ *Lib.* i. cap. 16. p. 13. ed. Francof. 1586. fol.

|| *Minucii Felicis Octav.* xxx. p. 307. xxxi. p. 326. See also the Christian writers quoted on this passage by Elmenhorst.

expenses incurred by those who had maintained them.* This cruel practice was nevertheless continued for a long time after. Lactantius,† who lived under the reign of Constantine, describes it as a still prevailing remnant of barbarity; and Julius Firmicus, who wrote about the year 336, considered it worth his while to give particular instructions for casting the nativity of foundlings.‡ The exposure of children was not completely prohibited till the time of Valentinian, Valens, and Gratian, in the last half of the fourth century.§

* Cod. Theodos. Lib. v. tit. 7. de expositis, l. 1. p. 487. edit. Ritteri, where the whole has been proved and illustrated by Gothofredus.

† Lactant. vi. 20, 21.

‡ Astronom. lib. vii. c. 1. p. 194. edit. Basilæ apud Hervagium, 1533. fol. I shall refer those desirous of becoming acquainted with all the proofs belonging to this subject to Ger. Noot, *Julius Paulus*, which may be found in *Noodt Opera omnia*, Coloniae 1732. fol. p. 493. Against some of the assertions here Bynkershoek started doubts, in his *Opuscula*, ed. a Conrado, Halæ 1729. 4to. ii. p. 108; which Noodt, however, endeavoured to controvert in a particular tract, p. 515. This answer was printed by Bynkershoek in his *Opuscula*, p. 311, with his own observations, which, according to the usual manner, are very coarse. The observations of Elmenhorst, Ouzel, and others, on *Minucius Felix*, p. 307 and 326, in the beautiful edition Lugd. Bat. 1709. 8vo, deserve in particular to be read. Bynkershoek refers chiefly to *Alphonsi á Caranza de partu naturali et legitimo*, cap. 4. *de partu exposito*.

§ This prohibition may be found in *Cod. Justin.* lib. iv. tit. 52. de infant. expositis, l. 2. Unusquisque sobolem suam nutriat; quod si exponendam putaverit, animadversioni, quæ constituta est, subiacabit.

One cannot, without reluctance, believe that this barbarous practice was so long permitted, or remained unpunished, in civilised states ; but it must be mentioned, to the honour of antiquity, that in many countries the care of government was directed, at an early period, to exposed children. Not only were means pursued in Greece and Rome to encourage the reception and educating of foundlings, by assigning them as property to those who took them under their protection ; but it was also made a law, that foundlings who were not received by private persons should be educated at the public expense. At Thebes, where, as already observed, child-murder and the exposure of children were forbidden, parents in needy circumstances were desired to carry their new-born children to the government, and the latter committed them into the hands of those who engaged to take the best care of them for the least money. In the like manner, at present, foundlings are placed with nurses to be maintained at the cheapest rate ; but with this difference, that at Thebes the children became slaves for life to those by whom they were educated, whereas in our times, when they grow up, they are free people, and learn to gain a livelihood for themselves.*

* I do not know whether I rightly understand Ælian, who is the only author by whom this establishment is mentioned. His words are : *αι αρχαι παραλαβουσι αποδιδονται το βρεφος τη τιμην ελαχιστην*

The humane decrees of the emperor Constantine the Great, both for Italy and Africa, the first in the year 315, and the second in 322, deserve here to be mentioned. The governments in those countries were enjoined to prevent the murder, sale, giving in pawn, or the exposure of children, by taking care that parents who were too poor to educate their offspring, should receive from the public treasury or magazines, or from the emperor's privy purse, as we say at present, food, clothing, and other necessaries; and as new-born

δονται. Here the foster-father seems to have purchased the child; but had it been sold, it must have been given not to the person who offered the least, but to him who offered the largest sum. Ælian, perhaps, meant to say, that the child was consigned to the person who gave for it any sum, however small; but τιμη ελαχιστη can hardly have this meaning. In the old translation of Justus Vulteius the passage is thus given: *magistratus acceptum infantem alicui tradit levi pretio, cum quo pactum et conditiones intercedunt, ut bona fide infantem alat* Here by omitting δονται the meaning seems to be left to the reader. In Perizonius, who boasts of having improved that translation, we read: *magistratus acceptum dedunt infantem, minimum pro eo pretium danti*; but this writer has not given any explanation. Professor Tychsen, to whom I have often acknowledged my obligation, thinks that, because at auctions it was customary to call out "Who bids more?" the same expression was used when the question was "Who will take the least?" Thus at present, instead of saying *to kindle, to burn*, people use the expression *to throw into the fire*, even when the thing to be burnt, such for example as a ship, cannot be thrown into the fire. Quintus Calaber, a long-expected edition of which has been lately published by Mr. Tychsen, says νηας δε πυρος καθυπερθε βαλεσθαι, lib. i. v. 94, for *to burn the ships*. The grammarians, I think, have given to this irregularity, which seems to be borrowed from the language of the vulgar, the name of *enallage*.

children required immediate attention, that this should be done without any delay.*

The conjecture of Gothofredus, that the emperor was induced to adopt these measures by the urgent representation of Lactantius, appears to me highly probable. This writer, from the year 317, had been tutor to Prince Crispus, and had before dedicated or transmitted to the emperor his book, wherein he painted, in glowing colours, the detestable practice of parents then prevalent, which gave rise to the greatest disorders; and on that account he offered them the specious advice not to beget more children than they were able to main-

* Codex Theodos. lib. xi. tit. 27. tom iv. p. 197: De alimentis, quæ inopes parentes de publico petere debent. Tabulis - - scripta per omnes civitates Italiæ proponatur lex, quæ parentum manus a parricidio areeat, votumque vertat in melius. Officiumque tuum hæc eura perstringat, ut si quis parens adferat sobolem, quam pro paupertate educare non possit, nec in alimentis, nec in veste imperienda tardetur, cum educatio naseentis infantia moras ferre non possit; ad quam rem et fiscum nostrum et rem privatam indiscreta jussimus præbere obsequia. The decree for Africa was as follows: Provinciales egestate victus atque alimonix inopia laborantes, liberos suos vendere vel obpignorare cognovimus; quisquis igitur hujusmodi repperietur, qui nulla rei familiaris substantia fultus est, qui que liberos suos ægre atque difficile sustentet, per fiscum nostrum antequam fiat calamitati obnoxius, adjuvetur; ita ut proconsules, præsidesque et rationales per universam Africam habeant potestatem, et universis, quos adverterint, in egestate miserabili constitutos, stipem necessariam largiantur, atque ex horreis substantiam protinus tribuant competentem. Abhorret enim nostris moribus, ut quemquam fame confici, vel ad indignum facinus prorumpere, concedamus.

tain.* I am inclined to think that this advice did not much please the emperor, who was obliged to keep on foot a numerous army; and as it could not be very agreeable to many married persons, he comprehended this recommendation of prudence or moderation among those calamities from which he was desirous to preserve parents by the above decrees.

After these imperial orders, children remained with their parents, and were educated by them; but it appears that the cities of Athens and Rome had, at an early period, public orphan-houses, in which children were educated at the public expense. What has been already said of the gymnasium called *cynosarges* may serve as a proof; and Festus and Victor make it still more certain that there was an institution of this kind at the *columna lactaria*. At any rate, there can be no doubt that, in the sixth century, there were houses at Rome for the reception of deserted children.

The emperor Justinian, who by a particular law, in the year 529, declared foundlings to be free, and forbade those by whom they were received and educated to treat them and detain them as slaves, † often introduces these establishments, under the appellation of *brephotrophium*, in his laws re-

* Quare si quis liberos ob pauperiem non poterit educare, satius est, ut se ab uxoris congressione contineat, quam sceleratis manibus Dei opera corrumpat. Lib. vi. cap. 20.

† Cod. lib. viii. tit. de infant. expos. l. 3.

specting donations to churches and other beneficent institutions.* This word, composed of the Greek term *brephos* a child, and *trepho* to educate, seems to show that houses of this kind were established at an earlier period in the cities of Greece, and were only imitated at Rome; though of this I have, as yet, found no proof. Du Cange and Stephen have both introduced the word in their Greek dictionaries, but refer only to the Justinian code. Gesner, in Stephen's lexicon, makes a distinction between *brephotrophium* and *curotrophium*; the latter, it is said, means a house in which grown-up and not new-born children are educated, and the same thing is repeated in the same words in *Calvini Lexicon Juridicum*. Both assert that this word, formed from *κουρος* or *κορος*, *puer*, is used by Justinian, but does not occur in the book of laws, nor is used by Brisson. It is not to be found in the dictionary of Basle nor in Stephen's Greek Lexicon, but both these have the word *κουροτροφος*, which indeed occurs in Homer and in Hesiod.

* Cod. lib. i. tit. 2. de sacrosanctis eccles. 19. p. 19: Si quis vero donationes usque ad 500 solidos in quibuseunque rebus fecerit, vel in sanctam ecclesiam, vel in xenodochium, vel in nosocomium, vel orphanotrophium, vel in ptochotrophium, vel in gerontocomium, vel in brephotrophium, vel in ipsos pauperes, vel in quameunque civitatem; istæ donationes. - - - The same names are repeated in the law 23 immediately following; also in *Novell. collat. 8. tit. 12. cap. 1. p. 219.* and *coll. 9. tit. 3. cap. 1. p. 245.* Here not only foundling hospitals but poor-houses in particular are mentioned. The former are named also in *Cod. lib. 1. tit. 3. de episc. et clericis, L. 32. p. 32.* and in the same *L. 42. 5, and 9; likewise, L. 46, 1.*

As Calvin and Gesner refer to Hottoman, I am inclined to think that the word was coined by him, especially as Gesner in the Thesaurus of Faber says, “*Curotrophium potest dici domus alendis parvulis destinata.*”

It is rather astonishing that no mention of the oldest institutions of this kind, or of their establishment, is to be found in the works of the ancients. There is reason, however, to conjecture, that as long as the sale of children and the slavery of foundlings were permitted, the number of those maintained at the public expense could not be very great. But respecting the *brephotrophia*, even under the later Christian emperors, nothing is said to be found that can give us any idea of the manner in which they were regulated; nothing in regard to the place from which the nurses were procured, or how food and clothing were provided for the children, and as little in regard to the number of children, reared in these benevolent institutions who lived to become old.

It might be satisfactory to know, whether the oldest institutions of this kind were more fortunate in answering the object of their establishment, than our expensive orphan-houses are at present.

The great difficulties which attend institutions of this kind are, no doubt, the chief cause why mention of them so seldom occurs during the later centuries, in which the foundation of hos-

pitals, and donations to these and other pious establishments, were so numerous: they are, however, found so often, that it is impossible to consider them as an invention of modern times. I shall here point out those instances which have hitherto occurred to me; but must first observe, that many more will be found in perusing the lives of saints, and the history of convents, religious orders, churches, and towns. Wherever they are mentioned, they are always under the inspection of the clergy.*

The oldest establishment for orphans in Germany, which I can mention at present, is that at Triers, in the eighth, or seventh, or even sixth century; the account of it is to be found in the life of St. Goar, who lived at Triers under Childebert, consequently in the last half of the sixth century. His historians or panegyrists relate, that, being accused before archbishop Rusticus of many misdemeanors, as a proof of his innocence he hung up his hood (in the Latin original *cappam seu cucullum*) upon one of the sun's rays, which entered his cell, as if upon a nail, and that his enemies were still so incredulous, as to consider him guilty. The archbishop then, continue they, to whom a

* I am inclined to think that much information on this subject might be found in a work of Muratori, which he published under the name of Lamindus Pritanius, with the following title: *Della carita Cristiana in quanto essa e amore del prossimo*: I have not, however, been able to find it.

new-born child, which had been deposited in the marble conch before the church door, had been brought, asked him, as a proof of his sanctity, whether he could tell the father of it; upon which Goar, after a most fervent prayer, commanded the child, in the name of the Father, Son, and Holy Ghost, to declare who were its parents. The child, with a clear voice immediately named its mother, and also its father, the archbishop himself, who in consequence was deprived of his dignity.*

* One life of St. Goar is to be found in *Acta Sanctorum*, Jul. 2. p. 327—346, whence the passage, which is very faulty, has been transcribed into *Meusel's Geschichtsforscher*, iv. p. 226, and into *C. F. Meisner's Abhandlungen über die Frage: sind Findelhäuser vortheilhaft oder schädlich?* Gottingen 1779. 8vo. p. 134. It is much more intelligible in Mabillon's *Acta Sanctorum ordinis S. Benedicti*, Venetiis 1733, fol. p. 266, from which I shall transcribe it: Venit puer de clero Treverorum, nomine Leobiscus, portans in brachio suo infantem tres noctes habentem, qui fuerat projectus in illam concham marmoream, sicut est consuetudo Treverorum, ubi pauperulæ feminæ infantes suos solent jactare. Hæcque consuetudo erat, ut quando aliquis homo de ipsis infantibus projectis misericordia motus vellet curam habere, ab illis quos nutricarios vocant matriculariis S. Petri compararet, et illi episcopo ipsum infantem præsentare deberent, et postea episcopi auctoritas eundem hominem de illo nutricario confirmabat.

Another life by Wandelbart may be found also in *Mabillon*, p. 273; but here the story is fuller and more circumstantial: Supervenit puer quidam ex clericis ecclesiæ, nomine Leobiscus, in ulnis infantulum gestans, qui ab hora nativitatis tres tantum noctes implese putabatur, et cujus qui essent parentes ignorabatur. Moris quippe tunc Trevirorum erat, ut cum casu quælibet femina infantem peperisset cujus nollet sciri parentes, aut certe quem pro inopia rei familiaris nequaquam nutrire sufficeret, ortum parvulum in quadam marmore concha, quæ ad hoc ipsum statuta erat, exponeret; quæ etiam

The small portion of truth contained in this ridiculous story is, that, at the time when the author wrote, there was an establishment for foundlings at the church of Triers; that the children were deposited in a marble conch placed before the church; that they were received by poor people maintained in order to watch the church, and who were called *matricarii*, because they were matriculated in it, and by them carried immediately to the bishop, and that the child under his sanction was given to some person in the community who agreed to take care of it. These foster-parents were named *nutricarii*. It may be thence easily perceived, that there were then no orphan-houses properly so called, in which children are educated; but that the children, as is the case in our institutions for the poor, were given to others to be nursed, and, in all probability, the clergy paid to the *nutricarii* a certain sum from the alms destined for that purpose.

One of the lives which relates to the silly tale already mentioned, was written by an author who,

concha nunc in monasterio Prumia, dono Pippini clarissimi regis aquæduetui mancipata, fratribus aquam eoram refectorio præbet: ut cum expositus infans reperiretur, existeret aliquis qui eum provocatus miseratione suscipere et enutrire. Si quando igitur id contigisset, eustodes vel matricularii ecclesiæ puerum accipientes quærebant in populo, si quis forte eum suscipere nutriendum et pro suo deinceps habere vellet; ubi ad eam rem offerret se aliquis, infans qui esset expositus episcopo deferebatur, et ejus privilegio auctoritas nutriendi habendique parvuli ei qui a matriculariis susceperat firmabatur.

according to the opinion of Mabillon, lived at a period not much later than St. Goar. The other is by Wandelbart, who lived in the ninth century, and who refers for his authorities to old manuscripts and other documents, *vetusta et perantiqua exemplaria*. It may, therefore, with safety be asserted, that this establishment for foundlings existed at Triers in the eighth century. The annalists of Triers, indeed, do not mention any bishop named Rusticus who lived about that period; but no doubt needs be excited on that account, as this difficulty may be solved in more ways than one.*

In the seventh century, there were similar establishments at Anjou, or Angers, in France. St. Magnebodus, who was bishop of that place, where he died, and was buried in the church called at present Saint Mainbeuf, is praised in a very old life of him, never yet printed, for having caused several houses for the rearing of children to be erected.†

In the following century, that is, about the year 787, an arch-priest named Datheus, established at Milan, at his own expenses, a foundling hospital,

* Meusel's *Geschichtsforscher*, iv. p. 232.

† Du Cange, under the word *Brephotrophium*, has quoted from this life the following passage: *Xenodochia ac brephotrophia diversaque mansionum habitacula ædificare procuravit*. Of this Magnebodus and his biographer some account may be found in Mabillon's *Acta Sanctorum ord. Benedicti*. See the prefixed catalogue. In that defective work the Dictionary of the Saints (*Heiligen-Lexicon*), he is entirely omitted.

in order to put a stop to the crime of child-murder, which had been introduced, and of which he gives a very affecting account in the letter of foundation. With this view he purchased a house near the church, and issued an order that the foundlings (*jactati*) should be suckled in it by hired nurses, and educated for seven years. They were to be taught some handicraft; to be supplied in the establishment with food, clothing, and shoes, and at the age of seven to be discharged as free-born.* It deserves to be remarked, that the mothers of children carried to such establishments strewed salt between the swaddling-clothes, when they wished to announce that the child had not been baptized. This, perhaps, had a reference to the circumstance of new-born children being washed in salt water; but I conjecture that the salt thus interspersed, was meant to denote that the child had not been washed, and much less baptized.

* Muratori has printed the letter of foundation in *Antiq. Ital. mediæ ævi*, T. iii. p. 587: I shall here quote a few only of the most remarkable lines: Volo et statuo, ut cum tales feminæ, quæ ex adultero conceperint et parturierint, si in ecclesia provenerint, continuo per præpositum colligantur et colloentur in prædicto exsenodochio, atque nutrices eis provideantur mercede conductæ, quæ parvulos laete nutriant, et ad baptismatis purificationem perducant. Et cum ablaetati fuerint illic demorentur usque ad annos continuos septem, et artificio quocunque imbuantur sufficienter, habentes ex ipso exsenodochio victum et vestitum seu calceamentum. Et eum ad septem annorum ætatem expletam pervenerint, stent omnes liberi et absoluti ab omni vinculo servitutis, cesso eis jure patronatus eundi vel habitandi ubi voluerint.

In the capitulary of Charlemagne we meet with all the *loci venerabiles* of the Justinian code: *xenodochium*, *ptochotrophium*, *nosocomium*, *orphantrophium*,* *gerontocomium* and also *brephotrophium*.† But at that time, at least among the Franks, the foundlings belonged to those by whom they had been received and educated, unless they were demanded back by their parents or relations within ten days.‡ It is not improbable that the same practice prevailed at this time in other countries; and perhaps the founder of the foundling hospital at Milan, on this account, declared so expressly, that the children, when they grew up, were to be discharged from the institution, as persons born free.

In the year 1168, St. Galdinus, cardinal and archbishop of Milan, exercised great severity against heretics; but took particular care of the poor, who believed what he taught; namely, that the hospital § there considered itself obliged, not only to receive the sick, but also such children as

* In quo parentibus orbatu pueri pascuntur. These orphan-houses then were expressly distinguished from the foundling-hospitals.

† In quo infantes aluntur. In *Capitularia regum Francorum*, ed. Baluzii. Parisiis 1677. fol. i. p. 747. Capit. lib. ii. 29.

‡ The same account, in the same words, is found in the *Capitularia*, composed about the year 744, in Baluz, p. 151, in *Capitularia Caroli Magni*, vi. 144. p. 947, and in *Isaaci Episcop. Lingonensis Canones*, 16. p. 1279.

§ Hospitalis domus.

might be exposed in the city, and to provide them with food and clothing.*

In 1070, Olivier de la Trau founded at Montpellier an order, the members of which called themselves *hospitalarii, sive spiritus*. They entered into an engagement to take care of the poor as soon as possible, and to provide for the maintenance and education of foundlings and orphans. In the course of a little time, they spread themselves into different countries; and wherever they went, the effects of their benevolent vow are still to be found. Some say that the institution for foundlings, or the Hospital of the Holy Ghost, at Montpellier, was established in the year 1180.† In 1201, they settled at Rome, and, according to the testimony of historians, formed there an establishment of the same kind, after they had been confirmed by Pope Innocent III, in the year 1198, and obtained for that purpose an elegant mansion, fitted up in the best manner.‡ In the papal bulls, mention is made of many convents, founded by this order; and I am inclined to think, that those who might take the trouble to examine thoroughly,

* See Muratori *Antiq. Ital. mediæ ævi*, iii. p. 591: Ut colligere debeant omnes ægrotantes pauperes - - - et expositos infantes, quos per urbem invenerint, et ad Ospitale ducere, et sufficientem victum et vestitum pro posse tribuere.

† Girtanner *Abhandl. über die krankheiten der kinder*. Berlin 1794. 8vo. p. 76; but without any proofs.

‡ Of its present state an account may be found in Volkman's *Nachrichten von Italien*, 2. p. 633.

the confused history of these hospitallers, or of this order of the Holy Ghost, and of the still existing hospitals distinguished by that title, would find much information in regard to this subject. I call the history confused, because there have been many kinds of hospitallers, and similar orders; and these have often been confounded with each other.*

Our neighbourhood had similar establishments at an early period. At any rate, there was one of this kind at Einbeck, before the year 1274, that is to say, an hospital of the Holy Ghost. It began to be built by duke Albert,† who brought Einbeck to the house of Brunswick, when it submitted to him in 1272, in order to get rid of the importunity of Count von Dassel. Alms were collected for its

* See Gregorii Rivii *Monastica Historia Occidentis*, Lipsiæ 1737, 8vo. cap. 34. p. 59. The name of the author was George Burchard Lauterbach; he was secretary in the Ducal library of Wolfenbüttel: see *Burkhard Histor. Biblioth. Augustæ, quæ Wolfenbütteli est*, Lips. 1746. 4to. i. p. 275; *Nova Acta erudit.* 1737. p. 534; and *Unschuldige Nachrichten*, 1739. p. 231. The best account would be found perhaps in *Tableau de l'ordre du S. Esprit*, par Nic. Gaultier, Par. 1646; and *Abrégé de l'Hist. des frères Hospitaliers de l'ordre du S. Esprit* par Gaultier, Paris 1653, 8vo. But the books quoted by Lauterbach seldom occur, and are not in the library of our university.

† That duke Albert was the founder, is expressly stated in the letter-patent. Lersner, therefore, is under an error, when, in the account of Einbeck, in the *Dasselschen und Einbeckschen chronik*, Erfurt, 1596, fol. he says that the poor-house of the Holy Ghost was founded by Duke Otto, son of Duke Otto, the Quadé, consequently not till the end of the fourteenth century.

establishment and maintenance; and to promote these, the council issued recommendations, or letters-patent, in which it was expressly stated, that not only the indigent, and among these foreigners, were received into their hospital, but also orphans and foundlings, who were maintained and educated till they grew up. Such recommendations were from time to time repeated, for one still exists of the year 1300, which is a literal transcript of that issued in 1274.* I do not believe that the hospital at Einbeck was established by the order before mentioned; at any rate, hospitals of the Holy Ghost occur chiefly in the twelfth and two following centuries; and were founded, not by hospitallers, but established perhaps upon their model.

In this manner a rich citizen of Nuremberg, Conrad Heinz, surnamed *der grosse*, founded the Hospital of the Holy Ghost, in 1331. It began to be built in 1333, and was completed in 1341. Neither in the letter of foundation, however, nor

* Such a recommendation, with the title, *Concessio ad eleemosynas colligendas pro ædificatione hospitalis S. Spiritus in Einbecke*, may be found in *Senkenberg's Selecta juris et historiarum*, Francof. 1742-3. vi. p. 451, and p. 469. The first is inserted also in *Meissner's Abhandlung von Findelhäusern*, p. 132, from which I shall transcribe only the following lines: *Pueri quoque qui a matribus suis, timore Dei postposito, ante fores ecclesiæ deponuntur, vel in aliis locis nocturno tempore tanquam eadavera misere abjiciuntur, si viventes inveniuntur in eodem hospitali recepti usque ad annos discretionis in omnibus necessariis procurantur.*

in the confirmation, are foundlings particularly named; but it may be readily seen that this institution received poor pregnant women, and educated the children which were either born in it or admitted into it. In the like manner pregnant females, both married and unmarried, and also foundlings, are received into the Hospital of St. John, at Turin.* The founder of the house at Nuremberg made it a rule, that the day of the birth or reception of each child should be written down, in order that the expense incurred by it might be known, in case it should ever be able and inclined to repay it.†

The magnificent foundling hospital at Florence, called at present *Spedale degl' Innocenti*, was founded in 1316, by one Pollini.‡ There can be little doubt that this is the same establishment for which the well-known Camaldule monk, Ambrosius, often mentioned under his family name Traversari, solicited support from the pope, in the beginning of the fifteenth century. He boasts that

* Volkmann's Nachrichten von Italien, i. p. 176.

† The documents here quoted may be found in *von Murr Beschreibung der Merkwürdigkeiten in Nürnberg*, Nürnberg. 1801. 8vo. p. 100, and 638. P. 650, De matribus pauperibus, de puerperis in dicto hospitali jacentibus. P. 652, Scribentur in registro anni et dies, ac nomina parvulorum in hospitali natorum vel nutritorum, ut si forte ad pinguiorem fortunam pervenerint, eidem hospitali, unde alimenta misericorditer acceperunt, ad retributionis meritum fortius se sentiant obligatos.

‡ Baldinger's Neues Magazin für Aerzte, xii. 2. p. 154.

the foundlings received by this institution, which he calls *brephotrophium*, were first given to nurses to be suckled, and then admitted into the house and instructed. Girls fit for marriage were furnished with a portion. Citizens also were accustomed to send their children to be educated in the school of this hospital.*

L' Hopital du S. Esprit, at Paris, is said to have been founded in 1362, and various persons out of compassion for the exposed children contributed the money necessary to its support.† A brotherhood, called *la Confrairie du S. Esprit*, established to conduct the affairs of the institution, was confirmed the same year by Pope Urban V.

Paris, however, from time to time obtained more institutions of this kind. In the year 1638, a widow devoted her house to this propose, and on that account it was called *la Maison de la Couche*, a name still given to the foundling hospital at the

* Martenne, *Veterum Script. amplissima collectio*. Parisiis 1724, fol. iii. p. 15: Locus intra Florentiæ urbis mœnia, brephotrophion Græci appellant, ubi expositi incertis parentibus educantur infantes, plures quam ducenti utriusque sexus. Traduntur ex more primum nutricibus lacte alendi, et ubi ablactati fuere, intra locum illum diligentissime nutriuntur. Mares traduntur litteris imbuendi; puellæ muliebria discunt. Postea vero quam adulti fuerint, illi artem ex qua sustententur ediscunt; illæ traduntur viris, loco suppeditante dotes. Compare also, p. 79. 81, 82.

† In *Descript. de la ville de Paris, par Brice*, Paris, 1713, 8vo. ii. p. 15. and in various other books, the year, by a transposition of the last two figures, is made to be 1326. See *Le Theatre des anti-quittez de Paris, par du Breul*, Paris 1639. 4to. p. 740.

church of *Notre Dame*. But it was soon found necessary to abandon this well-meant institution, in consequence of the shameful abuses which had crept into it. The nurses often sold the children to beggars, who distorted or mutilated their limbs, in order that they might excite more compassion, and thereby obtain greater alms. Many were purchased also for magical purposes. The price for each was twenty sous.

Saint Vincent de Paule, of the congregation St. Lazare, founded, in 1640, a new institution, which in 1670 was transferred to the street *Notre Dame*. It obtained new improvements by the chancellor Etienne d'Aligre and his lady Elizabeth Luillier. At present this house is known under the name *l'Hopital des enfans trouvés, or de Notre Dame de la misericorde*.*

That an institution for foundlings at Venice, named before the destruction of the republic *Della Pieta*, was established in 1380, by a Franciscan named Petruccio, I have somewhere read, but in what author I do not at present remember.

In England a proposal for a similar institution was made so early as 1687; but the present foundling hospital was not established till the year 1739. †

* Varietés historiques, physiques, et litteraires. Paris 1752, 12mo. iii. p. 300. *Brice ut supra*, ii. p. 88. *Les Curiositez de Paris, par M. L. R.* Paris 1716. 8vo. p. 143.

† Alberti Briefe über Zustand der Rel. und Wisseneh. in Grossbritannien. Hannover 1752, 8vo. i. p. 102.

I shall not, however, enlarge further on the modern institutions of this kind: my object was to show that they are by no means a new invention, and that they have been continued from the oldest periods to the present time through all ages, and even in those which we are accustomed to call barbarous.

In our times, most of the foundling hospitals have been suffered to fall to decay; chiefly because, to answer the benevolent purpose for which they are intended, they would require to be on a larger scale, and better supported than it is possible for them to be at present; also because they do not entirely prevent child-murder, as they are not capable of completely removing the causes of it. After the establishment of the foundling institution at Cassel, not a year passed without some children being found murdered, either in that place or its neighbourhood.* To this may be added also, that it is impossible with the utmost exertion to provide sound nurses for the continually increasing number of children brought in, and to ensure to them sufficient attention.

From the year 1763 to the end of 1781 the number of children brought into the foundling hospital at Cassel amounted to 740, of whom no

* See the account of the foundling institution at Cassel in professor Osiander's *Beobachtungen über Krankheiten der Frauenz. und Kinder*. Tübingen 1787. 8vo. p. 37.

more than 88 remained alive at the end of the latter year. More than one half of them died under the age of eight, and scarcely ten attained to their fourteenth year. In Paris, in the year 1790, more than 23,000, and in 1800 about 62,000 children were brought in. In 1790, of the children which had been brought in between 1774 and that period, 15,000 only were alive; and it is estimated that $\frac{1}{3}$ of all the children brought in perish annually through hunger or neglect. Of 100 foundlings in the foundling hospital at Vienna, $54\frac{1}{2}$ died in the year 1789. In 1797, the nurses in the foundling hospital at Metz had for fourteen months received no wages, and calculation shewed that $\frac{7}{8}$ of the whole children perished. In an institution of this kind, in a certain German principality, only one of the foundlings in twenty years attained to manhood, and yet the establishment had cost the country annually 20,000 dollars at least. The education of no hereditary prince ever cost so much.*

For these observations I am indebted to professor Osiander.—The case with foundling hospitals is the same as with the artificial breeding of fowls: it is easy to obtain chickens, but for want of maternal feeding and care it is almost impossible to rear them. Of what use then is it to collect chickens?

* Hannover. Magazin, 1778. p. 600.

ORPHAN HOUSES.

As so ancient proofs are found of public attention paid to foundlings, it may be readily supposed that in well-regulated states care was employed, at an early period, to provide also for the maintenance and education of orphans. There is reason to believe that this was the case at Thebes, which took under its protection the children of all poor parents.* Solon made a law, that children whose fathers had fallen in the defence of their country should be educated at the expense and under the inspection of government.† The same thing was customary among the Iasei, who inhabited an island on the western coast of Caria.‡

At Rome children maintained at the public ex-

* See what has been said in the preceding article.

† Diogen. Laert. i. § 55. p. 34. See the observation of Menage on this passage, p. 32. This law is praised by Plato in *Menexenus*, according to the Frankfort edit. 1602. fol. p. 525. F. also by Demosthenes *adversus Macartatum*, in the edit. Aurel. Allobrog. 1607, fol. p. 669. A.

‡ Heraclides de Politis, added to the edition of *Aristot. Politic.* Heinsii, Lugd. Bat. 1621. 8vo. p. 1004. Advertebant (ταπειν) diligenter quo orphani honeste educarentur, quibus patrimonium in inanus tradebant, simulatque vigesimum ætatis annum attigissent. An account of these people may be found in *Cellarii Geographia*, Lipsiæ 1706. 4to. ii. p. 90.

pense were called *pueri alimentarii*, and *puellæ alimentariæ*.*

The emperor Trajan was the first who formed large establishments for this purpose; and the children maintained in them were called, from his family name, *pueri Ulpiani*. Pliny relates in his panegyric, that he had caused five thousand free-born children to be sought out and educated.† It is more than probable that he suffered them to remain with their parents, and that those who were unable to educate them themselves, received a monthly or annual allowance in corn or money. Orphans perhaps were given out to board at a certain fixed sum. It deserves to be remarked, that the emperor in this manner might afford assistance, not only to such as were depressed by poverty, but also to persons of distinction who were not able, according as we say at present, to support their families in a manner suitable to their rank. To have an offspring therefore was not a misfortune, but rather a blessing. Children were begotten in order that the parents might take advantage of this beneficence, as some people build houses that they may obtain the offered premium;

* Mention is made of them several times in the Roman code of laws, L. 8. § 9. et § 24. D. de transact. L. pen. § 1. D. ad leg. Falcid. See also *Ælii Spart. Vita Adriani*, c. 7. p. 67. *Æl. Capitolin. Vita Antonini*. P. cap. 8. p. 266. *Vita Pertin.* c. 9. p. 555. *Æl. Lamprid. Vita Alexandri Severi*, c. 44. p. 995.

† Cap. 26. 28.

and the large capitals required were not taken from the public treasury, but from the emperor's own privy purse. That these establishments might exist after his death, the money in different parts destined for their support was laid out on land, which produced a perpetual income. This is shewn by a letter of foundation for the town of Veleia,* which is still extant.

In the year 1747, some peasants while ploughing in the neighbourhood of Placentia found, together with several other antiquities, a copper plate, five and a half feet in height and ten and a half in breadth, which weighed 600 pounds. They broke it in great haste, because they expected to find under it a treasure, and sold the pieces as old copper. One of these having fallen into the hands of the learned count Giovanni Roncovieri, he remarked, that it contained a part of a public document, belonging to the reign of Trajan. With much trouble, and at considerable expense, he at length collected all the pieces, the possessors of which, on account of the eagerness shown to obtain them, expected for them a high price, and thus was the means of saving one of the most beautiful monuments of antiquity, a complete document in regard to the imperial establishment for

* This city was situated at no great distance from Piacenza (Placentia). It is mentioned by Horace, Pliny, and *Phlego Tral-lianus de longævis*, i. p. 114. See *Cluverii Ital.* iv. 14. p. 1259. *Cellarii Geograph.* i. p. 665.

the community of Veleia.* The inscription forms six hundred and seventy lines, and is divided into seven columns, over which stands the following title: Obligatio. praediorum. ob. H—S. deciens. quadraginta. quatuor. milia. vt. ex. indulgentia. optimi maximique. principis. imp. caes. Nervae. Trajani. Aug. Germanici. Dacici. pueri. puellaeque. alimenta. accipiant. legitimi. n. CCXLV. in. singulos H—S. XVI. n. f. H—S XLVII. XL. n. legitimae. n. XXXIV. sing. H—S. XII. n. f. H—S. IV. DCCCXCVI. spurius I. H—S. CXLIV. spuria. I. H—S. CXX. summa. H—S. LIIIC. quae. sit vsura $\approx \sim \approx$ sortis. supra. scriptae.

* This remarkable inscription, as far as I know, has been printed complete three times. First by itself, with the title *Exemplar tabulae Trajanæ pro pueris et puellis alimentariis reip. Veleiatium. Cura et recensione A. F. Gorii*. Florentiæ, 1749, five sheets in folio. To this belongs *Dell' insigne tavola spettante ai fanciulli e fanciulle alimentari di Trajano, edizione e spozizione fatta da L. A. Muratori*. In Firenze 1749, three and a half sheets 8vo. Secondly, in *Museum Veronense*, Veronæ 1749. fol. pag. cclclxxxi, to which some explanations are added. Thirdly, in *Histoire de la jurisprudence Romaine, par A. Terrasson*, Paris 1750, fol. in the Appendix, p. 27—43. Terrasson was unacquainted with the Florentine edition, and therefore conceived that he was the first person who made known this inscription from a copy procured in Italy. A full illustration of it is given in a work entitled *Della celebratissima tavola alimentare di Trajano* - - - - *spiegazione fatta da S. G. Pittarelli*. Torino 1790. 4to. 332 pages. The author has directed his chief attention to an explanation of the names of persons and places which occur in the inscription. On the same subject may be added, *Idea della spiegazione della tavola alim. di Trajano* - - - - *da Pittarelli*. Torino 1788, twenty pages in quarto.

Trajan therefore laid out a capital of 1,044,000 sesterces at five per cent interest, on forty-six farms around Veleia, which town on community was destined for this establishment. These farms formed the mortgage, and on that account are particularly named, together with the sum for which they were security. The annual interest amounted to 52,200 sesterces. Of this sum 245 boys born in wedlock received monthly sixteen sesterces each, which in a year makes 47,040; and 34 girls of the same description twelve sesterces monthly, making in a year 4896 sesterces. Besides these, one illegitimate male child received yearly 144 sesterces, and one illegitimate female child 120 sesterces. These different sums amounted exactly to the interest of the capital laid out.*

It is hardly worth while to reduce these sums to our present currency. For even if we should calculate how many pounds or shillings the silver contained in 1,044,000 sesterces would make, this result would not give us the real value, because we have no standard by which the relative value can be determined; that is to say, it is not known what proportion silver and copper bore in those periods to the prices of the necessaries of life. The

* Sestertiorum decies quadraginta quattuor millia (1044000)
 - - - - Ut pueri puellaeque alimenta accipiant; legitimi numero 245.
 in singulos sestertios 16 nummos; fiunt sestertii 47040, nummi.
 Legitimæ numero 34. singulis sestertii 12 nummi; fiunt sestertii
 4896 - - - - summa sestertium 52200, quae fit vsura quincunx sortis
 supra scriptae. That is to say, $47040 + 4896 + 144 + 120 = 52,200$.

price of grain, proposed by Unger as a standard, can be employed only for later times, when corn began to be a more general article of trade.

However, Trajan's capital, according to our money at present, makes about 54,375 dollars, and the sum of the interest 2718 dollars; consequently a legitimate male child obtained yearly ten dollars, and a legitimate female child between seven and eight dollars. Such is the calculation made from the principles laid down in Romé de l'Isle's Metrology by professor Hegewisch, who has endeavoured also to compare some pieces in the time of Trajan with those at present.*

It appears, therefore, that among 300 children the emperor admitted only two illegitimate; and professor Hegewisch is inclined to believe that this was the actual proportion at that time; which indeed would induce one to form a very favourable opinion of the state of public morals, under the reign of Trajan, in the district above named.

That it was then customary to pay interest, salaries, and pensions, not annually but monthly, is known from other sources of information. The case was the same in regard to the distribution of corn (*frumentatio*), as is proved by a passage in Dionysius of Halicarnassus,† and when money was

* Schleswig-Holstein. Blätter für Polizey und Kultur, 1799. 4to. p. 172.

† Τον δημοσιως διδομενον σιτον λαμβανοντες κατα μηνι, Frumentum mensurum e publico accipientes. Lib. iv. p. 228. edit. Francof. 1586. fol.

bequeathed in perpetuity for benevolent purposes by any person's will.*

Muratori is of opinion that these pensions were paid to boys till they arrived at the age of eighteen, and to girls till they attained to that of fourteen; and for a proof he refers to an order of Adrian, confirmed by the emperor Alexander Severus.† At the above age the males could become soldiers and gain their pay; and girls of fourteen were fit either to be given in marriage, or to be employed in such a way as to obtain a livelihood by their industry. That the emperor, in forming this establishment, had an eye to recruits for the army, appears probable from a passage in Pliny;‡ and the example of Trajan induced rich private individuals during his life-time, and afterwards many of his successors, to form similar establishments for the like purpose. The same plate was destined also to eternise the bequest of one Cornelius, according to which 3600 sesterces, or about 187 dollars, being the interest of 72,000 sesterces, or 3750 dollars, were to be employed in maintaining eighteen legitimate male children, and one legitimate female

* See the proofs quoted by Brisson, under the word *Menstruum*.

† Si quis exemplum alimentorum quae dudum pueris et puellis dabantur, velit sequi, sciat, Hadrianum constituisse, ut pueri usque ad decimum octavum, puellæ usque ad quartum decimum annum alantur. Et hanc formam ab Hadriano datam, observandam imperator noster rescripsit. *Digest. 34. tit. 1. 14.*

‡ Crescerent de tuo qui crescerent tibi, alimentisque tuis ad stipendia tua pervenirent.

child, at the rate before mentioned. Pliny even, the panegyrist of Trajan, founded from his own property pensions for the free-born children of poor parents; a circumstance which he does not forget to mention in his letters, and the same thing is confirmed by an inscription still extant.* Antoninus Pius made a similar establishment for poor girls, which after his consort were called *puellæ Faustinianæ*.† The emperor Antoninus Philosophus did the same thing; and from the name of the empress the girls were called *Faustinianæ*, but by way of distinction *novæ puellæ Faustinianæ*.‡ Alexander Severus formed an institution for the education of boys and girls, whom he caused to be named from his mother *mammæani* and *mammæanæ*.§

In regard to the manner in which these establishments were managed, we are entirely ignorant. It is known only, that in each of the provinces into which Italy was divided, there was a public functionary of some rank, with the title *procurator ad alimenta*, to whom, in all probability, the inspection of them was intrusted. That this was an honourable office is proved by the information which professor Hegewisch has quoted. It was held by the emperor Pertinax when a young man, in the towns

* Plin. Epist. i. 8. 10. p. 30: and vii. 18. p. 515. Gruteri Inscript. p. MXXVIII. n. 5.

† Capitolin. cap. 8.

‡ Capitolin. cap. 26.

§ Lamprid. cap. 57.

and villages on the Via Ancilia, and in his old age at Rome itself.* It was held also by Didius Julianus before he became emperor, after he had been prætor and consul, that is, enjoyed the highest offices next to the imperial dignity, and after he had been governor of Germany.† On ancient monuments erected to the memory of persons of distinction, by their children, relations, or friends, it is mentioned, that, besides filling other places of honour, they had been *procuratores ad alimenta* in certain districts there named.‡

These are the oldest instances, with which I am at present acquainted, of institutions for the benefit of poor children and orphans. Orphan houses, properly so called, in which the children were educated together, I find mentioned for the first time, under the name of *orphanotrophium*, in the laws of the emperor Justinian. At later periods they occur frequently in the decrees of the different councils, such as that of Chalcedon in the fifth century.§ At the court of Byzantium the office of inspector of orphans, *orphanotrophi*, was so honourable and important, that it was filled by a brother of the emperor Michael IV (Paphlago) in the beginning of the eleventh century.|| But

* Ælian. Spartan. cap. 1. p. 574.

† Capitolin. cap. 2. p. 532; and cap. 4. p. 537.

‡ Gruteri Inscription. ccccxli. 1; and cccclviii. 7.

§ Canon viii. Chalced. in Balsamonis Collectio. p. 332.

|| Zonaras in the Life of that Emperor. *Histor. Augusta*. Lugduni 1594. 8vo. iv. p. 798.

under the latter emperors this place was entirely suppressed.*

At present, orphan houses have been abolished since it has been shown, by many years' experience, that the children cannot be educated in them healthy and at a sufficiently cheap rate. The children are placed out to be boarded and educated by individuals, under the inspection of those who manage every thing relating to the poor.



INFIRMARIES. HOSPITALS FOR INVALIDS. FIELD LAZARETTOS.

By the preceding article I am induced to give some information in regard to the history of infirmaries. To offer any thing complete on this subject, it would be necessary to enter also into the history of inns established for the use of pilgrims and strangers, which in general were combined with them, and likewise into that of the different orders instituted for the like purpose, and of taverns which arose at a later period.

It is certain that ancient Rome, though a magnificent city, had no houses into which sick persons

* Codinus, who lived in the 15th century, says: *Ορφανοτροφος ην μεν φροντιζων και επιμελουμενος παλαι των ορφανων, νυν δε ουδαμως κεκτηται τινα υπηρεσιαν.* Orphanotrophus quidem olim curabat et observabat orphanos, nunc vero nullum prorsus ejus officium est.

were admitted in order to be taken care of and cured. Diseased people, however, were carried to the temple of Æsculapius, but for a very different purpose. They waited there for a cure, as some Christian believers still do in churches which contain wonder-working images; but no preparations were made there for their accommodation. Those numerous benevolent institutions for the accommodation of travellers, the indigent, and the sick, which do so much honour to modern times, were first introduced by Christianity.

Bodin,* who could not deny this service, endeavoured to lessen it, by asserting that, on the introduction of Christianity, freedom was given to many slaves, who possessed nothing else; and who, having learned no trade or handicraft by which they could gain a living, became so burdensome to the state, that the clergy were obliged to devise some means to remove from the public view, and to provide with the necessary support, these unfortunate beings, abandoned by all mankind, whose increasing number was asserted by unbelievers to be an effect of the Christian religion.

In this representation, however, there is some truth. It indeed cannot be denied that our religion, as it requires humanity and compassion, though the intolerance it occasions converts the severest cruelties into good works, procures to beggars

* J. Bodini de republica libri vi. lib. 1. cap. 5. according to the Franckfort edition 1594. 8vo. p. 61.

more indulgence and respect than they in general deserve, and thereby causes a continual increase of their number. But it is to be observed that Bodin, notwithstanding his acuteness and great learning, often suffers himself to be led away by the effects of his innate Jewish hatred to the Christians; and he readily embraces every opportunity of exalting his paternal religion, the Jewish, and depreciating the Christian, by which he obtained riches and honour.

The enemies of Christianity, however, during the first years of our æra, could not but observe the numerous means for alleviating human misfortunes which were introduced by the new religion. It was galling to the emperor Julian to acknowledge this superiority; and in order to banish it, he caused his priests to provide for the poor, and to establish for them inns (*Xenodochia*), into which they could be received; and he assigned to them the funds necessary for that purpose. Into these were admitted not only persons of his own religion but of every other, in imitation of the Christians, who, besides supporting their own poor, maintained those of the pagans also. How much he interested himself to weaken this mean, by which the impious Galilæans* procured respect, love, and attachment, may be seen by an oration wherein he inculcated the Christian mo-

* 'Οι δυσσεβεις Γαλιλαιαι.

rality as his own.* This imitation of the new religion, which contributed more perhaps to recommend it than to bring it into discredit, is ridiculed by Gregory Nazianzenus in his third oration.

The care of providing the necessary assistance to those sick persons who can expect no help and attention from individuals, belongs to the police; and because this forms a part of government, rulers and sovereigns ought, at all times, to have made the establishments requisite for that purpose. But in the oldest periods, as appears, they had too much to do in administering justice, and securing the state against hostile attacks, to be able to attend to the necessary police establishments.

On the other hand, the clergy, whose first duty was to maintain good order, discipline, and virtue, however much they might often in private offend against them themselves, endeavoured to supply this want; and, on that account, among the decrees of various councils, we find a great many regulations which have not yet been sufficiently employed to illustrate the history of police. The establishment of the first houses for the reception of the sick, is among the services rendered by the

* The imperial order has been preserved by Sozomenus in his *Ecclesiastic History*, v. 16. edit. Valesii, Amstelod. 1695. fol. p. 619, where more information on this subject, worthy of attention, has been collected. See *Juliani Opera*, edit. Spanhemii, Lipsiæ 1696, fol. p. 430, and *Julian's Oration*, p. 305.

clergy; and to mention all the places of this kind, either founded by them or at their instigation, would form a very long list. The first, or at least one of the first houses for the reception of indigent sick was that built at Rome by Fabiola, a Roman lady, the friend of St. Jerome, consequently in the fifth century.*

When pilgrimages to holy places, as they were called, and often from very distant countries, came to be considered as a part of religion, the number of these houses was much increased. Taverns, in which pilgrims could procure proper care and attention for payment, were not then to be found; and most people travelled without money, in the full confidence of meeting with gratuitous assistance. When the clergy wished to maintain and increase the number of pilgrims, which their own advantage induced them to do, it was necessary that they should afford them every facility of travelling, and consequently provide for the wants of indigent pilgrims; and it was impossible that among these there should not be some sick, especially as the inconvenience, fatigue, and dangers of the journey were much increased by many things injurious to the health.

But as the principal and most dangerous pilgrimages were made to Palestine, which is situ-

* *Primo omnium nosocomium, id est languentium villam instituit, in quo aegrotantes colligeret de plateis, et consumta languoribus atque inedia miserorum membra foveret. Hieron. ep. 39.*

ated beyond the boundaries of Europe, where no countrymen, and not even Christians, one of whose religious duties is to be compassionate, could be expected, institutions for the reception of sound as well as of sick pilgrims were erected by the clergy at a very early period on the road thither, and also at the holy places. Thus Jerome built an hospital at Bethlem;* and his friend Paula caused several to be erected on the road to that village, in order that the devout idlers, as she says, might fare better than the mother of God, who, on her necessary journey thither, could find no inn.† In the like manner, the Scots and Irish erected hospitals in France for the use of their countrymen, who, on their pilgrimage to Rome, might be desirous of passing through that kingdom.‡

But hospitals were most necessary in wild and desert parts, where human habitations were not to be expected; and particularly in woody, mountainous districts, and on the banks of broad rivers, where travellers were stopped for the want of bridges, and collected together in great numbers. It is probable, that many of these hospitals may have given rise to the villages which are still found in such situations.

Pope Adrian I recommended to the notice of

* Epist. at Pamachium.

† Hieron. Epitaph. Paulæ.

‡ Baronii Annal. ad an. 845. xxxvi. ed. Mansii. Lucæ 1743, tom. xiv. p. 325.

Charlemagne* the hospitals built in the Alps; and in the year 855, the emperor Louis II caused those situated on mountains to be visited and repaired.† The ruins of many of these edifices still exist.

Towards the end of the eleventh century, brotherhoods, which undertook to provide for the wants of sick pilgrims, were formed in the Holy Land; and these became richer and more numerous as the crusades increased. It was not uncommon for opulent persons, when dying, to bequeath their property to establishments in which they had found consolation and relief; and very often those who had experienced a cure gave their money and effects, or a considerable part of them, to some brotherhood, either in consequence of a vow, or in order to show their gratitude. On this account the hospitals in Palestine could be constructed on a larger scale, and provided with better accommodations, than any before seen in Europe. They were therefore considered as models; and princes and rich persons, on returning safe from their pilgrimages, caused similar ones to be established in their own countries. Many princes even brought with them to Europe members of these brotherhoods, which in the course of time were converted into orders of knighthood, that

* Epist. 74. codicis Carolin. *Muratori antiquitat. Ital. med. ævi*, iii. p. 581.

† Capitulare ad an. 855. in *Muratori rerum Italic. ii. 1*; and *Antiquitat. Ital. med. ævi*, iii. p. 581.

they might employ them in the erection of hospitals. Instances of this circumstance have been given by Möhsen, in his History of the Sciences in the Mark of Brandenburg,* and these might be easily increased. In the same author may be seen an account of the establishment of houses for the reception of persons afflicted with cutaneous disorders, and of their conversion into pest-houses. I shall here only remark, that these inns and hospitals contributed, in no small degree, to facilitate the travelling of mercantile people, who, in the infancy of trade, when the roads were insecure and no means of conveyance established, were obliged to accompany their merchandise themselves.

The assertion of Muratori, however, that the oldest hospitals were not properly established for sick travellers, but rather for the sound, is undoubtedly true; and it appears that hospitals, according to the meaning of the word at present, that is, such as were destined for the sick alone, were not introduced before the eleventh century. The above author quotes† from the life of St. Lanfranc, who was archbishop of Canterbury in the year 1070, that he caused an hospital to be built there, and fitted up in such a manner, that one part of it was destined for sick men, and the

* Geschichte der Wissenschaften in der M. Brandenburg. Berlin 1781. 4to. p. 271.

† Antiquitat. l. c. p. 593.

other for sick women. It is probable, or rather almost certain, that this prelate formed the institution here mentioned after the model of those which he had seen in his native country, Italy. After this period similar establishments for the sick are mentioned in various other parts.

The first hospitals, at least in general, were built close to cathedrals or monasteries; and the bishops themselves had the inspection of them; but afterwards, either for the greater convenience or the want of leisure, when their occupations increased, they committed this charge to the deacons. In the course of time, when houses for the sick were erected by laymen, and entirely separate from monasteries, the bishops asserted their right, often confirmed to them by imperial as well as pontifical laws, of visiting these institutions. We find, however, that in latter times they were deprived of this privilege by princes and sovereigns, either because they wished to omit no opportunity of lessening the power of the clergy, or because the latter had given reason to suspect that the incomes destined for the use of the hospitals were not always applied to the intended purpose. Instances are found also, where, by the letters of foundation, the whole management is consigned to the sovereign or the heirs of the founder.* These institutions, however, have the appearance

* See the proofs adduced in the *Teutschen Encyclopædie*, xvi. p. 157.

of ecclesiastical establishments, and still retain in many cases similar privileges. As such they are free from all taxes, are spared as much as possible in war, and enjoy the same rank as churches.

Of the internal economy of the oldest houses for the reception of the sick, no information, however, is to be found. It is not even known whether physicians and surgeons belonged to them, nor in what manner they were supplied with medicines. Apothecary shops were not then established; and those found in hospitals, at present, are but of modern existence.

In the hospitals at Jerusalem the knights and brothers attended the sick themselves, bound up their wounds, and, in imitation of the Grecian heroes, Hercules, Achilles, and others, acted as their physicians. Thus we find in *Amadis*, and other books of knight-errantry written in the middle ages, how much the knights exerted themselves to obtain the best balsamic mixtures, and that, in general, they dressed each other's wounds. Möhsen,* from whom I have borrowed this information, remarks, that the well-known *baume de commendeur* is one of the oldest compositions of this kind, belonging to the times of knighthood.

Profound or extensive knowledge of medicine could not be expected among these knights, were we even unacquainted with the account given of their skill by Guy de Chauliac. This author, who

* Geschichte der Wissenschaften in der M. Brandenb. p. 274.

wrote his book on the healing of wounds in the year 1363, mentions the different medical sects, and among these, names the German knights as the fourth sect, who, he says, cured wounds by exorcism, beverages, oil, wool, and cabbage-leaves, and trusted to the belief that God had conferred a supernatural power upon words, plants, and stones.*

The oldest mention of physicians and surgeons, established in houses for the sick belonging to the order of Templars, found by Möhsen, was under the government of John de Lastic, who, in 1437, undertook the office of grand-master, and defined very exactly the duty of physician and surgeon.†

* Möhsen quotes this passage, but does not seem to have had the book itself. I shall therefore give it verbatim from the copy in my possession. The title runs thus: *La grande chirurgie de M. Guy de Chauliac, medecin tres-fameux de l'université de Montpellier—Restituée par M. Laurens Joubert.* A Rouen 1641. 8vo. The words stand in the *chapitre singulier*, p. 11: Le 4 sexte (secte) est de tous les gensdarmes, ou chevaliers Theutoniques, et autres suivans la guerre; lesquels avec coniurations et breuvages, huile, laine, et feuilles de choux, pensent (pansent) toutes playes, se fondans sur cela que Dieu a mis sa vertu aux parolles, aux herbes, et aux pierres.

† As every edition of the statutes of this order are scarce, I shall here give a brief account of that which I have now before me, from the library of our university. 1. *Nova Statutorum ordinis S. Joannis Hierosolymitani editio* - - Madriti 1577, consisting, besides the index, of 140 leaves, small folio. 2. *Privilegia ordinis S. Jo. Hierosol.* forming 204 pages in small folio, without the index before, which stands Romae 1588. 3. *Statuta hospitalis*, without place or date, but making also 204 pages, small folio, and seems to be merely another impression: each copy, however, has many things which in the other are wanting. 4. *Histoire de Malthe avec les statuts et*

It, however, appears to me, as it does to Möhsen, that the hospitals had regular and learned physicians at a period much earlier.

But, as long as this was not the case, they could afford no instruction to young physicians in the theory or practice of their art, like our hospitals at present. We, however, find a very singular account in regard to Persia, where it is said that some Nestorian priests had an hospital adjacent to their monastery, together with an institute or school for young physicians, who under certain prescribed rules were allowed to visit the sick. This establishment was in a town called Gandisapor, or, as professor Sprengel writes it, Dschandisapor, the medical school of which is not unfrequently mentioned after the seventh century. The pupils who were desirous of attending the hospital for their improvement, were first obliged to submit to a trial, and to read the psalms of David and the New Testament. Many of those who had here studied medicine attained to high ecclesiastical dignity, which is the more surprising as the rest of the Nestorian schools in the East pay attention only to theology, and prohibit the young clergy entirely from studying medicine.*

les ordonnances de l'ordre. Paris 1643, fol. 5. *Codice del sacro militare ordine Gerosolimitano.* In Malta 1782, fol. The words relating to this subject may be found in *Titulo quarto de Hospitalitate*, xi et xii.

* The proofs of this singular account may be seen in *Assemani Bibliotheca orientalis*, tonii iii. P. 2. pag. CMXL. The first person

Mad-houses, or houses for the reception and cure of insane persons, seem also to have been first established in the East. Zimmerman says that, so early as the year 491 there was a house of this kind at Jerusalem, the chief object of which was to take care of such monks as became insane in the monasteries, or such hermits as were visited by the same affliction in the deserts; but, as usual, he has given no proofs.* In the twelfth century, when the Jew, Benjamin of Tudela, was in Bagdad, he found many hospitals having nearly sixty shops or dispensaries belonging to them, which distributed, at the public expense, the necessary medicines. A large building called *Dal alme-raphtan*, that is, the House of Grace, was destined for the reception of those who lost their reason in summer. They were kept there in chains till they were cured; and every month this house was visited by magistrates, who examined the state of the patients and suffered those who had recovered their reason to return to their relations or friends.†

To those police establishments which form the

who collected and illustrated every thing relating to this subject was J. H. Schulz, whose dissertation *de Gandisapora Persarum quondam academia* was printed in *Commentur. Acad. Scien. Petropolit.* tom. xiii. ad an. 1741. p. 437. See also *Sprengel's Geschichte der Arzneykunst*, ii. p. 255.

* Ueber die Einsamkeit. Leipz. 1784. ii. p. 116.

† Itinerarium. Lugduni Bat. 1633. 8vo. p. 69. In the Helmstadt edition, p. 65; and in Baratier's translation, Amst. 1734. 8vo. p. 145.

subject of this article belong also hospitals for invalids. Though it may be true, that among many ancient nations the soldiers, as sailors in some privateers at present, served voluntarily and without pay, in the hope of acquiring by plunder a sufficient compensation for the expenses, labour, and dangers to which they were exposed in war, it was, at any rate, considered as a general duty to make such provision for the indigent, and also for those become incapable of military service, when they had no means of support, that they might not be a burthen on the public. If any one should be so devoid of feeling as to suppose that our soldiers, after enjoying years of peace without much waste of their bodily powers or laborious occupation, free from care, amidst every necessary of life, and the enjoyment of rank above those members of the state from which they were taken, ought to consider it no hardship to perform military service when war renders it necessary; it still remains a duty incumbent on the government to provide for soldiers incapable of further service, who are destitute of support; and besides, political prudence requires it, in order that others may not be deterred from defending their native country or sovereign, but rather by the confident hope of a future provision may have their courage and fidelity strengthened; which, notwithstanding the strictest subordination, and though fire-arms require less personal bravery than bows and arrows, is still

indispensably necessary. This truth seems to have been fully acknowledged in the oldest periods.*

Solon deducted something from the pay of soldiers, and employed it for the education of children whose fathers had fallen in battle, in order that others might be encouraged to bravery.† Pisistratus, following this example, made an order that those who had lost any of their limbs in war should be maintained at the public expense.‡ The pensions granted do not seem at all times to have been equally great, and they appear to have been even modified according to circumstances.§

Of the attention paid by the Romans to the care of their invalids, *militēs causariū*, or soldiers become unfit for service, either by wounds or old age, many instances may be found, some of which occur in the Justinian and several in the Theodosian code.¶ They were not only exempted

* *Vulneratorum magnam haberi curam æquum est. Nam si negligimus eos, et alios in pugna rem intelligemus male gesturos, et qui cura illa conservari possent amitteremus. Mauricii Stratagicum*, p. 189. Upsaliæ 1664. 8vo. The same thing is repeated by Leo in his *Tactica*, cap. 20. 103. p. 381.

† Diogen. Laert. lib. i. seg. 55. p. 34. This regulation has been praised by many. Plato in *Menexemo*, p. 527. Æschines *Orat. contra Ctesiphon*. p. 296. ed. Aureliæ Allobrog. 1607. fol.

‡ Plutarchus, *Vita Solonis*, p. 96. c. Francof. 1620. fol.

§ Suidas, v. *ἀδυνατοι*, ed. Kusteri, i. p. 59. Compare *Lysia Orat.* 23, *contra Pancleonem*, edit. Taylori. Cantabrig. 1740. 8vo. p. 200; and in the annexed translation p. 179.

¶ Cod. Theodos. lib. vii. tit. 20. 8. vol. ii. p. 440. *Brisson de verbor. sig. v. Caussarius*.

from taxes, but frequently obtained lands and cattle as well as money, and were assigned over, to be taken care of by rich families and communities.* The assertion, however, that the Romans had particular houses for invalids, in which soldiers worn out by the fatigues of war were taken care of, and that the *taberna meritoria* was a house of this kind, is one of the many errors of Peter von Andlo, canon of Colmer, who is entitled to the merit of having written in the fifteenth century, and with a great deal of freedom, the first work on the German public law.†

How such an idea could be conceived by this author I do not know; for the following is the only account of the *taberna meritoria* to be found among the ancients. In the first place we are told by Valerius Maximus, ‡ that a traveller was

* Livius, ii. 47. p. 458. *Dio Cassiūs*, lib. iv. 23. p. 793. *Sueton. vita Jul. Cæsar.* cap. 38. To this subject belong many passages in the *Auctor. rei agrar.* p. 15, 16, 17, 205, ed. Amstelod. 1674. 4to. More may be found in *J. P. Ludewig diss. historia juris valedudinarii militum emeritorum, in Opusc. miscell.* Halæ 1720, fol. ii. p. 263. Ludewig wished to praise his sovereign for erecting an hospital for invalids; and wastes a great deal of learning to prove that the king did what others had done before him.

† De Imperio Romano, lib. ii. cap. 12. p. 121. Argentor. 1612. 4to. See Pütter's *Litteratur des Teutschen Staatsrechts*, i. p. 77. *Pauperes milites remissi, qui amplius belligerare non poterant, Romæ in tabernam meritoriam recipiebantur, ubi milites ob meritum vitæ stipendium aere publico recipiebant. In qua et tempore natalis Christi fons olei largissimo rivo per totum diem manare cœpit in loco, ubi nunc templum S. Mariæ trans Tiberim situm est.*

‡ Lib. i. cap. 7. ext. 10.

murdered in one of them in which he lodged. Judging from this circumstance, the *taberna meritoria* appears to have been a public tavern or inn, which meaning writers on jurisprudence seem always to have adopted.* In the next place Eusebius, who died in the year 340, relates, not in his Ecclesiastical History, as commonly quoted, but in his Chronicon,† and under the second or third year of the reign of Augustus, that an oil issued from the earth in a *taberna meritoria*, on the other side of the Tiber, and continued flowing without interruption the whole day; but I cannot see what relation this phænomenon can have to Jesus Christ. In the third place, the same thing is related by Orosius,‡ who lived about the year 416; but he makes the time of this event much later, that is to say, in the year 730 or 731 after the building of the city, which would be about twenty years before the birth of Christ. Nevertheless, Martinus Polonus said, in the thirteenth century, that this oil appeared at the birth of Christ.§ Damasus (Pope Formosus? in the ninth

* *Brisson de Verbor. Signif. v. Meritorius.*

† This writer says, p. 146: *E taberna meritoria trans Tiberim, oleum terra erupit, fluxitque toto die sine intermissione, significans Christi gratiam ex gentibus.*

‡ *Histor. lib. vi. cap. 20. p. 553. ed. Coloniae 1582. 8vo.*

§ This I learn from Pontac's Observations on the Chronicon of Eusebius, p. 507, in the principal but scarce edition, a copy of which I have now in my possession, *Chronica trium illustrium auctorum.* Burdigalæ 1604. fol. See *Biblioth. par Clement.* viii. p. 173.

century) added that, on this account, Pope Calistus I, so early as the third century, caused a Christian church to be built in that place; and some modern writers believe, contrary to the assertion of Platina,* that it is the present church of St. Mary Transtiberina, *Maria in Trastevere*; and in this church a stone is still shown with the inscription *fons olei*.† To render the building of a church in the third century probable, some moderns have conjectured that this *taberna* was the cook's shop purchased by the Christians under the reign of Alexander Severus, who assigned it to them with the observation that "it was better that God should be served in any manner in that place, than that tavern-keepers, cooks, or perhaps the ministers of voluptuousness, *popinari*, should there carry on their occupations.‡" Our writers on historical criticism positively deny that Calistus I. built a church at Rome.§ It is to be observed also, that Donatus, who died in 1640, confidently asserts that the *taberna meritoria* was the house where the people of Ravenna lodged when they came to Rome to see the public spectacles;

* Platina de vitis Pontificum, p. 48, in the edition of 1664, 12mo. without any place mentioned.

† Adlers Beschreibung der Stadt Rom. Altona 1781, 4to. p. 345. *Volkman's Nachrichten von Italien*, ii. p. 623.

‡ Lamprid. vita Alex. Severi, cap. 49.

§ Walch's Entwurf einer Histor. der Pábste. Göttingen 1758. 8vo. p. 57.

but he does not tell us whence he derived this information.* What I have here collected in regard to the *taberna meritoria* may serve to correct a false and often repeated relation; but all I can prove from it is, that this *taberna* was not an hospital for invalids.

Hardouin also was of opinion that there were hospitals for invalids at Rome, one of which was built by Metellus, the son-in-law of Pompey; but for proof he refers only to a coin with the image of Metellus, on the reverse of which is the naked figure of a man walking, who holds in his right-hand the palladium, and bears on his left shoulder a naked man, with the inscription on the face, *Q. Metellus Pius*. From this Hardouin infers that Metellus built an *Hôtel des Invalides* for sick or wounded soldiers, which he dedicated to Pallas, and that on this account he obtained the surname of *pius*.† It is, indeed, remarkable that two coins, having the same reverse, and the inscription *pietas*, occur in Patin. I shall leave to the judgement of the critics this opinion of Hardouin; but I must confess that the explanation of ambiguous figures on coins, has a resemblance to the far-fetched derivations of etymologists. Both may be learned, ingenious, and probable; but they cannot be employed alone as evidence, except to add more

* Roma vet. et nova, lib. iii. cap. 21.

† See Hardouin's Observations on Plin. lib. viii. seg. 74. p. 477; and the figure of the coin, plate vii.

force to a truth already proved. These coins, perhaps, allude to some other attention paid to wounded soldiers, of which Metellus, Herennius, and Cæsar may have given examples; and the people are always weak enough to set too high a value on every mark of compassion or benevolence exhibited by their sovereigns or commanders, because it is seldom that they observe as they ought the general duties incumbent upon them.

I do not consider it a reproach to the Romans, notwithstanding their propensity to war and robbery, that they had no hospitals for invalids; because the remark already made in regard to orphan houses, is applicable also to them. Magnificent buildings, fitted up at great expense, afford a proof of the wealth and perhaps the liberality of the founder; but there can be no doubt that with the capital employed, a greater number of invalids might be maintained, and in a manner much more beneficial to the public; that is to say, by making such arrangements that the invalids could be distributed throughout the country, and placed out at board and lodging for a certain sum. In this case many families would be glad to receive them, both on account of the money, and because these invalids could be of great assistance to them in their domestic economy, either by labouring themselves or overlooking others. People may praise large and expensive hospitals as much as they please; but the sight of so many men who have lost their

health or limbs in war is but a melancholy spectacle, and gives too great occasion to reflect how much mankind suffer from the avarice, pride, and revenge of sovereigns, without which wars would be less frequent.

The first establishment for the reception of invalids which, as far as I know at present, occurs in history, is that formed at Constantinople by the emperor Alexius Comnenus, at the end of the eleventh century. A complete description of it may be found in the history of that prince, written by his learned daughter Anna Comnena, who says, that the emperor caused a great number of buildings, standing around a church, to be fitted up as an hospital, which undoubtedly was never exceeded in size; though other historians relate that Alexius only revived and enlarged in an uncommon degree an old institution. It was indeed called the orphan house; but sick and indigent persons of both sexes and of every age, and, as the female historian expressly says, soldiers dismissed from service, were admitted into it, and provided with bed, board, and clothing.* Though the emperor se-

* Annæ Comnenæ Alexiados lib. xv; according to the Venice edition, p. 383; according to that of Paris, p. 484. The authoress says expressly, that the name *ορφανοτροφειον* is taken only *a parte potiori*, as it is known that at later periods not only children who had lost their parents, but others also who were entirely or in part educated at the public expense, and likewise the children of the choir, were called *ορφανοι*. See *Du Cange, Glossar. Græcit.* Peter Possin makes Anna say, that soldiers who by wounds, sickness, or old age,

cured to this institution several sources of revenue, it however appears not to have long existed; at any rate, in the time of George Codinus, that is, in the fifteenth century, the high office of director or manager had long been disused.*

Of the hospitals for invalids existing at present, the oldest and largest is the *Hôtel des Invalides* at Paris. The kings of France enjoyed from the earliest times what was called *droit d'oblat*, which consisted in the power of sending to abbeys and monasteries, in order to be maintained, officers and soldiers unfit for further service, and particularly such as had been wounded. Traces of this practice are said to occur under the reign of Charles the Great; at least Seissel, in the life of Louis XII, relates, that there was an old tradition in an abbey in Languedoc, that the abbot had

had become unfit for service, were received into this institution. But she states only in a brief manner that the house received *τους ορφανους και αποστρατευτους*, that is, soldiers discharged from service. I have seldom met with a more unfaithful translation than that given by the before-mentioned French Jesuit of this work, which contains such a variety of matter, that it is much to be wished that some competent person would give a complete and accurate one in a new edition. The emperor, however, was accustomed to send orphans to the monasteries to be educated and instructed; but with this express intimation, that they were not to be treated and instructed as serfs, but as the children of freemen. *Επισκηψε μη ως δουλα, αλλ' ως ελευθερα αναγειν παντοιας παιδειας αξιουντας, και τα ιερα εκπαιδενοντας γραμματα.* Anna Comn. p. 381. I quote this as an addition to what has been before said in regard to the state of orphan houses,

* See the last note to the preceding article.

been punished by that prince, because he would not receive the soldiers assigned to him. It may be readily conceived how unpleasant these guests must have been to the clergy, and how little the ideas, mode of living, and manners of these two classes would accord with each other. The complaints on this subject had become so great under Henry IV, that he, at length, resolved to cause all invalids to be lodged and maintained together in a palace called *la maison royale de la charité Chretienne*. But as the revenues destined for the support of this establishment were not sufficient, it was abolished under the same sovereign, and the invalids were again distributed among the abbeys and convents. In the course of time, these houses purchased exemption from this burthen, by giving an annual pension to their guests; but they soon spent their money, and then fell into a state of the greatest poverty. On this account Louis XIII renewed the experiment of founding an hospital for invalids, which through the want of money was never completed. At length Louis XIV, in the year 1670, began to build the *Hôtel des Invalides*, the extravagant magnificence of which is rather a proof and monument of the profusion and pride of that sovereign, than of his care for meritorious soldiers.*

* There are two expensive and scarce descriptions of this palace, both of which I have now before me from the library of our university. *Description generale de l'Hôtel royal des Invalides—Avec les*

In the same year, 1670, the hospital for soldiers at Chelsea was founded in England by James II, and completed by William III. But far larger and more magnificent is the hospital for seamen at Greenwich, which was first suggested by Queen Mary, the consort of King William. The building, determined on in the year 1694, was begun in 1695, and from time to time enlarged and beautified.* As France was the first country in Europe that maintained a standing army of national troops, it had therefore first occasion to make provision for its native soldiers when disabled by service. As long as military men consisted chiefly of foreigners, who served during a certain period for pay and plunder, sovereigns believed that when a war was ended, they were no further indebted to these aliens; they consequently suffered them to retire wherever they thought proper, and gave themselves no further trouble respecting them.

In the last place, I shall here consider the question, Since what time have regular surgeons been appointed to armies? and lay before the

plans, profils, et elevations de ses faces, coupes, et appartemens. Paris 1683. fol. with many large engravings. But the following is much more elegant: *Histoire de l'Hôtel royal des Invalides.* Par Jean Joseph Granet, avocat en Parlement. Enrichie d'estampes representant les plans, coupes, et elevations geometrales de ce grand edifice. Dessinées et gravées par le S. Cochin. Paris 1736, fol. with 103 excellent engravings.

* An Historical Account of the Royal Hospital for Seamen at Greenwich. London 1789, 4to. with some beautiful plates.

reader the little I have been able to collect towards answering it. In the Trojan war they were indeed not known. At that period many of the principal heroes had acquired some knowledge of surgery, and, like the knights in the time of the crusades, undertook the office of assisting and curing the wounded.* Such persons in armies were particularly honoured, and considered to be of great value, as appears from what Idomeneus, speaking of Machaon, says :

Ιητρος γαρ ανηρ πολλων αναξις αλλων.

Medicus vir multis æquiparandus aliis.†

Yet the instance of Machaon shows how little care was then taken of the wounded ; for Virgil makes him even, whose assistance must every moment have been necessary, to mount into the wooden horse, and he was the first who came out of it.‡ There is reason to think that the armies in Homer, and till the introduction of Christianity, and the invention of gunpowder, had in every battle but few wounded, and always a much greater proportion of killed than in modern times. Hostile bands stood nearer to each other ; all came to close action ; prisoners were not exchanged, but made slaves, and among the Romans sold to the infa-

* Even Alexander the Great undertook this office, as Plutarch expressly says in his life. *Plutarchi Opera*. Francof. 1620, fol. i. p. 668.

† *Iliad*. xi. 514.

‡ *Æneid*. ii. 263.

mous schools for gladiators. Wounded prisoners were a burthen to the victorious party; such as could not escape defended themselves to the last, and were put to death by the conquerors.

In Achilles Tatius,* who seems to have lived in the third century of the Christian æra, I find that an army-physician, *exercitus medicus*,† was called in to a sick person; and one might almost believe that a regular physician appointed to attend an army is here meant, especially as Saumaise, on this passage, says that each cohort had in general a physician, and therefore the appellations *medicus cohortis*, *medicus legionis*, were found in ancient inscriptions. I will not venture to contradict so great a man on a subject of this kind; but I am sorry that I have not been able to find any further instances of such army-physicians.

The first traces of field hospitals, or, as they are commonly called at present, flying hospitals, occur perhaps in the East. At any rate, the emperor Mauricius, in the sixth century, had along with his armies *deputati*, whose duty he describes, as did also the emperor Leo VI, in the ninth century, who has copied many things verbatim from the work of that prince. These *deputati*‡ were distributed in the armies among the cavalry, and were obliged to carry off those wounded in battle. On this account they

* Achillis Tatii Ερωτικά. Lugd. Batav. 1640. 12mo. p. 243. 617.

† In the original *ὁ τοῦ στρατοπέδου ἰατρός*.

‡ *Διπυτάτοι, ἔμποτάτοι, δαιπυτάτοι*.

had on the left side of the saddle two stirrups, in order that they might more easily take up the wounded behind them;* and for every person thus saved they obtained a certain reward. They were obliged also to carry with them a bottle containing water, for the purpose of reviving those who might have fainted through the loss of blood. Leo, besides the officers necessary for each band, or company, † of a regiment, mentions expressly not only the *deputati*, but also physicians, and attendants on the sick. ‡

It has been already remarked by Möhsen§ that, though an order was made by the first council of Ratisbon|| in 742, that every commander of an

* See the second volume of this work, p. 266.

† In the original *βανδον* and *ταγμα*.

‡ *Mauricii Ars Militaris*, p. 29 and 62, according to Scheffer's edit. Upsaliæ 1664. 8vo. *Leonis Tactica*, ed. *Meursii*, Lugd. Bat. 1612. 4to. lib. iv. 6. p. 35. and 15. p. 37. lib. xii. 51. p. 149. 53. p. 150. 119. p. 128. In the first passage it is said that, besides officers, the following persons were necessary: *βανδοφοροι, σαλπικηται, ηγγουν βουκινατροες, θεραπευται, ιατροι οι και διποτατοι*. The *θεραπευται* appear to me to have been persons who attended the sick. The *deputati*, in the ninth century, as Leo says, p. 37, were called *σκριθωνες*; for *σκριμωνες*, in that passage, is a typographical error. To this subject belongs, in particular, a passage in the *Tactica* of the emperor Leo, p. 430. n. 62, 63, where it is recommended that medicines both for the healing of wounds and the curing of diseases should be kept in readiness in armies.

§ *Geschichte der Wissensch. in der M. Brandenb.* p. 288.

|| Möhsen means the convention of Ratisbon, which was held two years earlier than the council of Franckfort, and which is often

army should have along with him two bishops, with priests and chaplains, and that every colonel should be attended by a confessor, no mention is to be found either of field hospitals or army surgeons belonging to the first Christian armies in the writings of the middle ages. We read, however, in the works of Paracelsus, Thurneyser, Lotich, and others, that they were present at battles and sieges; but it can be proved that they were not appointed as army surgeons, but served merely as soldiers.

The field surgeons, says Möhsen, who occur as accompanying armies in the beginning of the fifteenth century, were destined rather for the use of the commanders and principal officers, than for the service of the field hospital. Their number was too small for a whole army; and as they were authorised by their commission to receive prisoners and booty, and, like the knights, were obliged to bring with them archers, it is highly probable that to fight was a part of their duty also.

When Henry V of England carried on war with France in 1415, he took into his service Nicholas Colnet, as field surgeon, for a year.* He was bound to carry with him three archers on

called *concilium Carolomanni*. Such an order is certainly to be found among the decrees of that assembly. See *Semleri Hist. eccles. selecta capita*. Halæ 1769. 8vo. ii. p. 144.

* Rymer's *Fœdera*, T. iv. 2. p. 116, 117.

horseback, and to accompany the king wherever he went. In return he was to receive yearly forty marks, or pounds, to be paid at the rate of ten marks every quarter. He was allowed also twelve pennies per day as subsistence money, and each of his archers had twenty marks a year, and six pennies daily for subsistence. The chief army surgeon, Morstede, was engaged with fifteen men, three of whom were to be archers, and the remaining twelve surgeons. He received also ten pounds quarterly as pay, and twelve pennies daily for subsistence. His archers and surgeons were placed on an equal footing; each was to receive quarterly five pounds, and six pennies daily as subsistence. Both Colnet and Morstede could receive prisoners and plunder; but when the latter amounted to more than twenty pounds in value, a third part of it was to be given to the king. Both these head-men got a quarter's pay in advance; and that they might always have security for the next quarter, the king engaged to put into their hands, by way of pledge, as many jewels or other articles as might be equivalent to one quarter's pay and subsistence.

The Rev. Walter Harte, in his *Life of Gustavus Adolphus*,* seems to believe that this prince first appointed four surgeons to each regiment, which

* According to the German Translation, Leipzig 1761. 4to. ii. p. viii.

he reduced from the number of two or three thousand, first to 1200, and afterwards to 1008; and he is of opinion, that it may with certainty be believed that the imperial troops at that time had no surgeons, because Tilly himself, after the battle at Leipsic, was obliged to cause his wounds to be dressed by a surgeon established at Halle. He adds, in a note, that he was told that the Austrians, till about the year 1718, had no regimental surgeons regularly appointed. However this may be, it is certain that the field hospital establishments of the imperial army, till the beginning of the eighteenth century, were on a very bad footing. Even in the year 1718, they had no field surgeons; but at this period the company surgeons were dismissed, and a regimental surgeon, with six assistants, was appointed to each regiment; and besides the field medicine chest, surgical instruments were provided at the emperor's expense.*

The establishment of field hospitals in Germany is certainly much older; for Fronsperger, who wrote in the middle of the sixteenth century, does not speak of field surgeons, army surgeons, and their servants, as if they had been then newly in-

* See Hoyers *Geschichte der Kriegskunst*, Göttingen 1799. 8vo. ii. p. 176; the author of which refers to *C. F. von Khevenhillers Observationspunkte bey dem ihm anvertraucten Dragoner-Regiment*, Wien. 1734. 4to.

troduced; but in such a manner as shows that the need of them had been generally acknowledged long before that period.* According to his statement, it was necessary that there should be along with the commander-in-chief, or according to the modern phrase, the general staff, a field surgeon in chief, a doctor who had the inspection of the field surgeons, the barbers, and their servants, whose duty was to drag the wounded from the heaps of slain, and to convey them to the former. He was obliged to keep by him instruments and medicines, and at each mustering to examine the instruments and apparatus of the field surgeons; he decided also, in disputed cases, how much soldiers whose wounds had been cured ought to pay to the field surgeon. During marches he was bound to remain with the commander-in-chief. Fronsperger says also, that there ought to be with the artillery a field surgeon of *arckelley*, and with each company a particular field

* The title of the book is, *Kriegsbuch, erster Theil. Von Kaiserlichem Kriegsrechten, Malefiz und Schuldthändlen - - - durch Leonhart Fronsperger. Ander Theil. Von Wagenburgk umb die Veldleger*. The author calls himself a citizen of Ulm, and *provisioner* to his imperial majesty. He says, in a notice prefixed to the second part, which was printed for the first time at Franckfort, 1573, that the first was printed there in 1565, by George Raben, at the expense of Sigismund Feyrabends. That this was the first edition is proved also by the date of the first part, January 2, 1565. Of the first part I possess a Franckfort edition of 1571, folio. The passage I have quoted is found here, i. p. 53 and 85. There is no edition of 1555 and 1557, as is said in the additions to *Hoyers Geschichte der Kriegskunst*, i. p. 25.

surgeon, not however a paltry beard-scaper (*bart-scherer*), but a regularly instructed, experienced, and well-practised man. This person was bound always to accompany, with able servants, the ensign, and he received double pay.

COCK-FIGHTING.

AT present, the English are almost the only people among whom cock-fighting is a favourite amusement; and on that account it is considered as peculiar to them, though it was esteemed among various nations many centuries ago. It is not improbable that it was first introduced into England by the Romans. That it, however, has been constantly retained there, though the practice of inciting animals to fight has been long scouted by moral and enlightened nations, is as singular an anomaly, as that the Spaniards should still continue their bull-fights, and that princes who wish to avoid the appearance of cruelty should nevertheless pursue, with immoderate passion, the detestable and so often condemned hunting with dogs. I shall leave to others the task of moralising on these contradictions in the character of whole nations as well as individuals, and shall here only give the history of cock-fighting as far as I am acquainted with it.

This pastime is certainly very old; but I agree in opinion with Mr. Pegge,* that Palmerius† has made it much older than can fully be proved. The latter supposes that Adrastus, the son of Midas, king of Phrygia, killed his brother in consequence of a quarrel which took place between them in regard to a battle of quails. Adrastus on account of this murder fled to Cræsus; and as that prince lived about 550 years before the Christian æra, quail-fighting, according to the opinion of Palmerius, must have been customary at that time: and in this case one might admit that cock-fighting was of the same antiquity, because the battles of the domestic cock are still more violent, and can afford more amusement. Herodotus,‡ who relates the story of Adrastus, does not mention the cause of the quarrel; but it is given by the historian Ptolemy, the son of Hephestion, called also Alexandrinus, who lived about the time of Trajan and Adrian.§ He however only says

* In the *Archæologia*, by the Society of Antiquaries of London, vol. iii. p. 132: A Memoir on Cock-fighting, by Samuel Pegge, M. A. Rector of Wittington. As this learned antiquary, whose works are mentioned in *Reutz Gelehrtem England*, made use of what was collected by others on this subject, I have taken the same liberty with his paper; but in the like manner have rectified some mistakes, made new additions, and arranged the whole in my own way.

† Jac. Palmerii *Exercitationes in auctores Græcos*. Ultraj. 1694. 4to. p. 3.

‡ Lib. i. cap. 35 et 45. p. 21.

§ See Vossius de *Historicis Græcis*. Lugd. Bat. 1651. 4to. lib. ii. cap. 10. p. 213. Extracts from this book of Ptolemy, *περι παραδοξου*

that the two brothers quarrelled about a quail. Did any other proofs exist that quail-fighting was common at so early a period, it would indeed be then probable that the brothers quarrelled during that pastime. But as no such proofs are to be found, many other causes of quarrelling in regard to a quail, either in catching or pursuing it, may be conceived.

It is, however, certain that quails, as well as the domestic cock, are exceedingly irritable and quarrelsome birds; and that, like the latter, they can be employed for fighting;* but it appears that quail-fighting was first practised by the Romans, in whose writings it is frequently mentioned;† whereas among the Greeks it seldom or never occurs, while cock-fighting is spoken of on many occasions.

ιστορίας, may be found in *Photii Bibliotheca*, 1612. fol. p. 472. The words relating to this subject are: και αναيرهθαι αυτον (fratrem) περι ορτυγος φιλονεικουντα, et de eoturnice contendentem occubuisse.

* Buffon's Nat. Hist. of Birds.

† The passages which indisputably relate to quail-fighting, as far as I know, are as follows: *Plutarch. Apophthegm.* p. 207. ed. Francofurt. 1620. fol. Cæsar Augustus caused a person to be punished for having purchased and used as food a quail which had always been victorious: ορτυγα του κρατουντα παντων εν τη μαχεσθαι και αηττητον οντα: coturnieem, quæ in pugna omnes vinceret, insuperabilisque esset. *Plutarch. Vita Antonini*, p. 930. Antoninus often had the satisfaction of seeing his game-cocks and quails victorious: πολλακις αλεκτριονες, πολλακις δε μαχιμους ορτυγας. *M. Antoninus*, των εις εαυτον, i. § 6. ed. Gatakeri, Lond. 1697. 4to. p. 1. declares that he never took pleasure in keeping quails for fighting, ορτυγοτροφειν. *Herodian*, iii. 10. 4. p. 153, says, that the son of Septimus Severus always got into quarrels at quail- and cock-fighting, δι' ορτυγων μαχας και αλεκτριωνων συμβολας.

The latter, however, sported with quails; but their pastime* with these birds seems not to have been fighting, properly so called, where the great object of contest is whose quail shall be the victor: but the information on this subject is so imperfect, that it cannot be fully understood.† Sometimes the parties laid bets who could kill the other's quails, or the greatest number of them, with one blow. One placed a quail within a circle, and another endeavoured by irritating the animal to make it go beyond it. If he proved successful in this attempt, he was declared the winner. Several were often placed within a circle at the same time, and the person lost whose bird first quitted it. Kühn and others are of opinion, that each of the parties endeavoured to induce the quail of the other to leave the circle, by irritating or enticing it; but the words appear without doubt to allude to a contest of several quails with each other,‡ were it possible that the later Greeks had learned to play at this game from the contests of the Romans.

Solon, however, in Lucian,§ speaks of cock-fights and quail-fights exhibited publicly at

* Ορτυγοκοπιαί.

† This account is given by *Jul. Pollux*, lib. ix. cap. 7. § 102 et 108. *Suidas*, v. ορτυγοκοπος, ed. Kusteri, ii. p. 717. *Meursius de ludis Græcorum*, in *Gronovii Thesaurο Græcar. Antiquitat.* vii. p. 979.

‡ Pollux says, p. 1095: εἰστάσαν τοὺς ορτυγὰς ἐπὶ ταῖς μάχαις ταῖς πρὸς ἀλλήλους: constituebant coturnices ad pugnas mutuas.

§ De Gymnasiis, cap. 37. ed. Bipont. vii. p. 199. 493.

Athens. But Lucian lived in the second century ; had travelled into Italy ; was well acquainted with the Roman customs ; and made Solon mention quail-fighting, which he never saw in Greece, merely because he himself had seen it in Italy. This blunder may appear too gross, perhaps, for so acute a writer as Lucian ; but since he has fallen into two anachronisms in the same dialogue, as he not only makes Solon a cotemporary of Lycurgus, who lived, however, two centuries earlier, but also introduces him as speaking of public cock-fights at Athens, which were first established half a century later, that is to say, after the battle of Marathon, he may readily have been guilty of a third oversight, by transferring quail-fighting to Athens. But, at any rate, similar games were usual in the island of Cyprus in the sixteenth century.*

It appears, however, that the Romans bred and employed partridges for fighting, in the same manner as quails. Lampridius relates, that the emperor Alexander Severus was fond of seeing battles of this kind ; † and Ælian, who lived in

* Ils se delectoient pareillement à la chasse, et y a bien peu de citoyens et villageois, qui n'eust des cailles privées et apprises à combattre l'une contre l'autre, premierment de la voix, puis avec le bec, des pieds, et ailes. *Histoire generale du royaume de Cypre, par Etienne de Lusignan.* Paris 1613. 4to. cap. 29. p. 221.

† Cap. 41. p. 985 : Summa oblectatio fuit ut catuli cum porcellis luderent, aut perdices inter se pugnarent.

Italy under Heliogabalus, in the second century,* says that those who kept partridges for fighting, when they pitted them against each other, placed the females close to the males, in order to render them more courageous. Without doubt he here speaks of what was then usual at Rome.

Cock-fighting was appointed at Athens to be a public or solemn pastime, in consequence of a circumstance which occurred to Themistocles. At least, Ælian relates† that this commander, when he led out the Greeks against the Persians, happening to see two cocks fighting, took that opportunity to rouse the courage of his soldiers by telling them, that as these animals contended with so much obstinacy, though they fought neither for

* *Histor. Anim.* iv. 1: Qui perdices ad pugnam alunt, *οι τρεφοντες τους αθλητας περδικας*, quando in mutuum certamen incitant, *οταν αυτους εις την μαχην την κατ' αλληλων υποθηγωσι*, feminam suam singulis adstare curant.

† *Æliani var. histor.* ii. 28. Kühn quotes from Eustathius's commentary on the *Iliad*, p. 740, the following passage: Athenienses, Persis devictis, lepidum quoddam et innoxium excogitarunt exercitamentum, dum gallos quotannis solenni quodam die publice committendos sanxerunt, cum Themistocles exercitum in Persas educens, gallosque videns pugnantes pro victoria, hoc exemplo suorum animos ad pugnam accendisset. Simile et Romanis factitatum per còtùnicum commissiones, præcone indicente certamen his verbis: Pulli pugnant, et ita spectatores evocante I have transcribed this translation, because it contains a new proof that the Romans had quail-fighting rather than cock-fighting. The words of Ælian are admitted by Petit, among the Attic laws. See *Jurisprudentia Romana et Attica, cum præfat.* Wesselingii, Lugd. Bat. 1741. fol. p. 156.

their country, their families, nor their liberty, but merely for the honour of victory, it was much more incumbent on them to exert themselves with bravery, as they had all these causes of incitement. Having defeated the enemy, as a memorial of his victory and a future encouragement to bravery, it was ordered that fighting cocks should be exhibited every year, in a public theatre, in the presence of the whole people.

Mr. Pegge and others are of opinion that the Greeks afterwards took so much pleasure in the fighting of these birds, that they were generally employed throughout all Greece for this pastime and for betting. I am ready to admit that this is probable; but the institution of Themistocles appears to me to be no proof that cock-fighting was not practised at an earlier period. Even if it had been common, the Athenians might have thought proper to establish a religious or at least solemn cock-fighting to be exhibited every year. Themistocles, however, is not the only person who employed the courage of game cocks as an incitement to bravery. Socrates inspired Iphicrates with courage, by showing him with what ferocity the cock of Midas, or Meidias, and that of Callias attacked each other.* What Themistocles said to his soldiers was addressed by Musonius as a philosopher to mankind, to encourage them to support labour,

* Diogen. Laert. ii. 30. p. 98.

danger, and pain, when duty or honour require it.*

Many modern writers ascribe the establishment of public cock-fighting at Athens, not to Themistocles, but to his cotemporary Miltiades. I have hitherto suspected that this arises merely from a confusion of names, as is certainly the case in Moses du Soul,† where a reference is made to Ælian, by whom however Miltiades is not mentioned. At present, I am of opinion that Philo the Jew, who wrote in the first century, gave occasion to this assertion. He relates, that when Miltiades was about to lead the Grecian troops against the Persians, he exhibited a cock-fight, in a place which had been employed for public shows, in order to inspire courage into his soldiers by this spectacle, and that the end proposed was accomplished; but nothing is said by that author in regard to the establishment of annual cock-fights.‡

* Stobæi eclog. ed. Gesneri. Tiguri 1543. fol. p. 298. *Cælius Rhodiginus Lection. antiq.* xvi. 13. and after him Dalechamp, Kühn, Pegge, and others say, that the philosopher Chrysippus extols the game cock also on account of its courage; but none of these writers has told us where this fragment of the lost works of that polygraph is to be found. I met with it in *Plutarchi lib. de Stoicorum repugnantiis*, p. 1049.

† Solanus ad Luciani lib. c.

‡ Convocatis in Panathenaicum conventum sociis, certamen alitum indixit, συναγαγων εν τω Παναθηναϊκω συμμαχους, ορνιθων αγωνα απεδειξε: ratus hujusce spectaculi admonitionem quavis oratione validiorem fore: nec cum fefellit sua opinio. The passage occurs in the treatise, *Liber quisquis virtuti studet*, ed. Hoeschellii, Colon. Allobrog. 1613. fol. p. 684. ed. Mangey, ii. p. 466.

According to this account, cock-fighting seems to have been, at that time, not uncommon; but as it remains doubtful whether Philo speaks of the campaign before the battle of Marathon, in which Miltiades and Themistocles were both present, very little can be gathered from his relation, and it appears to me not sufficient to contradict the more circumstantial account of Ælian.

Another small mistake, which Pegge thought it worth while to notice, deserves also perhaps to be rectified. Dalechamp* and Potter† assert that Themistocles, while leading out his army, having heard a cock crow, declared this to be an omen of victory, and after beating the enemy he instituted cock-fighting in remembrance of that event. I shall here remark, that Dalechamp is not the first person who made this assertion. Peucer,‡ and, at a period still earlier, Alexander ab Alexandro,§ mentioned the same thing, but no one ever pointed out the passage in any ancient author, upon which this assertion was founded; and I have been as unsuccessful in my endeavours to find it, as those who attempted to discover the sources from which

* In his observations on Pliny, lib.-x. 21. sect. 34.

† Archæologia, vol. i. p. 327.

‡ De Divinationum generibus. Servestæ 1591. 8vo. 232. b.

§ Themistocli prædic quam in Xerxem duceret, auditus gallorum cantus, victoriæ mox futuræ prænuncium fecit; idque ideo, quod victus nequaquam canit, victor vero obstrepit et murmurat. *Genial. Dier.* v. 13. p. 137.

Alexander derived his information. This author perhaps collected from manuscripts, in the fifteenth century, many things never printed, and which therefore have been lost. He may also have written many things from memory, without remembering them all with accuracy.

It is indeed true, that the crowing of a cock was sometimes considered as a presage of victory. Thus Cicero quotes an instance,* where a Bœotian soothsayer promised victory to the Thebans, from the crowing of a cock; and according to Pliny,† the same circumstance once served to the Bœotians as an omen of victory over the Lacedemonians. How then could Themistocles make choice of a cock-fight to commemorate a victory announced by the crowing of a cock! Besides, Anacharsis in Lucian confirms the object of the institution assigned by Ælian. In the history of antiquity many things are often repeated, without any one taking the trouble to examine whether they can be proved by the testimony of the ancients. Those who wish to attain to truth and certainty in matters of this kind, will not consider such short examinations to be of so little importance as they may to others appear.

Dempster has assigned another reason for the cock-fights established by Themistocles, which,

* De Divinatione, i. cap. 34.

† Plin. x. 21. sect. 34.

though adopted by many, is not even supported by probability. He conceives that these cock-fights were like a kind of permanent trophies or monuments of the conquered Persians, because the game cock was indigenous in Persia, and conveyed thence to other countries.*

Athenæus, † indeed, quotes from a work of Menodotus some lines by which the latter part of this assertion is confirmed; and Aristophanes ‡ in two places calls the domestic cock a Persian bird. It is proved by more modern accounts, that this species of fowl is, at present, found wild in the East Indies and many neighbouring countries. Sonnerat § found them in Hindostan; and they were seen by Cook and by Dampier || on Pulo Condor and many islands of the South Sea. According to the tes-

* In his Annotations on *Rosini Antiquit. Rom.* iii. cap. 10. p. 287. cd. 1632. 4to. *Id a Themistocle institutum, ut restaret veluti de devictis trophæum, nam avis ista e Perside primum in alias regiones transmissa est.* See *Hyde de Religione Persarum*, p. 163.

† Lib. xiv. cap. 20. p. 255.

‡ *Aves*, 484. 707. Beek, in his edition of this comedy, Lips. 1782. 8vo. p. 50, thinks that the ancients themselves did not know whence this appellation arose. He refers, therefore, to the scholiasts, and to Suidas, v. *Περσικος ορνις*, p. 102, whose words have been copied by Phavorinus into his dictionary, p. 598; and he supposes, with Suidas, that the similarity of the cock's comb to the Persian covering for the head gave occasion to the name. But the passage quoted from Athenæus assigns a much more probable reason.

§ Sonnerat, *Reise nach Ostindien*. Zürich 1783. 4to. ii. p. 117. where there is also a figure of the wild fowls.

|| Cook's Voyages.—Dampier, *Suite du Voyage de la Nouvelle Hollande*, v. p. 61.

timony of Gemelli Careri they were indigenous in the Philippine islands, and according to Morolla in the kingdom of Congo. That they are still found wild in Georgia is asserted by Reineggs.* The account, therefore, of the Greeks, that they obtained domestic fowls from Persia, may be admitted; but as in cock-fights one Persian overcame another, how could these convey the idea of a victory of the Greeks over the Persians? Is the object, then, as stated by Lucian and Ælian not sufficient and intelligible?

That cock-fighting, in the course of time, became a favourite pastime among the people, is proved by the frequent mention which is made of it in various authors. Pliny says† that it was exhibited annually at Pergamus, in the same manner as combats of gladiators. In this city, according to Petronius,‡ a boy was promised a fighting cock; and therefore it appears that boys kept cocks there for this pastime. Æschines§ reproaches Timarchus with spending the whole day in gaming and

* Reineggs Beschreibung des Kaukasus, 1797. 8vo. p. 69.

† Lib. x. cap. 7. Pergami omnibus annis spectaculum gallorum publice editur, ceu gladiatorum.

‡ Cap. 86: gallos gallinaceos pugnacissimos duos donabo patienti.

§ Contra Timarchum. Demosthen. et Æschin. Opera, Aureliæ Allobrog. 1607. fol. p. 178. The translator says: Ubi coturnices et galli gallinacei committuntur; but the Greek author mentions only the latter, αλεκτρονας.

cock-fighting. Plato* complains, that not only boys but grown-up persons, instead of labouring, bred birds for fighting, and employed their whole time in such idle amusements.

Cock-fights were represented also by the Greeks on coins and on cut stones. That the Dardani had them on their coins we are told by Pollux; † and this seems to prove that these people were as fond of that sport as their neighbours of Pergamus. Mr. Pegge caused engravings to be made of two gems in the collection of Sir William Hamilton, on one of which is seen a cock in the humble attitude of defeat, with its head hanging down, and another in the attitude of victory, with an ear of corn in its bill as the object of contest. On the other stone two cocks are fighting, while a mouse carries away the ear of corn for the possession of which they had quarrelled; a happy emblem of our law-suits, in which the greater part of the property in dispute falls to the lawyers and attorneys. Two cocks in the attitude of fighting are represented also on a lamp found in Herculaneum. ‡

* Platonis Opera. Francof. 1602. fol. *de legibus*, Lib. vii. p. 880. Apud nos nonnulli in ludis quibusdam magis quam decet versantur. Nam non pueri solum verum etiam seniores avium pullos alunt, et ad mutuam inter ipsas aves pugnam exercent, και πρεσβυτεροι τινες ορνιθων θρεμματα επι τας μάχας τας προς αλληλα ασκουτες τα τοιαυτα των Θηριων.

† Onomast. ix. 84.

‡ Delle Antichita di Ercolano. Tom. viii. *O sia delle lucerne*, Napoli 1792. fol. p. 63. More engravings of coins with similar ini-

That the Greeks employed various means to increase the irritability and courage of fighting-cocks is beyond all doubt. Besides the circumstance already mentioned in regard to the females, they gave them also food which produced nearly the same effect as opium does in India, and as brandy did some years ago on the European armies. Dioscorides* and Pliny† ascribe this effect to a plant which they call *adiantum*. The former says it was given to game cocks and quails, and the latter that it was given to game cocks and partridges, to incite them to fight. Garlick, *allium*,‡ was employed also, as we are told by Xenophon, not only for game cocks but also for horses and soldiers.§ That the Greeks, however, like the English at present, armed their cocks with steel spurs, in order to render their battles more

pressions may be found in *Thesaurus Britan.* i. p. 213. 234. in *Leonar. Agostini gem.* P. i. p. 199. and in *Gorlaeus*, P. i. 51, and 114. also P. 2. 246. *Harduini Numm. antiq. populorum et urb.* p. 134. *Frölich Notit. numism.* p. 81. A single cock may often have been the emblem of vigilance.

* Lib. iv. cap. 36. p. 292. Ποιησὶ καὶ τοὺς ἀλεκτρυόνας καὶ τοὺς ὀρνυγὰς μαχιμωτέρους.

† Lib. xxii. cap. 21. sect. 30: perdices et gallinaceos pugnaciores fieri putant, in cibum eorum additis. This affords a further proof that partridges also were made to fight.

‡ In Greek, σκοροδον.

§ Hence may be explained the words σκοροδιζειν and εσκοροδισμενος, which occur in Aristophanes. See *Acharnenses*, 165. *Equites*, 492. *Xenophon. Sympos.* p. 648. edit. Basilæ 1555, fol. More passages may be found in *Stephani Thesaurus Gr. Index*, ii. p. 44. σκοροδον.

bloody, is denied by Pegge; though the contrary seems to be proved by a passage in Aristophanes, now become a proverb, and the remarks of the scholiast.* As the English procure the strongest and best fighting-cocks from other countries, and often from Germany through Hamburgh, the Greeks, in the like manner, obtained foreign game cocks for the same purpose.†

Why the Romans showed more fondness for quail-fighting than for cock-fighting I do not know; but it is certain that they had not the latter, or at any rate only seldom and at a late period, which appears to be very singular, as they began then more and more to imitate the Greeks. Varro mentions the breeds which were chiefly sought for in Greece; but he adds, that though they might be good for fighting, they were not fit for breeding.‡ Had the breeding of game cocks been an employment, he would have spoken in a different manner. Columella also ridicules the breeding of these cocks, as a Grecian custom, and prefers the native race to all others. Eustathius, in the place already quoted, says expressly that the Romans preferred quails to

* *Aves*, 760: *αιρε πληκτρον ει μαχει*: tolle calcar si pugnas. See what has been said in regard to this proverb by Suidas, and by Erasmus in his *Adagia*.

† The most celebrated breeds are mentioned by *Columella*, viii. 2. *Plin.* x. 21. *Geopon.* xvi. 3. 30.

‡ Varro iii. 9: sunt pulchri et ad præliandum inter se maxime idonei, sed ad partus steriliores.

game cocks; yet in later times we find mention among them of cock-fighting, as has been before remarked.

There were cocks in England in the time of Julius Cæsar;* but it is said that they were kept there merely for pleasure, and not used as food. The latter part of this account is not improbable. The inhabitants of the Pelew Islands,† we are told, eat only the eggs of their hens, and not the flesh. But the question, how old cock-fighting is in England, cannot be determined. Pegge says, the oldest information which he found on this subject was in the Description of the city of London by William Fitz-Stephens, who lived in the reign of Henry II, and died in 1191.‡ This writer relates that every

* Leporem et gallinam et anserem gustare fas non putant; hæc tamen alunt, animi voluptatisque caussa. *Cæsar de Bello Gallico*, lib. v, 12.

† Physikal Œkon. Biblioth. xvi. p. 263.

‡ Præterea quotannis die, quæ dicitur carnivale (ut a puerorum ludis incipiamus, omnes enim pueri fuimus) scholarum singuli pueri suos apportant magistro suo gallos gallinaceos pugnatores, et totum illud antemeridianum datur ludo puerorum vacantium spectare in scholis suorum pugnas gallorum. I have transcribed these words from the first edition of this old topography, which is entitled *A Survey of London, written in the year 1598, by John Stow* - - - with an appendix containing *Libellum de situ et nobilitate Londini*, written by William Fitzstephen. Lond. 1599. 4to. p. 480. Mr. Pegge has *carnilevaria*, and says that this word occurs neither in Spelmann nor Du Cange; but it is not in the first edition, which has *carnivale* in its stead. The former perhaps may be in later editions. Pegge refers to one of 1754. Stow translates the word, p. 68, by *Shrove-tuesday*.

year on Shrove-tuesday the boys at school brought their game cocks to the master, and the whole forenoon was devoted to cock-fighting, for the amusement of the pupils. The theatre or cockpit, therefore, was in the school-house, and the pupils seem to have had the direction of it. To this information I can add, that cock-fighting in France was forbidden by a council in 1260, on account of some mischief to which it had given rise.*

This pastime has been sometimes forbidden even in England, as was the case under Edward III† and Henry VIII;‡ also in the year 1569,§ and even later; but it has nevertheless still been retained. Even Henry VIII himself instituted fights of this kind;|| and a writer worthy of credit relates, that James I took great delight in them.¶

* Du Cange, *Glossarium*. Duellum gallorum gallinaeorum etiamnum in aliquot provinciis usurpatum a scholaribus puerulis vetatur in concilio Copriniaensi, an. 1260. cap. 7. quod scilicet superstitionem quamdam saperet, vel potius sortilegii, aut purgationis vulgaris nescio quid redoleret: Quia ex duello gallorum, quod in partibus istis, tam in scholis Grammaticæ, quam in aliis fieri inolevit, nonnulla mala aliquoties sunt exorta - - - This council, as I conjecture, was held in the town of *Coprinium in diocesi Burdegâensi*, which, as some think, was Cognac.

† Maitland's History of London, p. 101. *Stow's Survey of London*, i. p. 302. edit. 1754.

‡ Maitland, p. 1343. 933.

§ Ibid. p. 260.

|| Ibid. p. 1343.

¶ Pegge refers to the Letters of de la Boderie, i. p. 56, who was sent by Henry IV as ambassador to James I.

In modern times this cruel amusement has been carried beyond all bounds; so that the cock-fights in China,* Persia,† Malacca,‡ and America,§ are nothing in comparison of those called the *battle-royal* and the *Welsh main*. In the former a certain number of cocks are let loose to fight, and when they have destroyed each other, the survivor is accounted the victor, and obtains the prize. In the latter kind of battle, sixteen pair of cocks, for example, being pitted against each other, the sixteen conquerors are made to fight again; the eight of these which are victors, must fight a third time; and the four remaining a fourth time, till at length the two last conquerors terminate, by a fifth contest, this murderous game, after thirty-one cocks have successively butchered each other amidst the noisy exultation of the spectators, who, however, make a pretence to the character of magnanimity.

What here follows could not properly be introduced as a separate article, under a distinct head; and yet I am inclined to think that it will not be disagreeable to many of my readers. I wish, therefore, that it may be considered as a supplement to the preceding dissertation. An explanation will be found in it of a process formerly

* Bell's Travels, p. 303.

† Tavernier.

‡ Dampier. Also the *Gentleman's Mag.* 1770, p. 564.

§ Wafer, p. 118.

used, but long since forgotten, which appears not to be unimportant in regard to physiology and the breeding of cattle.

Cocks are so unfortunate as to have been tortured in another manner for the pleasure of mankind, during the course of two thousand years. I here allude to the practice of cutting them, in order that, as capons, they may fatten better and become more delicious for the table. At first hens only were fed; and, as Pliny* says, this practice was begun by the inhabitants of the island of Delos, who, in consequence of the barrenness of their soil, could not have many occupations.† These people brought the art to so much perfection that they became the instructors of the Romans, among whom all those who made a trade of feeding fowls were called *Deliaci*.‡ They had very properly remarked, at an early period, that the hens when cooped up in a warm, dark, and narrow place, became much sooner fat; and they carefully selected that kind of food which was most beneficial to

* Lib. x. cap. 50. sect. 71.

† In regard to the barrenness of this island, see *Callimachus in Delum*, 276; and Spanheim's remarks, p. 549.

‡ Cicero in his *Academ.* iv. 12. 26, relates that many *gallinarii Deliaci* could tell, on inspecting an egg, by what hen it had been laid. This orator had mentioned them also in the second oration *pro Cornel.* now lost. The passage must be sought for in the fragments, *ed. Verburgii* in 4to. iv. 1410. b. *Varro de Re Rustica*, iii. 9, 2.

them. In general, a sort of dough made with milk and meal was employed.*

But fowls fed in this manner were for a long time considered at Rome as excessive extravagance; and C. Fannius procured a law that no person should bring to his table more than one fowl, and that this fowl should not be crammed or fed; a law which was several times renewed, but, like all others made against luxury, was not long followed. At first it was eluded by people feeding young cocks, as well as they possibly could; so that they thus avoided the punishment announced by the law, in which pullets only were mentioned.

In the course of time the Romans followed the example of the Greeks, who had long known that the feeding of cocks could be much improved by first rendering these animals unfit to propagate their species. As the Delians took advantage of this process, and acquired the greatest dexterity in the management of it, they are mentioned by ancient writers, in ridiculing those who had the

* Gallinas includunt in locum tepidum et angustum et tenebricosum, quod motus earum et lux pinguitudini inimica. *Varro*, iii. 9. 19. Locus desideratur maxime calidus et minimi luminis, in quo singulæ caveis angustioribus inclusæ pendeant. *Columella*, viii. 7. 1.

Pascitur et dulci facilis gallina farina;

Pascitur et tenebris, ingeniosa gula est.

Martial, xiii. 62.

Aves, quæ conviviis comparantur, ut immotæ facile pinguescant, in obscuro continentur. *Seneca epist.* 123.

misfortune to be deprived of their manhood.* The inventor of this art, so important in cookery, is not known; but whoever he may have been, it is probable that he might be led to it by what was remarked in regard to eunuchs, who long before, or at any rate in Egypt in the time of Moses, were exceedingly numerous; † namely, that they all became plump and fat in an extraordinary degree. It is, however, singular that in the Greek writers no particular name occurs for capons, and that it is not known whence the Romans obtained the terms *capo* and *capus*. ‡

Neither the Greeks nor the Romans, in making capons, deprived the animals of those parts in which manhood is supposed to consist; they left them unweakened, but they made it impossible for them to use them. This we are told expressly by Columella; § and Galen twice mentions that the testicles of a cock are excellent eating, but especially those of one that has been fed, and in particular when its food has been prepared with milk. ||

* Petron. cap. 23: *Deliaci manu recisi*.

† Gouget *Geschichte der Ges. und Künste*, i. p. 365.

‡ Vossius *de Idololatria*, iii. 91. p. 609. a.

§ Lib. viii. 2. 3: *Fœminæ proprie appellantur gallinæ, mares autem galli, semimares capi, qui hoc nomine vocantur, cum sint castrati libidinis abolendæ causa. Nec tamen id patiuntur amissis genitalibus, sed ferro candente calcaribus inustis, quæ cum ignea vi consumpta sunt, facta ulcera, dum consanescant, figulari creta linuntur.*

|| *De Alimentor. Facultat.* iii. 7. ed. Gesneri, cl. 2. p. 53. ed. Hervagian. Basilicæ 1538. fol. iv. p. 339: *Μοσοι δ' οἱ τῶν ἀλεκτρούων*

Old cocks, without doubt, no one would attempt to feed; and therefore allusion must here be made to those cocks for which the Greeks, as already said, had no name; cocks to which procreation was denied, and in which these parts, in all probability, were found to be larger and tenderer after the animal was killed. Such was the opinion of Apicius;* and that respectable writer Conrade Gesner has committed an error,† when he says that these parts are the same as those which are taken out in cutting. But capons were not made at that time by cutting, properly so called. Some doubt might be excited against my assertion by a passage in Varro;‡ but this will entirely disappear when the words are compared

αριστοι κατα παντα, και μαλιστα των σιτευθεντων: Soli testes gallorum gallinaceorum undequoque sunt præstantissimi, et potissimum eorum qui saginati fuerint. *Cap.* 21. 343: οι δ' ορχεις αριστοι και μαλιστα των σιτευτων αλεκτρονων. ετι δε μαλλον οσοι δια γαλακτος ορβωδους τας τροφας προσενεγκονται: Gallorum testes sunt præstantissimi, præcipue altillium, et multo magis si cibus eorum, quo sunt nutriti, seroso lacte fuerit imbutus. In *Alexandri Aphrodis. Problemat.* according to the translation of 1541, 12mo, quoted in the third volume of this work, the following words occur, lib. ii. p. 70: Cur testes gallorum gallinaceorum, quos lacte saginant, amplissimi et concoctu facillimi efficiantur. In the Greek edition of 1541, 12mo, this passage is wanting.

* Lib. iv. cap. 3. p. 132, in the recipe for *minutal apicianum*: testiculi caponum.

† *Histor. avium*, p. 413. He explains the words of Apicius by, Testiculi gallis nimirum dum castrarentur exempti.

‡ *De Re rustica*, ii. 7. 15: Equi castrantur demptis testiculis; ii canterii appellantur, ut in subus majales, in gallis gallinaceis capi.

with what others have written on the same subject. The term *canterii* certainly denotes such horses, *majales* such swine, and *capi* such domestic cocks, as have been rendered unfit for procreation; but the first only were reduced to that state by the loss of the parts. In the same manner, we must not extend the comparison or play of words in Martial, where he first alludes to a capon and then to a priest of Cybele,* any further than to suppose that both were deprived of their generative faculty.

The horse, the bull, the he-goat, the ram, and the males of most of the mammalia may, by cutting, be easily deprived of those parts without which they cannot procreate; and therefore this method has been practised in the oldest periods; but this is more difficult in regard to fowls, because these parts are situated in the abdomen close to the kidneys. This kind of cutting appears to have been considered, in the oldest times, as too dangerous; and on that account, other methods were devised for destroying these parts, or by stopping up their ducts to render them entirely useless.

If it be true that the Persians were the first people who ventured to deprive males of their manhood, and if it can be believed that domestic

* Ne nimis exhausto macrescerent inguine gallus
Amisit testes; nunc mihi Gallus erit.

Epigr. xiii. 63. *Capo.*

fowls were always indigenious among them,* and from them were transmitted to the Greeks; it appears incredible that the art of making capons should in modern times have been carried from Europe to Persia through Armenia; and yet this is asserted by Tavernier.†

How old our present method of making capons may be, I do not know; but one might almost believe that it was practised in the seventh century, because Isidore of Seville‡ seems to say so, unless we are to suppose that this ecclesiastic, not being fully master of the subject, wrote merely from conjecture.

It does not appear that cocks were cut by the Greeks or the Romans, though the camels and swine were subjected by them to that operation; the latter, because they became thereby much sooner fat, and were greatly improved in regard to their flesh. For this purpose, besides cutting, which Galen§ and the newer anatomists declare

* Stephanus de urbibus, v. Σπαδα, p. 615. Hence the allusion of Petronius, *Persarum ritus*; and of Claudian, *Ferrum Persicæ luxuriæ*.

† *Les six voyages de Tavernier*. Paris 1682. 4to. i. p. 346.

‡ Origines, xii. 7. p. 307: *Gallus a castratione vocatus. Inter cæteras enim aves huic soli testiculi adimuntur.* The savages in the South Sea islands also are said to make capons. See *Algem. Welt-histor.* xxvii. p. 70.

§ Aristot. *Hist. animal.* at the end of the ninth book, p. 1175: *Execatur etiam vulva scropharum, ita ut non amplius coire opus habeant, sed brevi tempore pinguescant. Igitur biduum cum jejunarint, appensa pernis posterioribus secatur sumen, qua potissimum*

to be dangerous, another method was employed ; that is, by burning, to destroy or mutilate those parts which serve for fructification.* Mankind, even at an early period, adopted the cruel practice of rendering young women incapable of conception. How this was done I shall leave to be examined and described by others.† The castration, how-

parte maribus testes sunt. Ibi enim scrophis vulva a natura sita est, quo loco paululum seindentes consuunt. *Galenus de Semine*, i. 15. ed. Gesneri, clas. i. p. 670: Suas feminas apud nos non in Asia tantum, sed in superioribus etiam nationibus in Cappadociam usque execare consuefecerunt, quæ similes omnes castratis evadunt, obesæ admodum ac pingues, carnisque suavitate aliis feminis, quemadmodum etiam castrati mares aliis maribus præstant. Non tamen ita tuto in feminis testium extractio administrari potest ob sedem, in qua collocati sunt. *Plin.* viii. 51. *sect.* 77. The method used at present is described by *Bartholinus*, *cent.* 3. *epist.* 64. p. 259.

* Fœminis quoque vulvæ ferro exulcerantur, et eiatricibus clauduntur, ne sint genitales ; quod facere, non intelligo, quæ ratio compellat, nisi penuria cibi. Nam ubi est ubertas pabuli, submittere prolem semper expedit. *Columella*, vii. 9. 5. Was this experienced farmer, then, unacquainted with the benefit of cutting?

† This practice, according to Athenæus, was begun by Andramites, and, according to Hesychius and Suidas, by Gyges, both kings of Lydia. See *Athenæus*, xii. 4. p. 515. *Hesychius de viris illustribus*, Antverpiæ 1572, 8vo. p. 37. 45 ; and *Suidas*, v. *Xanthus*, ii. p. 642. More on this subject may be found in *Franck de Franck satyræ medicæ*, Lipsiæ 1722, 8vo. p. 36, and in the Jesuit Raynaud's *Dissertat. de Eunuchis*, in his *Opera*, tom. xiv. Lugd. 1655, fol. p. 561. As the castration of the female sex was combined with much greater danger, some suppose that the means employed for this shameful purpose were the same as those still used in Arabia Petræa, Ethiopia, and other countries, where men are so cruel as either to cause parts, possessing a high degree of sensation, to grow together by sewing them up, so that before marriage they must be again separated by an incision ; or a ring is drawn through them and then

ever, of the domestic cock, in my opinion, was first practised in France, in the beginning of the

fastened with a lock or soldered together. I am acquainted, I confess, with no proof that the Greeks and the Romans ever employed these means; though the fibulation of boys is frequently mentioned. The Greeks immured their wives, and when they wished to be very careful they only sealed up the apartment: locks among them were not much in use. See a dissertation by Bottiger in *Neuen Teutschen Merkur*, 1802, i. p. 23. 34. If the chain-girdle, mentioned in Isaiah, chap. iii. ver. 16—20, was applied to this purpose, as the talmudists believe, it had no lock. The padlock which the French call *cademat des jaloux*, and the Germans the Italian, is of much later invention. Some ascribe it to Hieronymus Cardan, and believe that he employed the spring lock, which he invented. He gives indeed a description of it, *De Subtilit.* lib. vii. p. 498, but he does not say that he was the inventor; he only remarks that it was made by an artist, of whom he says, p. 478: Janellus Turrianus Cremonensis, vir acris ingenii, multa alia aut excogitavit, aut ab aliis excogitata in melius traduxit. It has been described by several of his cotemporaries, for example John Buteo, 1560, in *Logisticis*. See *Schwenters Erquickstunden*, i. p. 448. Doppelmayr, p. 200, wishes to ascribe the invention to a native of Nuremberg. But none of these writers make any mention of this indecent use. Krünitz in his *Encyclopedia*, vol. xxxvii. p. 191, says: Alexius Carrara, the last of the tyrants, as they were called, of Padua, was the inventor of the Italian lock, which on that account was distinguished by his name. With this Alexius I am not acquainted; the last of the house of Carrara, whom the Venetians caused to be executed in 1406, was named Francis. We are told by Keysler, in his *Travels*, p. 509, that such a lock was shown to him at Florence as the first of its kind. But the inscription—*Gelt, Füchlein, ich habe dich erwischt.* 1618, proves that to be so it was too modern. Brantome, in *Dames galantes* (see *Collection universelle des mémoires relatifs à l'histoire de France*, 1790, 8vo. tom. lxi. p. 376), relates that in the time of Henry II a dealer in toys exposed, for the first time, in the fair of St. Germain, a dozen of such locks, which had been used at Venice before the year 1552; but he adds that they were not much employed in France, because the ladies soon found out the

sixteenth century; but it was not made known in Germany till a much later period, when our princes began to fall into the weakness of imitating the French, and to employ French cooks. La Bruyere-Champier, who wrote his book on cookery in 1530, says expressly, that the art of cutting cocks was a new invention.* Aldrovandi, in the year 1598, treats of capons, and adds, that the cutting of cocks was not common.† Olivier de Serres, however, whose treatise on agriculture was printed for the first time in 1600, ‡ speaks of this method of feeding, as a thing well known and understood by every agriculturist. After that period, the word *poularde* was not used, as before, to denote a cock which had been fed, but one cut and afterwards fed. About the year 1642, Vincent Tanara, the Italian, described this method of treating cocks as a practice very common. § In 1645 Lewis Nonnius said, that the method of castrating cocks, in order to render them more beautiful, had been lately found out. ||

But it appears that the Germans were a long

means of making false keys. Bonneval relates that he once met with in Italy a lock of this kind, which he had long wished to see. See *Begebenheiten des Gr. von Bonneval*, 1738, 8vo. i. p. 71.

* Bruyerinus de re cibaria, 1600, 8vo. xii. 4. p. 508.

† Ornithol. lib. xiv. tom. ii. p. 146.

‡ Theatre d'agriculture. Paris 1603, 4to. v. 2. p. 326.

§ *Economia del cittadino in villa*. See *Physikal ökonom. Biblioth.* xvi. p. 207.

|| *Diæteticon*. Antverp. 1646, 4to. ii. 22. p. 231.

time behind their neighbours in this improvement in cookery, as it is not mentioned by Colerus, Florinus, and Heresbach. Hohberg* only speaks of it as a thing usual in France. It is not improbable that some of the French, driven from their native country by the revocation of the edict of Nantes, may have introduced it into Germany; and perhaps the well-known Von Eckhart† was the first who, in 1753, gave a complete description of this art to my countrymen, and rendered it clear by a wood-cut. He employs, on this occasion, the new-fashioned term *poulanderie*, and says, that it was first known in the German courts, to which it was brought from France.



SALTPETRE. GUNPOWDER. AQUA-FORTIS.

IN examining the question, whether Theophrastus, Pliny, and in general the ancient Greeks and Romans, were acquainted with our saltpetre, or at what period it became known, I shall perhaps meet with as little success as those who have pre-

* *Georgica curiosa*. Nuremberg 1716. fol. ii. p. 377.

† *Experimental-Oekonomie*. Jena 1754, 4to. p. 325. According to Suckow's edition, p. 326.

ceded me in the same research.* I shall therefore be satisfied if competent judges allow that I have contributed any thing new that can tend to illustrate the subject.

Our saltpetre, which is commonly called *nitrum*, and sometimes, though more rarely, *sal nitræ*, is a neutral salt from the acid peculiar to it, named the acid of saltpetre, and that vegetable alkali to which our pot-ash in general belongs. The marks by which it is most readily distinguished from the other salts are its cooling taste; its fusibility when exposed to a small degree of heat, and in particular, its so called decrepitation; that is, the

* To this subject belong the following works: *Ars magna artillariæ, auctore Casim. Siemienowicz.* Amst. 1650. fol. p. 61. The author thinks that the *nitrum* of the ancients is not at present known.

The Natural History of Nitre, by Will. Clarke. Lond. 1670. 8vo.—*Naturalis Historia Nitri.* Franeof. et Hamb. 1675, 8vo. p. 19. It is here said that the *nitrum* of the ancients was impure saltpetre, and that the latter is produced from the former by purification. The Latin translation is, in many parts, unintelligible.

G. C. Schelhameri de nitro, cum veterum tum nostro, commentatio, Amst. 1709, 8vo, contains good philological observations, particularly in regard to the period, but leaves the question undetermined.

Saggi sul ristabilimento dell' antica arte de' Greci e Romani pittori, del Sig. Doct. Vincenzo Requeno, Seconda ediz. Parma 1787, 2 tomi in 8vo. ii. p. 95 and p. 131: a learned work, but spun out to such a length, that it requires some trouble to discover the author's meaning, and the grounds on which it is supported. He thinks that the *nitrum* of the ancients was our saltpetre; and what others consider as proofs of its being mineralised alkali, he understands as indicating

property it has when placed in the fire, or on an ignited body, or when melted in a crucible with an inflammable substance, of suddenly bursting into a very bright flame, by which it becomes alkalisèd, or in other words loses its acid, so that nothing remains but the vegetable alkali. The principal use of it is in making gunpowder, and for the preparation of that acid known under the name of aqua-fortis, which is employed in various ways:

Native saltpetre, or saltpetre completely formed by nature, is so rare, that Cronstedt was not acquainted with it. At present, however, it is known that it is found in the East Indies, in the lower

alkalisèd saltpetre. I am not, however, convinced. Before I ascribe to the ancients a knowledge of our saltpetre, I must be shown in their writings properties of their *nitrum* sufficient to convince me that it was the same substance, that is to say, properties not belonging to alkali, but to our saltpetre alone. It is to be observed also, that this Italian author is not always correct in quoting his sources.

Commentat. de nitro Plinii, in *J. D. Michaelis commentationes*. Bremæ 1784, 4to. The author only illustrates the account of Pliny, and states what, according to his opinion, we are to understand in it in regard to alkali, and what in regard to our saltpetre. When this dissertation was about to be printed the second time, the author requested from me some annotations; which, however, I did not give, because they must have opposed his assertions. I was unwilling to offend either my pupils or friends, by contradicting a circumstance which could have no influence on human happiness.

In *Tromsdorfs Journal der Pharmacie*, iv. 1. p. 129, professor Fuchs says, he had sent a dissertation on the *natrum* of the ancients to the Electoral Academy of Mentz, which however I do not find in their Transactions.

part of Italy, also in Portugal,* Spain,† America,‡ and some other countries. § But almost all the saltpetre obtained in Europe is produced partly by nature and partly by art. The putrefaction of organised bodies gives rise, under certain circumstances, to nitrous acid, which in general combines with calcareous earth wherever it finds it, and forms the so called earthy saltpetre. This is decomposed by fixed vegetable alkali, and the latter uniting with the acid forms common saltpetre. Sometimes also it is found that the nitrous acid, instead of being united with calcareous earth, is united with the mineral alkali, which produces the so called cubical saltpetre. ||

* I found the account of the Portuguese saltpetre in *Mémoires instructifs pour un voyageur*, a translation of which was published at Dantzic, 1755, 8vo, with the following title: *Der gegenwartige staat von England, Portugal, und Spanien*, i. p. 177. The author of this work was the well-known Theodore king of Corsica.

† The proofs, in regard to Spanish saltpetre, may be found in my *Physikal-Œconom. Bibliothek*, xi. p. 508. xiv. p. 122. xviii. p. 189.

‡ A description of Patagonia, by Faulkner. Herford 1774, 4to.

§ More accounts of native saltpetre may be found in *Recueil de mémoires sur la formation du salpêtre. Par les commissaires de l'Académie*. Paris 1776, 8vo. *Del nitro minerale memoria dell' ab. Fortis*, 1787, 8vo.

|| The first, or one of the first, who was acquainted with and made known the cubical saltpetre, was professor John Bohn of Leipsic, in the *Acta eruditorum*, 1683, p. 410; but with more precision in his *Dissertat. chymico-physicæ*, Lips. 1696, 8vo. p. 36: Inter alios aquam regiam parandi modos hic pluribus innotescit, ut spiritus nitri a sale communi cohobetur, sicque aliquid de spiritu

Both these saline substances, but the earthy more frequently than the cubical, are often found on effloresced walls; and both are then comprehended under the common names of *mauersalz* or *mauerbeschlag*, *sal murale*.

This efflorescence on walls was observed, in all probability, at a very early period, especially as it is produced in many parts in great abundance, and as it makes itself perceptible by the decay of walls, which it seems to corrode. It is the plague or leprosy of houses mentioned in the Mosaic code of laws.* As the ancients were so much inclined to expect medicinal virtue in all natural bodies, there is reason to think that they soon collected and made trial of this saline incrustation. That this indeed was actually the case, and that they gave the name of *nitrum* to this saline mass, may be proved from their writings. Their *nitrum*, however, must have been exceedingly various in its properties. For this incrustation is not always calcareous saltpetre; it is often mineral alkali, to which, at present, chemists rather give the am-

salis recipiendo virtutem aurum solvendi acquirat, potentiam in argentum perdat; pauci vero profecto attenderunt, parum hoc menstruum amplius de spiritu nitri, plus autem longe de salis stagmate, participare; quippe sal in fundo retortæ remanens, si crystallisetur, figuram quidem salis cubicam præ se fert, quantum quantum tamen est, nitrum evasit, quod ejus inflammabilitas, sapor, ac spiritus inde elicere jubent.

* Levit. chap. xiv. ver. 33. See *J. D. Michaelis Mosaisches Recht*. Frankf. 1778, 8vo. Theil iv. p. 280.

biguous name of soda, mixed with more or less calcareous earth; and sometimes it belongs to the vitriolic salts. In modern times, on closer examination, other nitrous salts have been found in the incrustation of walls, such as flaming saltpetre, bitter saltpetre; but of these no mention can be expected in the works of the ancients.

Substances so different ought not indeed to have been all named *nitrum*; but before natural history began to be formed into a regular system, mankind in general fell into an error directly contrary to that committed at present. Objects essentially different were comprehended under one name, if they any how corresponded with each other even in things accidental. Whereas at present every variety, however small, obtains a distinct appellation; because many wish to have the pleasure, if not of forming new species, at any rate of giving new names. The elephant and rhinoceros were formerly called oxen; the sable and ermine were named mice, and the ostrich was distinguished by the appellation of sparrow. In the like manner, calcareous saltpetre and alkali might be called *nitrum*. The ancients, however, gave to their *nitrum* some epithets; but they seem to have been used only to denote uncommon varieties.

Now, as the ancients were not acquainted with any accurate method of separating and distinguishing salts, it needs excite no wonder that they

should ascribe to their *nitrum* properties which could not possibly be united in a salt, and much less exist in our saltpetre. But as they were neither acquainted with aquafortis nor manufactured gunpowder, and as no particular use of calcareous saltpetre was known, the *nitrum* most valuable to them must have been that which consisted chiefly of the mineral alkali, and which consequently could be employed in washing, in painting, and in glass-making.

It is well known, that in warm countries this alkali effloresces here and there from the earth, particularly in a dry soil, and even in such quantity as to be employed in commerce. Hence it may be readily comprehended why this effloresced salt, which is very often mixed with common salt, obtained the name of *nitrum*.

The important discovery, that a similar salt, having the like properties, and applicable to the same uses, named at present soda, may be obtained from the ashes of certain plants, was first made, in my opinion, by the ancient Egyptians or Arabians. This salt also, at least by the Greeks, was named *nitrum*, or considered as a species of it. By the incineration of the plants this salt was rendered slightly caustic; and it then became moist in the air, and deliquesced when not preserved in very close vessels. It was, therefore, like those salts which are obtained, in the same manner, from the ashes of all other plants; though

the latter are essentially different from the former, and in the course of time obtained the peculiar appellation of potash. One can hardly be surprised that the ancients were not able to distinguish the mineral and vegetable alkali, especially as they were both obtained from vegetable ashes, and as in modern times we have learned to distinguish them only by the neutral salts which they form.

But were the ancients, under the ambiguous name of *nitrum*, acquainted with our saltpetre? There is certainly reason to think that it became known to them by lixiviating earths impregnated with salts. There are, as already said, not only in India but also in Africa, and particularly in Egypt, earths which, without the addition of ashes or vegetable alkali, give real saltpetre, like that of the rubbish-hills on the road from new to old Cairo,* and like the earth in some parts of Spain. It is a knowledge only of this natural kind of saltpetre, which required no artificial composition, that can be allowed to the ancients, as it does not appear by their writings that they were sufficiently versed in chemistry to prepare the artificial kind used at present.

But even admitting that they had our saltpetre, where and by what means can we be convinced of

* Abhandlungen über Aegypten des Instituts zu Kairo. Berlin 1800, 8vo. i. p. 29. In like manner, a heap of dung covered with earth is lixiviated, and the result, without the addition of ashes, used as saltpetre. See *Physikal-ækon. Biblioth.* viii. p. 52. from *Georgi's Bemerkungen einer Reise*, i.

it? Is it to be expected that any of the before-mentioned marks or properties of this salt should occur in their writings? They neither made aquafortis nor gunpowder; and they seem scarcely to have had any occasion or opportunity to discover its decrepitation and the alkalisation thereby effected, or, when observed, to examine and describe it. No other use of our saltpetre which could properly announce this phenomenon has yet been known. How then can it be ascertained that under the term *nitrum* they sometimes meant our saltpetre?

Those inclined to believe too little rather than too much, who cannot be satisfied with mere conjectures or probabilities, but always require full proof, will acknowledge with me, that the first certain accounts of our saltpetre cannot be expected much before the invention of aquafortis and gunpowder. It deserves also to be remarked, that the real saltpetre, as soon as it became known, was named also *nitrum*; but, by way of distinction, either *sal nitrum*, or *sal nitri*, or *sal petræ*. The first appellation, from which our ancestors made *salniter*, was occasioned by an unintelligible passage of Pliny, which I shall afterwards point out. The two other names signify, like *sal tartari*, *sal succini*, a salt which was not *nitrum* but obtained from *nitrum*. *Sal nitri*, therefore, or *salniter*, was that salt which, according to the representation of the ancients, was separated by art from *nitrum*, yet was essentially different from the

nitrum or mineralised alkali commonly in use. Biringoccio says expressly,* that the artificial *nitrum*, for the sake of distinction, was named, not *nitrum*, but *sal nitrum*.

The name *nitrum* is of great antiquity, and seems to have been conveyed from Egypt and Palestine to Greece, and thence to Italy and every part of Europe. For it is evidently the *neter* mentioned by the prophet Jeremiah, chap. ii. ver. 22; and which occurs also in the Proverbs of Solomon, chap. xxv. ver. 20.† But whether the name *nitrum*, as Jerome says,‡ be derived from the Egyptian pro-

* Pirotechnia, lib. ii. cap. 8. p. 35. 6.

† Michaelis commentat. l. c. p. 165.

‡ The passage of Jerome relating to Proverbs, xxv. 20, I here insert entire, because I shall often have occasion to employ it: Nitrum a Nitria provincia, ubi maxime nasci solet, nomen accepit. Nec multum a salis Ammoniaci specie distat. Nam sicut salem in litore maris fervor solis conficit, durando in petram aquas marinas, quas major vis ventorum, vel ipsius maris fervor in litoris ulteriora projecit; ita in Nitria, ubi æstate pluviae prolixiores tellurem infundunt, adest ardor sideris tantus, quod ipsas aquas pluviales per latitudinem arenarum concoquat in petram; salis quidem vel glaciei aspectui simillimam; sed nil gelidi rigoris, nil salsi saporis habentem, quæ tamen, juxta naturam salis, in caumate durare, et in nubiloso aere fluere ac liquefieri solet. Hanc indigenæ sumentes servant, et ubi opus extiterit, pro lomento utuntur. Unde Judæo peccanti dicit propheta Jeremias: Si laveris te nitro, et multiplicaveris tibi herbam borith, maculata es in iniquitate tua, dicit Dominus Deus. Crepitat autem in aqua quomodo calx viva; et ipsum quidem disperit, sed aquam lavationiabilem reddit; cujus natura cui sit apta figuræ, cernens Solomon ait: Acetum in nitro, qui cantat carmina cordi pessimo. Acetum quippe si mittatur in nitrum, protinus ebullit.

vince *Nitria*, whence it was exported in great abundance, or the name of the province was derived from *nitrum*, is a question of little importance in regard to this research. *Nitron* is mentioned by Herodotus, where he describes the Egyptian method of embalming dead bodies;* by some of the Greeks the word was written and pronounced *litron*. In the same manner people say *nympha* and *lympa*. In order to avoid confusion, I shall here call the *nitrum* of the ancients *nitrum*, and the *nitrum* of the mineralogists saltpetre.

In the course of time men became acquainted with the purer, more useful, and cheaper mineral alkali which was furnished, under the name of soda, by the Moors and inhabitants of the southern countries, who had learned the method of preparing it. The vegetable alkali also was always more and more manufactured in woody districts, as an article in great request, and sold under the name of potash, *cineres clavellati*. All knowledge of the impure alkali from the incrustation of walls was then lost; and as there was no further need of guarding against confusion, it was not longer thought worth while to name saltpetre *sal nitri*: it was called *nitrum*; and the oldest signification of this word being forgotten, it was admitted without further examination, that the *nitrum* of the ancients was nothing else than our saltpetre.

* Herodot. ii. cap. 86 et 87, p. 142, 143, edit. Wessel.

In the sixteenth century some learned Europeans, while travelling through the East, heard the name *natrum* given to the mineral alkali which was then exported as an article of commerce, and introduced in their works this transformation of the ancient word *nitrum*. This appellation was employed by the systematic mineralogists, who, giving themselves little trouble about the original meaning of words, and taking care only to avoid confusion, called the mineral alkali also *natrum*, and applied the name of *nitrum* to saltpetre. As far as I know at present, it was first stated by Peter Bellon* and Prosper Alpinus,† that the mineral alkali was in the East called *natrum*. The former returned in 1549, and the latter was still in Cairo in 1580.

This word was adopted in mineralogy by Linnæus, in the year 1736, as the name of a species, in which he comprehended for the first time the alkaline incrustation found on walls. In this he is followed by Wallerius, who includes also the mineral alkali from the East. Afterwards the word *natrum*

* Nitri, Memphi et Byzantii, tanta est apud negotiatores copia, ut nihil vulgatius sit. Vulgari nomine Natron dicitur. Sic quoque in Damasco. *Bellonii de operum antiquorum præstantia*, lib. iii. cap. 8. p. 2629, in *Thesaurus Græc. Antiq.* viii. or *De medicato funere*, ii. 8.

† Nitrum, quod Arabes Natron vocant, copiosum in Ægypto effoditur. *Histor. Ægypti naturalis*. Lugd. Bat. 1735, 4to. iii. 2. p. 140.—See also *Forskål Flora Ægyptiaco-Arabica*. Havniæ 1755. 4to. p. xlv.

was employed in the same sense by all mineralogists.

It deserves here to be remarked, that Boyle* even had examined and determined the difference between the fixed and volatile alkalies; but that mineralogists and chemists, till the latest periods, believed that all fixed alkali arose, or at least was obtained, by the incineration of plants. The difference between the mineral and vegetable alkalies was first defined, in a proper manner, by the exertion of the German chemists Pott, Model, and Marggraf; especially after the last had proved, in the year 1758, that the basis of common salt was not, as had before been generally believed, an alkaline earth, but a fixed alkali, to which, because it was in many of its properties different from the fixed vegetable alkali, he gave the name of fixed mineral alkali.† Soon after, this substance was discovered in mineral springs; and Model and others have shown that it is not essentially different from that which in the East is called *natrum*.

It is singular, and yet may be accounted for, that since that time many have spoken of the *nitrum* and *natrum* of the ancients, though they are only different pronunciations of the same word; and *natrum* is never found in the works of the Greeks or the Romans, and not even in writings of the middle ages.

* Gmclin's Geschichte der Chemie, ii. p. 50.

† Chymisches Schriften, i. p. 169.

But if the greater part of what I have here said should be considered only as conjecture, it must nevertheless be acknowledged that it is deduced from the nature of the thing; and, when impartially compared with what we read in the ancients, the latter I hope will be better understood than it hitherto has been; the impropriety of many readings will become apparent, and the truth of this conjecture be admitted.

Were I here to relate every thing that we read of *nitrum*, in order to compare it with nature and to examine it thoroughly, as in my opinion ought to be done in illustrating the natural history of the ancients, and as I once did myself,* I should be obliged to extend this article to a greater length than might be agreeable to the reader. I shall, therefore, give only the principal proofs of my assertion, premising, that doubts which might be excited by single passages not here mentioned, will, on a closer comparison, vanish without my assistance. But I maintain that those who wish to explain the old names of natural objects must relate every thing said of them, and not that alone which is favourable to their opinion, and which may be often contradicted by what was purposely or accidentally concealed. The first part of such an examination is always a careful collection from

* For example, in *Aristot. auscultat. mirab.* p. 65. *Geschichte der Erfindungen*, ii. p. 206. iv. p. 42. iv. p. 19. *Vorrath kleiner Anmerkungen*, i. p. 192.

the writings of the ancients of all the prædicates of the natural object, the systematic name of which one is endeavouring to prove.

There is reason however to conjecture, that the ancients, in the history of their impure nitre, the manner of obtaining which the Romans at least had no opportunity themselves of seeing, for Pliny says expressly that it was not procured in Italy, fell into many errors and mistakes, which at present cannot all be explained.

Hence it happened, that the ancients did not understand the art of purifying the salt which they obtained from minerals; and therefore they were obliged to use it in the same impure state in which they found it. On this account they considered each natural mixture as a peculiar kind; gave to the greater part of them, or those most useful, particular names; and of these recommended for different purposes those which, according to their purity or mixture, or according to other circumstances, were the most convenient. It is not probable that all these varieties could be again found out or defined; and it seems to be of little importance, when it is known that the names denote nothing more than the varieties of a mineral.

In this examination it is to be regretted that the book of Theophrastus, in which he expressly treated of *nitrum*, has not been preserved. But it may be believed, even without the testimony of

Pliny, that he was one of the most accurate and acute naturalists among the ancients, and that he gave the best account of this substance.* It must, however, be admitted that Pliny thoroughly understood this author, and gave a correct extract from him, and that the transcriber fell into no mistake.

That the *nitrum* of the ancients was an alkali more or less impure, but not saltpetre, has been long admitted by those who had the least knowledge of mineralogy, as well as by the most sagacious physicians. The grounds for this opinion, as far as I have yet learned, are as follows: more indeed might be found, but these are sufficient to afford a complete proof. Galen, a cautious writer, says that *nitrum* was in general burnt, by which means its effects were strengthened.† Had it been

* Lib. xxxi. cap. 10: Palam est, et medicos qui de nitro scripserunt ignorasse naturam, nec quenquam Theophrasto diligentius tradidisse.

† De simplic. med. facult. ix. ed. Gesneri, cl. 5. p. 142, and in the edition of Basle, ii. p. 126. Nitrum ustum propius ad aphronitrum accedit, utpote ex ustione tenuius redditum, λεπτομερεστερον - - - Ceterum nitro usto simul et non usto - - - in talibus morbis uti consuevimus, νιτρω δε κεκαυμενω τε και ακαυστω και ημεις επι τοιουτων χρωμεθα. Dioscorides also, v. 131. p. 378, speaks as if it had been well known that *nitrum* was commonly burnt. This has been repeated from him by Oribasius in *Collectan. medicin.* lib. xiii. p. m. 518. ed. Venet. ap. Manutium, in 8vo. Abuleasis also, who in the twelfth century taught the preparation of medicines in the *Liber Servitoris*, already quoted, says: Combustio nitri. Teratur et ponatur in erucibulo super prunas. Et exuffletur donec aduratur. Et si non aduritur bene iterum ponatur, et exuffletur, donec aduratur, quantum oportet. Pag. m. 242. a

saltpetre, it is impossible that the ancients should not in burning it have observed its decrepitation, and this property excites too much astonishment not to have been mentioned. But nothing is to be found that can with any probability be supposed to allude to it.*

But should it be admitted without any grounds that it was not an alkali but saltpetre which they burnt, it must certainly have been alkalised; for a burning body may easily have fallen into the crucible, and in general *nitrum* seems to have been burnt in an open fire, like our lime, because Pliny speaking of the Egyptian considers the contrary as somewhat uncommon. Physicians then, at any rate, must have observed, that a body very different both in its appearance and effects was produced from saltpetre by burning, but which could not be used for any other purpose than that salt. Of this however we do not find the least intimation.

But *nitrum* was undoubtedly mineral alkali, and on that account when burnt must have become caustic as well as stronger in most of its effects, and in this respect similar to the vegetable alkali, since it in the same manner became moist and de-

* In Gesner's edition of Galen there is a short dissertation, Clàs. 7. p. 365. *de incantatione*, in which it is said, where the author at the end relates wonderful things of every kind, *lapis qui vocatur nitrum foco incenditur*. But this dissertation is of modern date, and so insipid, that I must beg the reader's pardon for having here mentioned it.

liquesced in the air. What Pliny relates of the Egyptian *nitrum* becomes then intelligible.* The latter, he says, was transported in pitched vessels, because it would otherwise have deliquesced; and he afterwards adds, that it was burnt before it was sent off. Had he known that the latter was the cause and the former the effect, he would have mentioned the latter first; but his whole extract, in regard to nitre, is written in general without order. The vessels, no doubt, were of clay; but whether he means in what he adds that they were not burnt but only baked in the sun, or that before they were filled they were completely dried in the sun, has been determined by no commentator. To me the latter is the more probable. Pliny also mentions another circumstance in regard to the burning of the Egyptian *nitrum*; namely, that it must be done in a close vessel, otherwise it would decrepitate or fly off. This is perfectly intelligible, when it is considered that it contained a great deal of common salt, which alone possessed the property of decrepitating; and it is well known in mineralogy that native mineral alkali, and even that which in modern times has been introduced

* Lib. xxxi. cap. 10: Ægyptium affertur in vasis picatis, ne liquescat. Vasa quoque in sole inarescentia perficiuntur - - Adulteratur in Ægypto calce; deprehenditur gustu. Sincerum enim facile resolvitur; adulteratum pungit. Calce aspersum reddit odorem vehementem. Uritur in testa opertum, ne exsultet; alias igni non exsilit nitrum.

into our collections from Tripoli, and of which I have in my possession a specimen, contains common salt,* and often in cubical crystals. On this some have founded the conjecture, either that alkali is formed from the common salt after the loss of the acid, or that common salt is produced from the alkali by the addition of the muriatic acid.† Pliny had just reason to add, that *nitrum* otherwise does not properly decrepitate.‡ The ancients were well acquainted with the affinity of their *nitrum* to lime, and especially of that which was burnt. On this account, because the Egyptian was exported after it had been burnt, it could easily be mixed with quicklime, or, as Pliny says, be adulterated. But the proof which he gives he does not seem to have thoroughly understood. The Egyptian must at all times have been caustic (*pungens*) even without lime; but that which was mixed with

* Phil. Transactions, 1771. vol. lxi. p. 567. *Abhandlung der Schwedisch. Akad.* xxxv. p. 131; where, however, the existence of saline crystals in the Tripoline alkali is denied.

† Bergman Opusc. iii. p. 267. See the opinion of Berthollet in *Physik. ökon. Biblioth.* xxi. p. 307.

‡ Michaelis thinks the reading ought to be, *alias igni exilit*, and that the word *non* should be expunged; but in this case the author must have said twice in succession *ne exsultet, alias exsilit*. Were I allowed to make any change, I should only ready *aliud*, instead of *alias*, and understand the passage in this manner, that the Egyptian *nitrum* decrepitates, but other kinds do not. I, however, think that *alias* may be allowed also in the former meaning. In regard to this signification of the word see the annotation of Grævius to *Sueton. Tiber.* cap. 71.

lime could not so speedily or completely dissolve on the tongue as that which was pure, and left behind it more earth. What he says of a test by the smell, I cannot understand in any other manner than that burnt lime, when moistened with water, diffused that disagreeable vapour observed in apartments the walls of which have been newly plastered;* though when the quantity is small this is hardly perceptible.

If I understand Theophrastus† properly, he seems to say, that if *nitrum* be burnt as soon as it is dug up, it communicates heat to water in the same manner as lime. I doubt this effect of heating, and do not know that in modern times it has ever been remarked. Perhaps it is observable only where the mineral alkali is burnt in large solid pieces, for which at present, at least in Europe, there is no occasion. Or has the account of Theophrastus arisen from *nitrum* strongly mixed with lime? Or has this heating been only suspected

* On this account the reading *aspersu reddit odorem vehementer*, appears to me the most proper. But perhaps Pliny alludes to the smell of volatile alkali from very impure *nitrum*, which Barchausen observed when he pounded Egyptian salt and lime. See his *Acromata*, Trajecti 1703. 8vo. p. 134.

† De igne, p. 435, ed. Heinsii, where he speaks of the heat produced in lime by slaking it: *εμφαινει δε πως και το νιτρον το κεκαυμενον εν τω ορυττεσθαι την τοιαυτην δυναμιν*. *Nitrum quoque ustum talem quodammodo, dum effoditur, potestatem significat*. Aristotle also mentions together *κονια* and *νιτρον*, on account of similar properties. *Proklemat.* i. 39. ed. Septalii, p. 71.

from its similarity to lime? At any rate it may here be seen how great an affinity the ancients found between their *nitrum*, alkaline earth, and lime.

The affinity of wood-ashes to the *nitrum* of the ancients, which they acknowledged, proves also that it was a real lixivious salt. We are told by Theophrastus* that *nitrum* was said to be produced from oak-ashes; and Pliny,† who borrowed from this writer, remarks that it was certain the ashes of that wood were nitrous. He ascribes also to burnt wine lees the nature and properties of *nitrum*.‡ Nay he considers as a kind of *nitrum* those saline ashes which, in many countries destitute of salt, were used for seasoning food, and which were prepared by pouring sea water or salt brine over burning piles of wood, gradually and in small quantities, so that the fire was not extinguished, by which means the water evaporated, leaving the salt behind, but mixed indeed with charcoal, ashes, earth, and lixivious salts; consequently it must have been moist, or at any rate nauseous, if not refined by a new solution. This method of preparing or boiling salt, which perhaps

* Hist. Plantarum, iii. 9. p. 50 : φασι δε και οταν κατακαυθη, γινεσθαι λιτρην εξ αυτης.

† xxvi. 8. Cremati quoque roboris cinerem nitrosum esse certum est.

‡ Fœx vini siccata recipit ignes, ac sine alimento per se flagrat. Cinis ejus nitri naturam habet, easdemque vires, hoc amplius quo pinguior sentitur, xiv. 20.

is the oldest, has been mentioned by various writers ; but many of them, through ignorance or neglect, have not told us that sea water or brine was employed, as they speak in such a manner as if any kind and even sweet water had been used for that purpose.

Varro relates that he saw this process employed on the Rhine.* Pliny says† that oak timber had before been burnt for that purpose. In another place he mentions a similar process among the Gauls and the Germans,‡ as Tacitus does among the Hermanduri and the Catti.§ The former also states, on the authority of Theophrastus, that the Umbri burned salt in the like manner.|| It is, however, certain that Pliny and other ancient writers

* *De re rustica*, lib. i. c. 7. In Gallia transalpina intus ad Rhenum, aliquot regiones accessi - - - ubi salem nec fossicium nec maritimum habent, sed ex quibusdam lignis combustis carbonibus salsis pro eo uterentur. Little, however, depended on the wood ; the principal thing was the sprinkling with water.

† xxxi. 10 : Quercu cremata nunquam multum factitatum est, et jam pridem totum omisum.

‡ xxxi. 7. Gallia Germaniæque ardentibus lignis aquam salsam infundunt. Hispaniæ quadam sui parte e puteis hauriunt, muriam appellant. Here express mention is made of brine.

§ Illisque silvis salem provenire, non ut alias apud gentes eluvie maris arescente unda, sed super ardentem arborum struem fusa ; ex contrariis inter se elementis, igne atque aquis concretum. *Taciti Anal.* xiii. 57. The two elements would not have done without sea water.

|| Lib. xxx. 7. Apud Theophrastum invenio, Umbros arundinis et junci cinerem decoquere aqua solitos, donec exiguum superesset humoris.

often quote from Theophrastus what, at present, is not to be found in the works of that naturalist, but in those of his preceptor Aristotle.*

Pliny adds, that this paltry method of obtaining salt had been long given up; and this, indeed, was the natural consequence of increased civilisation. It is, however, certain that it was long continued in many countries, and in some still exists.

About two centuries ago the inhabitants of the province of Zeeland, descendants perhaps of the Catti, used no other salt than what they obtained in the like manner, from mud thrown up by the sea, which they burned and moistened with sea water, as we are told by Lemnius, who was himself a native of that country. Boxhorn† says, in his annotations on the above-quoted passage of Tacitus, that he saw a painting at Zirkzee, in which the whole process was represented. It is probable that salt

* This is particularly the case in regard to *Aristot. Auscult. mirab.* as I have already remarked, in the preface. *Aristot. Meteorol.* ii. 3. p. 786. ed. Duval. Aliud huic rei proximum Umbri moliuntur: quendam enim locum habent, in quo arundines et junci enascuntur, quorum cinerem decoquere aqua soliti sunt, donec exiguum supersit humoris, qui ubi refrixit, in salis copiam solet evadere.

† Majores nostri olim salem confecerunt uberrimo sane quaestu --- ex maritimis glebis exustis atque in cinerem redactis, quem infusa aqua minutatim in salcum reducebant splendidum ac nitentem, *zel oft ziltzout*, populares atque indigenae denominant a glebis salsugine imbutis, unde id clicitur. Nec alio salis genere tota Belgica ad nostram usque memoriam usa est. *De miraculis occultis naturæ*, Colon. 1581. 8vo. Lib. iii. 9. p. 348. This salt therefore was refined, and in the course of the process the common salt shot into crystals, and the alkali remained in the mother-ley.

was boiled exactly in the same manner as at some of the Sleswic islands, described by Denkwerth,* from whose account it is seen that the *glebæ marinæ*, of which Lemnius speaks, consisted of mud mixed with roots growing in them ; and that the salt when afterwards refined was called there Frisic, in all probability because the inhabitants had learned to make it from their ancestors the Frieslanders. I remember somewhere to have read that salt was made for a long time in this manner by the so called Wurst-Frieslanders, in the country of Wurst, belonging to the duchy of Bremen. The inhabitants also of the Austrian part of Moldavia, or Buccovina as it is called, still use a salt, which they do not boil but burn with their superfluous wood, in the like manner from the brine of a saline spring.† A member of the former Academy of Brussels‡ took

* In the island of Dagebull, and also in Faretoft and Galmesbull, Frisic salt is made in the following manner. The inhabitants proceed along the coast in small vessels, and at low water go on shore on the mud, which they dig up till they come to a kind of earth called *torricht*: it is of a turfy nature, and interwoven with roots. This earth they convey to the islands, where they spread it out in the sun and leave it to dry, after which it is formed into a heap and burnt to ashes. What remains is again spread out, moistened, and trod upon with the naked feet; the small stones and other useless parts are picked out, and being again dried and besprinkled with water, the ley is put into salt-pans and boiled into salt. *Beschreibung von Schleswig und Holstein*. 1652. fol. p. 88.

† Von Fichtel Beytrag zur Mineralgeschichte von Siebenbürgen Nürnberg 1780. 4to. ii. p. 36.

‡ Memoires de l'acad. de Bruxelles, 1777. i. p. 345.

the trouble to examine the process as described by the ancients, and obtained, as might certainly have been expected, a highly alkaline kind of common salt, similar to that which Pliny, not without reason, considered as a sort of *nitrum*, because undoubtedly it may oftener have been a lixivious salt than common salt.

Boerhaave,* in quoting the passages of the ancients, did not reflect, that during the incineration of the wood salt water was poured over it. He considered the whole process as a burning of potash, and thought that the salt obtained was fit for use only because it was made according to the manner of Tachenius. That indeed gives a lixivious salt, which is almost saponaceous, and so mixed with various parts of the burnt plants that it is much milder, consequently fitter for use than common lixivious salt can be; but that salt was not so much of the Tachenian kind as a species of common salt superabundant in alkali.

If the *nitrum* was lixivious salt, there is reason to suppose that the ancients must have occasionally mentioned in their writings that it effervesced with acids. With the mineral acids indeed they were not acquainted; but they had vinegar, and that *nitrum* produced with this an effervescence had been known in the oldest times. A very clear allusion to this circumstance is found in the book of Proverbs, chap. xxv. ver. 20; where Luther

* *Elementa Chemicæ*. Lugd. Bat. 1732. 4to. i. p. 767.

however translates the word by *chalk*. Jerome, whose explanation I have already quoted, was in some degree acquainted with this phenomenon; and therefore to him the comparison of Solomon was intelligible.* But at present I can produce no proofs from Greek writers; though they might have occurred during the use of *nitrum* in medicine, in consequence of which it was often put into vinegar.

We shall be further convinced what *nitrum* really was, when the uses to which it was applied, as mentioned in the works of the ancients, are considered. The most common, as soap was not then known, appears to have been in washing, a purpose for which our saltpetre would not be fit; besides, it is at all times too scarce and too dear. I shall not here adduce any proofs of its being employed in this manner, as they often occur, and as several have been already given in a preceding volume.† Many salves and cosmetics were prepared with *nitrum*; and in all probability articles of this kind, used chiefly among the women, are to be understood by the term *nitron parthenicon*,‡ which occurs in Nicholas Myrepsius, in the beginning of the fourteenth century; *matronicon*,§ mentioned by

* Boyle considered the words of Solomon as a proof that *nether* must be fixed alkali; and he was more convinced of it when he saw nitre obtained from Egypt effervesce with acids. See *Experimenta circa producibilitatem chymicorum principiorum*. Genevæ 1694. 4to, p. 11.

† See the History of soap, vol. iii. p. 224.

‡ Νιτρον παρθενικον.

§ Ματρωνικον.

the same, and by Alexander of Tralles, about the year 565; and the *nitrum matronale* of Marcellus Empiricus, in the fifth century. That the use of it for washing still continues in the East, is confirmed in various books of travels.*

The oldest glass, of the preparation of which any account is to be found in history, was made by means of *nitrum* or mineral alkali. For though I doubt, with Merret, Dantic, and Tabor,† that it could have been produced on the sandy banks of the Belus, where some merchants when cooking supported their pots with lumps of *nitrum*,‡ because sand is not so easily brought to a state of fusion; it at any rate remains certain, that this supposed fusion with our saltpetre is altogether impossible.

The use of *nitrum* for painting announces, without doubt, a lixivious salt, and not saltpetre;§ and the case is the same with the various uses in the cookery of the ancients, many of which we have still retained. It was added to bread in baking, according

* Forskäl Flora Ægypt. Arabica, p. xlvi. *Vansleb, nouvelle relation d'un voyage*, Paris 1677. 8vo. p. 333.

† Loysel Anleitung zur Glasmacherkunst. Francf. 1802. 4to. p. 1. *Neri ars vitriaria*. Amst. 1668. 12mo. p. 259.

‡ Plin. xxxvi. 26. § 65. p. 758. The use of *nitrum* in making glass is often mentioned. *Plin.* l. c. p. 758. lin. 20. Also xxxi. 10. p. 565. *Taciti Hist.* v. 7. p. 357.

§ Plin. xxxi. 10. Ad aliqua sordidum *nitrum* optimum est, tanquam ad inficiendas purpuras tincturasque omnes. *Plutarchus de Oraculorum defectu*, p. 433: της δε κοκκιν το νιτρον δαχει την βαφην αγειν μεμιγμενον: *Nitrum cocci tincturam expedit admixtum.*

to Pliny,* in the stead of salt, but probably to promote its rising, for which purpose it is still employed by the Egyptians, as potash is by our bakers. For this use the mineral alkali was formerly brought from the Levant to France, till it was declared by the physicians to be injurious to the health.†

When meat which was too fresh was to be dressed, it was put into *nitrum*,‡ in order to make it tender; and, according to Forskal and others,§ this is still practised in the East. Our cooks also know that smoked meat, stock-fish, and other dried provisions become tenderer when placed in a ley of potash, or when a little potash is added while they are boiling.

Nitrum, however, was employed for curing articles of food which people wished to preserve.|| This appears to contradict what has been mentioned above; but, in all probability, a caustic sort was used for the former purpose; but for the latter a mild kind, mixed with a great deal of common salt. There were so many species, that some of them might have been applied to quite contrary purposes.

* Lib. xxx. 10. In pane salis vice utuntur nitro Chalastræo. *Serapio de temperamentis simplic.* cap. 401. p. m. 299: Species alia nitri dicitur *baurach panis*, quia in Yaya utuntur eo in pane, et hoc, quia homines illius terræ dissolvunt ipsum in aqua, et liniunt eo panem, antequam coquant eum, recepit enim ab eo claritatem.

† Forskäl Flora, p. xlvi. *Hasselquists Reise*, p. 548.

‡ Plutarehi Sympos. lib. vi. at the end.

§ Also Prosper Alpinus. *Hist. nat. Ægypti*, i. p. 142.

|| Plin. xxxi. 10. Ad ea quoque, quæ inveterari volunt, nitro utuntur.

As I conjecture, the use of *nitrum* for causing chestnuts and other husky fruits to boil soft, was also known: to produce the same effect, potash is at present thrown among boiling lentils and peas. I am inclined to think, that for this reason Apicius caused chestnuts to be boiled with nitre.*

It is highly probable, that this effect of lixivious salts induced agriculturists to believe that beans, peas, lentils, and other leguminous fruits, if steeped, before they were sown, in water in which nitre had been dissolved, or if the dung spread over the earth had been mixed with nitre, the future product could be more easily boiled soft.† However useful this addition may be in cookery, it would produce little effect on seed; and it appears to me that the old agriculturists placed little confidence in the last-mentioned use, because they were not agreed in regard to the result. Virgil and others seem to expect from it an increase of the fruit;‡

* De arte coquinaria. V. ii. p. 146.

† Theophrasti Histor. plant. ii. 5. p. 82: Ut legumina, ne incocilia fiant, nitro pridie macerata serere in sicca tellure præcipiunt. *Geopon.* ii. 35. 2. p. 179; and ii. 41. p. 194. *Palladius*, xii. tit. i. 3. p. 996: Fabæ semina nitrata aqua respersa, cocturam non habere difficilem.

‡ Semina vidi equidem multos medicare serentes,
Et nitro prius et nigra perfundere amurca,
Grandior ut fetus siliquis fallacibus esset.

Virg. Georg. i. 193.

Plin. xviii. 7. § 45. p. 121: Virgilius nitro et amurca perfundi jubet fabam; sic enim grandescere promittit. *Geopon.* ii. 36. p. 184.

but others, security against beetles, which eat the fruit and leave the husks empty.* When cabbages were transplanted they were strewed over with nitre, and by these means were said to ripen sooner.† Radishes also were treated in the same manner, or besprinkled with nitrous water, in order to make them more tender.‡

A common method employed by the ancient cooks to give a beautiful green colour to pickled or boiled vegetables, was to add *nitrum* to them while boiling; but this effect could be produced by *natrum*, and not by the *nitrum* of the moderns, or that neutral salt called saltpetre.§

Among the oldest accounts of *nitrum*, is that where it is mentioned as being employed for embalming dead bodies. It would be tiresome to read over and examine every thing written on that subject by the learned; but this much I think is

* Columella ii. 10, 11. p. 432: Nos quoque sic medicatam, cum ad maturitatem perducta sit, minus a curculione infestari.

† Plin. xix. 8. § 41. *Pallad.* iii. 24. 6. p. 920. *Geopon.* xii. 17. 1. p. 875. *Theophrast. de causa plant.* vi. 14. p. 368.

‡ Plin. xxxi. 10; and xix. 5. § 26. 10. p. 168.

§ Apicius, iii. 1. p. 70: Omne olus smaragdinum fiet, si cum nitro coquatur. It may be readily seen that *smaragdinum* denotes a beautiful green colour. Martial says, lib. xiii. ep. 17,

Ne tibi pallentes moveant fastidia caules,
Nitrata viridis brassica fiat aqua.

Plin. xix. 8. § 41. 3. p. 177: Nitrum in coquendo etiam viriditatem custodit. xxx. 10: Nitro olera viridiora fiunt. *Columella*, xi. 3. 23. p. 766: Hæc res efficit, ut in coctura brassica celerius madescat et viridem colorem sine nitro conservet.

clear, that either the flesh, and, in general, the softer parts of the body could be corroded in the course of seventy days* by the Egyptian nitrum,† which, as above shown, was burnt, and in general mixed with unslaked lime, and consequently caustic;‡ or that the moist parts could be desiccated by mild alkali, in the same manner as the manufacturers of parchment purify and dry their skins by the application of chalk. That saltpetre, in no case, could be useful for this purpose, needs hardly be mentioned.

The ancient physicians, who were unacquainted with our numerous class of neutral salts, employed their *nitrum* in many ways, and for a great variety of mixtures; but no writer, as far as I know, ever took the trouble to examine these recipes, though it has long since been declared that *nitrum* must have been potash or salt of tartar. Matthioli§ asserted, that those physicians would act very improperly, who should prescribe our saltpetre where the ancients employed their *nitrum*; and indeed

* This is the number assigned by Herodotus.

† Herodot. ii. 87. p. 143: τας δε σαρκας το νιτρον κατατηκει και δε λειπεται του νεκρου το δερμα μουνου και τα οσtea: Nitrum carnes tabefacit (absunit, colliquefacit, consumes) mortuique tantum cutis et ossa relinquuntur.

‡ Our tanners use unslaked lime for a similar purpose.

§ Annotations to Dioscorides, v. 89. p. 951. The recipes in which *nitrum* occurs, in Celsus, have been collected by Professor Fuchs, in *Tromsdorf's Journal der Pharmacie*, iv. i. p. 129; where it is proved from Hasselquist that *natrum* is used in the same manner, at present, in the East.

those in the least acquainted with the effects of salts must know, that all those extolled by the ancients announce lixivious salts. Thus burnt *nitrum* was employed for cleaning black teeth, as at present many use tobacco ashes instead of tooth powder.* It is seen by the works of Aretæus† and others, that burnt *nitrum* was used as a caustic, till people learned, in modern times, to prepare the more active *causticum potentiale*, or *sal causticum*.‡

What the ancients say of the taste of their *nitrum* seems, however, not entirely applicable to pure lixivious salt; and much less, or not at all, to our saltpetre. Had they meant the latter, they would certainly not have failed to mention the sensation of coolness which it occasions when applied to the tongue. Galen§ and Aetius|| say, that *nitrum* is as bitter as gall; but Serapio ascribes to it a saline taste, with a small degree of bitterness; as does also Pliny, only that for bitterness he substitutes the word sharpness. The names of tastes, however, are as uncertain as the names of the co-

* Plin. xxxi. 10.

† Aretæus de curatione morbor. acut. i. 10. p. 92. ed. Boerhaave. Lugd. Bat. 1735. fol.

‡ Haller says, in Boerhaave's *Method. studii medici*, p. 717, that Albucasis employed *lapis infernalis*; but I suspect that he meant *sal causticum*. For the *lapis infernalis* is made with nitrous acid, which to that Arabian physician was certainly unknown.

§ Lib. iv. Simplic. facult. e. 4. et cap. 20.

|| Tetrab. immediately at the beginning, and lib. ii. 50.

lours which occur in the works of the ancients. Both certainly deserve to be more accurately examined, and to be defined by comparing the things to which these names are given.* Prosper Alpinus, however, is of opinion that what the ancients called *amarum*, is not inapplicable to the taste of *natrum*.

The ancients mention various springs and streams which contained what they called *nitrum*;† but nitrous water, according to the present acceptance of the word, that is, water which contains saltpetre, does not exist; and if credit is to be given to Marggräf and others, that they observed traces of saltpetre in some kinds of water, the instances must have been so rare that mention of them could not be expected among the ancients. Their nitrous water was undoubtedly alkaline, and this indeed is not scarce. Such water was recommended by the ancient physicians, both for bathing and drinking;‡ and Pliny says, it was sin-

* *Histor. nat. Egypti*, i. p. 141. Those who may be desirous of explaining the taste of *nitrum*, as described by the ancients, must not forget to examine the passage of Plato in the *Timæus*, p. 1070, according to the edition of Franckfort, 1602. fol.

† A catalogue of such waters may be found in *Baccii liber de thermis. Patavii* 1711. fol. v. 5, 6, 7. p. 160. The following work also, in particular, deserves to be consulted: *Zückert systematische Beschreibung der Gesundbrunnen und Bäder*. Berlin 1768. 4to. p. 33 and 131.

‡ Plin. xxxi. 6. § 32. p. 556: *Aqua nitrosa* - - - *bibendo atque purgationibus utilis*. *Nitru.* viii. 3. p. 158.

gular that the salt of such water would not shoot into crystals, like common salt, which is undoubtedly true.*

Alkaline water of this kind, such as that of Armenia, was used for washing, and also by fullers, † Mr. Wahl ‡ is of opinion, that this Armenian water, together with the alkali, must have contained rock oil, and on that account was saponaceous. But rock oil at any rate is unnecessary for this purpose, because the alkali forms soap with the greasy dirt of the cloth, as is the case in the urine bath of the woollen-scourers. In Egypt, at present, people wash in the same manner with *nitrum*. §

It appears to me that many kinds of water, which were only impure and not potable on account of their nauseous taste, were considered by the ancients as nitrous. This seems to be proved by the means which they propose for rendering nitrous water fit to be drunk; that is, by throwing into it clay, or some grains of barley. || In the like manner, I saw the brewers at Amsterdam improve their dirty water, in some degree, by putting into it kneaded clay, and allowing it to sink to the bottom.

* xxxi. 10: *Aquæ nitrosæ pluribus locis reperiuntur, sed sine viribus densandi.*

† The proofs have been already given in the article Soap.

‡ *Geschichte und Beschreibung von Persien*, i. p. 924.

§ *Hasselquists Reise*, p. 548.

|| *Plin.* xxiv. 1. xxxi. 3. § 22. *Geopon.* ii. 5. 14. p. 85.

One foundation more for my assertion may be found, I think, in the name *borax*. The ancient *nitrum* by the Arabians was called *Bauracon* or *Baurach*. When that salt, which at present is every where called borax, became known to the Arabians, it was at first generally considered^d as a kind of nitre, and on that account called *Baurach*, because in most of its properties it approached near to the *nitrum* of the ancients, that is, the *natronum* of the present day, as the alkaline part predominated over the other, called in modern times sedative salt. But afterwards, when the difference became known, our borax, at least in Europe, retained exclusively the general name of *Baurach*, from which at length was formed the present word *borax*. My conclusion therefore is, that the *nitrum* of the ancients must have been mineral alkali; otherwise it is impossible that our borax, which till modern times was reckoned to be mineral alkali, should have been considered as a *nitrum*.*

For many centuries past, the people in Africa and Asia, and also in Spain and Sicily, have cultivated some kinds of plants, which they dry and

* That *Baurach* signifies *nitrum*, and that the word *borax* was at length formed from it, might be proved by the testimony of various authors, of whom I shall mention only the following. *Scrapius de temperamentis simplicium*, cap. 401. p. m. 269. *Mesue de simplicibus*, cap. 17. p. m. 67. a. *Avicenna*, ii. 2. cap. 87. p. 280. a. *Salmasius de homon.* 121. p. 221.

then burn to ashes. By regulating the fire in a particular manner, they cause these ashes to assume a certain degree of concretion, or vitrification, by which means they are formed into solid cakes of a grey colour, interspersed with many white and black spots. This substance, which in consequence of the vitrification does not become moist in the air, is broken into fragments, and sent to every part of Europe under the name of *soda*, for the use of the glass-houses, soap-boilers, dyers, and for other purposes.

These plants were undoubtedly first cultivated and employed in Europe by the Arabians, who made known the use of them. Those first or chiefly employed were named by them *axnan*, *usnan*, *usnen*, or *uscnanon*; and also *Hasciscio alcali*, that is, *herba kali*, the plant or herb kali, because the name *kali*, or, with the article prefixed, *al kali*, was not given to the plant but to the half-vitrified ashes *kali*.* Hence the chemists call all salts obtained from the ashes of plants, alkaline salts. I do not know how old this appellation may be; but it is to be found in Vincent Bellovacensis and in

* Salmasius de homonymis cap. 120. p. 220. *Mercati metallothea Vaticana*, Romæ 1717. fol. p. 27 et 35. The plant *usnea* is by Avicenna, Serapio, Mesue, and others, reckoned among the medicinal plants, and is either a *salicornia* or *salsola*; but the same name was given also to a lichen called, at present, *Lichen plicatus*, *Usnea officinarum*. Dillenius has given this name to a species of lichens.

the interpolated writings of Geber and Avicenna, and particularly in a passage quoted by the former, from an old alchemist named Jahie, where it is called *sal alchali*.* All these salts formerly were considered as nitrous salts, or a kind of *nitrum*. It was indeed soon observed that soda and wood ashes, which from the earliest periods had been burnt in woody districts, and which are now called potash, were not all of the same nature; but when the difference between the mineral and vegetable alkalies began to be studied, it was then known that soda contains the former, that is, our *natrum*, and potash the latter, but both indeed often rendered impure by earthy and foreign saline particles; and that there are many plants from the ashes of which mineral and not vegetable alkali is obtained. A question now arises, How old in the Levant is the method of preparing this *natrum* from the ashes of plants?

Michaelis is of opinion† that it is mentioned in Malachi, chap. iii. ver. 2.; which passage I shall give according to Luther's translation: "Who shall stand when he appeareth? for he is like the fire of the goldsmith, and the soap of the scourer. He will sit and melt and purify the silver, and make pure like gold and silver." This learned man here

* *Speculum naturæ* vii. 87. p. 480.

† See *Michaelis commentationes in Societ. Scient. Gotting. prælectæ*, Bremæ 1774. 4to. p. 151: *de nitro Hebræorum*. His *Fragen an die Reisenden in Arabien*, Franckfort 1762. 8vo. p. 233. *Götting. gelehrte anzeigen* 1761. p. 329.

seems to think, that the sacred writer alludes to refining the noble metals, and that the word *borith* means soda, which indeed may serve as a flux in the purification of them. I at first considered this meaning as true; but, on closer examination, I am fully convinced that we have both erred; and I now wish that I had written with more care.*

Those who read without prejudice the above passage of Malachi, must remark, that a double comparison or double image is employed. The messenger there promised was to separate the good from the bad, the clean from the unclean. The first occupation is compared with the labour of the gold refiner; the other, with that of the scourer of clothes. The first image is afterwards heightened, because the poet, in all probability, was desirous of applying the separation of the ignoble parts, such as slag, by means of fire, as being the stronger image which denotes punishment, in a closer manner to the Levites and priests. At the time of the poet, before the invention of soap, people employed for washing either nitre or the saponaceous juice of certain plants, which I have already endeavoured to determine.† The *borith* of the washer there expressly named, was undoubtedly one of these soap plants, and not the half vitrified ashes either of soda or potash.

* See vol. iii. p. 233.

† See vol. iii. p. 236.

This passage of Malachi was so understood in the oldest times. Professor Tychsel, a true pupil and intimate friend of Michaelis, to whose opinion I subjected my doubts, assured me that Michaelis was never able to convince him of the justness of his exposition; especially as Jerome,* without the least hesitation, understood *borith* to be a plant growing in Palestine, and used there for washing; and as the Greek translators, who were much nearer to the period of the poet, and could not be unacquainted with a thing so much used, have translated *borith* by the word $\pi\omicron\alpha$, a plant.

In Jeremiah, chap. ii. ver. 22. † both the substances formerly used for washing, *nitrum* and the soap plant, are so clearly named, that Michaelis was obliged to admit that we cannot understand there soda or potash, but a ley or soap, the last of which however was not at that time known. But, to speak the truth, potash and soda would not be altogether unfit for washing; at any rate, not less fit than the *nether* or *nitrum* there named. What may serve, however, to refute entirely the opinion of Michaelis is, that no proof has yet been found that soda is of so great antiquity. For my part,

* Hieronym. ad Jerem. ii. 22: Herba fullonum, quæ in Palestinæ humectis nascitur, et ad lavandas sordes eandem vim habet quam et nitrum.

† For though thou wash thee with nitre, and take thee much soap, yet thine iniquity is marked before me, saith the Lord God.

I am acquainted with no older mention of it than that which occurs in the works of the more modern Arabian physicians, Avicenna, Serapio, and others.*

* In regard to the two plants *usnee*, *asne*, and *usnem*, *assuan*, see *Avicennæ canon. medic.* Venetiis 1608. fol. p. 338, 406, 407. *Serapio de temperam. simplic.* p. 164: Usnen est herba kali, est illud quod lavantur panni - - - et accipitur ex arbore channis, ex quo accipitur sal alkali. Concerning the moss *usnee*, see p. 81. The following obscure passage from the translation of Serapio, p. 269, seems to allude to soda. Where he gives an account of the different kinds of nitrum from a lost work of Isaac Eben Amram he says: Baurach artificiale nominatur nitrum, et est sal petrosus, et est incisivum, abstersivum, et generatur ex materia nitri, et humiditate plumbi, et kali, quando miscentur ad invicem et ponuntur in ignem. It appears to me, that the translator did not understand what the author had written in regard to the incineration of the kali plant. The interpolated work of Avicenna, before quoted, contains, p. 274, the oldest account perhaps of the preparation and purification of the so called soda salt. See also p. 380. It is to be regretted that we are unacquainted with the period of the author, who in consequence of his monkish Latin cannot be of great antiquity. As the book is scarce, I shall here give the passage. Dixit Abuali Abincine: in hoc capitulo tractabo de sale alcali. Alcali est herba quædam, a qua abstrahunt succum et faciunt inde sal; et dicitur rosa; et est viridis cum magno folio, in longitudine medii palmi, et spinosa multam. Faciunt foveam subtus terram, et extrahunt succum de ea et impleunt foveam de illo succo: et illa est sosa, et color ejus cinericius, levis; sed non multum perforata. Tingunt inde pannos et cum aqua ejus et cum aqua de gallis tingunt nigrum - - - miscetur soda ad solvenda corpora, cum aliis salibus, et per indurare per emollire - - - Si vis dealbare, fac in hunc modum, accipe de sosa librum unum, et pista et solve, et misce de aqua in duplum, et bulli cum aqua donec redigatur ad libram unam, et mitte de aqua, et fac ita septies usque quo alba sit sicut sal gemma, et mitte ad ignem donec sit sicca, et serva grana, quia granosa efficietur, et alio modo dealbant, sed ista est me-

All these grounds afford sufficient proof that the *nitrum* of the ancients was our *natrum*, and not our saltpetre. But still, in the account given by the ancients of that salt, there remain many things inexplicable. Thus, for example, no one can accurately define the epithets, *chalastricum*, *halmirhaga*, *agrium*, *spuma nitri*, *aphronitrum*, and others, because they do not indicate different kinds, as already said, but accidental properties of the same salt. Without enlarging further on this subject, I shall only remark that Pliny admits a natural and an artificial kind of *nitrum*, and this division is adopted by Serapio; but the latter term has not the meaning which we affix to it at present. The ancients were acquainted with no

lior. In the same collection is contained *Gebri liber de investigatione perfectionis*, where the following words occur, p. 479: Sal alcali fit ex soda dissoluta et per filtrum distillata, et cocta ad tertiam, et descendet sal in tempore ad fundum vasis in modum crystalli, et est præparatum. Similiter sal alcali apud aliquos sic præparatur. Accipiunt cineris clavellati pondera quinque vel duo, calcis vivæ pondus unum, et trahunt totum lixivium et distillant et congelant. Vel sicut sal commune primo teratur totum, solvatur in aqua communi calida, postea distilletur per filtrum, et congeletur, et calcinetur cum igne lento. In *Du Cange's Glossar Græcitat.* p. 12. *addend.* ἀλκαλη, and in *Glossar. Latin.* v. the word *alcali* is quoted only from modern writers. That *kali*, however, does not mean the plant but the concrete ashes, is proved by the following explanation in *Castelli's Lexicon*: *Al kali*, cineres qui ex salicornia similibusque combustis herbis conficiuntur. Professor Tychsen pointed out to me the passages in the original of Avicenna where the word occurs. They are as follows: i. 248. 1; 343. 26; 371. 48; 500. 52; ii. 96. 47, 146. 21; *Borac. Avic.* i. 144. 30: &c. The numbers denote the parts, pages, and lines.

other than native *nitrum*, which they called artificial only sometimes, when it required a little more trouble and art to obtain it.

Most of the physicians* recommend red *nitrum*, which is mentioned also by many of the modern travellers. When Prosper Alpinus was in Egypt the rose-red *nitrum* cost twice as much as the white.† The red colour, in all probability, arises from a metallic admixture; yet the red *nitrum* may be purer than the other, as red or violet rock-salt is often clearer and purer than that which is colourless.

One of the darkest parts in the history of *nitrum* is the following passage of Pliny: *Faciunt ex his vasa, nec non frequenter liquatum cum sulphure, coquentes in carbonibus.* The latter words he seems soon after to repeat: *Sal nitrum sulphuri concoctum in lapidem vertitur.* From these words J. Rhodius‡ concludes that *nitrum fixum* was at that time known, because he considered *nitrum* to be saltpetre; but in that case with the sulphur, Glaser's sal polychrest must properly have been produced. This, however, was not the case, because *nitrum* was fixed alkali. The ancients, therefore, when they placed it with sulphur in a

* For example, Hippocrates *de natura muliebri*, p. 382, ed. von der Linden. *De morbis mulier.* i. p. 512. Scribonius, 216. And in Ovid. *de medicam. facici* 85: *rubentis nitri spuma.*

† Hist. nat. i. p. 141.

‡ In the annotations to Scribonius Largus, p. 228.

crucible upon burning coals must have obtained liver of sulphur, which when it cools is hard, but soon becomes moist when exposed to the air. But I will not venture to determine whether any thing of this kind is to be supposed in Pliny, who did not himself fully understand the subject on which he touches.

The account of vessels made of *nitrum* is still more singular. Michaelis conjectured* that articles of various kinds were cut out of this substance, not for real use but merely for ornament, in the same manner as similar things are cut out of rock salt in Transylvania, many specimens of which I have in my collection.† But even if *nitrum* had been compact and strong enough for this purpose, there could not be the same inducement to employ it as rock salt, which, in consequence of its solidity, transparency, brightness, and smoothness, appears to be capable of furnishing vessels equal to those made of the most beautiful crystal. Dalechamp seems to explain the whole as applicable to glazing; but in this case *nitrum* could serve only as a flux.

Mercati remarks,‡ in regard to this passage of Pliny, that the best and oldest editions have not

* Commentationes, p. 145, and *Fragen an die Reisenden in Arabien*, p. 231.

† Such things were known to Aristotle. See *Mirabil. auscult.* cap. 146.

‡ *Metallotheca Vaticana*, p. 43.

the words *sal nitrum sulphuri concoctum*, but *sal et nitrum sulphuri concoctum*. This reading I find also in my scarce edition of 1507, which I have already mentioned, and this furnishes a newer proof that Hardouin did not make a complete collection of all the principal readings. But I can as little understand the exposition of Mercati* as the original words of Pliny.

Though it can be certainly proved that the *nitrum* of the ancients was alkaline salt, it is difficult to determine the time when our saltpetre was discovered or made known. As many have conjectured that it was a component part of the Greek fire, invented about the year 678, which, in all probability, gave rise to the invention of gunpowder, I examined the prescriptions for the preparation of it. The oldest, and perhaps the most certain, is that given by the princess Anna Comnena; † in which however I find only resin, sulphur, and oil, but not saltpetre. Klingenshierna, ‡ therefore, judged very properly, that all recipes in which saltpetre occurs are either forged or of modern invention. Of this kind are those

* Aetius, cap. 56. lib. ii. et cap. 66. lib. viii: Vult salis fossilis (quem gemmam appellari diximus) inopiam pari nitri pondere emendari; pari ergo ratione sal fossilis penuriam nitri supplere poterit. These are the words of Mercati. In consequence of the reading in Pliny *sal nitrum*, nitrum seems to have been named *sal nitrum* and *sal niter*.

† Hist. xxi. 8.

‡ Dissertat. de igne Græco. Upsaliæ 1752.

which Scaliger, at least according to his own account, found in Arabic works, and in which mention is made of *oleum de nitro* and *sal petræ*.* But it does not occur in that prescription given by Marcus Græcus, and copied by Albertus Magnus, who died in 1280.†

I must still believe that the first certain mention of saltpetre will be found in the oldest account of the preparation of gunpowder, which, in my opinion, became known in Europe in the thirteenth century, about the same time that the use of the Greek fire, of which there were many kinds, began to be lost. Among the oldest information on this subject is that found in the above quoted work of Albertus Magnus, and the writings of Roger Bacon, who died in 1278. It is doubted whether the first mentioned treatise belongs to Albertus; but it is certain that the author, whoever he may have been, and also Bacon, both derived their information from the same source.

When Mr. von Arretin lately announced that he was about to publish a manuscript preserved in the electoral library at Munich, which contained the true recipe for making the Greek fire and the oldest for gunpowder, the same writing, as appears, was printed from two manuscripts in the library at Paris. I have now before me a copy of

* De Subtilitate, xiii. 3. p. 71. ed. Francof. 1612. 8vo.

† De Mirabilibus mundi, p. 201; at the end of the book *de Secretis mulierum*. Amst. 1702, 12mo.

it, which was transmitted to the library of our university by M. Laporte Dutheil, *conservateur des manuscrits de la bibliotheque*.*

It contains many recipes, but only with a few variations, as in Albertus Magnus; and it may be evidently seen that Bacon employed this writing, which was mentioned by Jebb in the preface to his edition, from a copy preserved in the library of Dr. Mead.† Of this Marcus Græcus nothing at present is known.‡ According to some, he lived in the ninth century;§ but others, with more probability, place him in the thirteenth. Of his work, perhaps, we have only a translation; for, from the surname Græcus, there is reason to think that the original was written in the Greek language. I must, however, remark that Cardan|| where he gives directions for making a fire which

* *Liber ignium ad comburendos hostes, auctore Marco Græco; ou traité des feux propres à détruire les ennemis, composé par Marcus le Grec. Publié d'après deux manuscrits de la bibliotheque nationale. Paris 1804, three sheets in quarto.*

† *Rogeri Bacon opus majus edidit S. Jebb. Londini 1733. fol.*

‡ He is not mentioned either in *Gesneri Biblioth.* nor *Fabricius*. But in *Borellii bibliotheca chemica, Parisiis 1654, 12mo.* I find: *Mareox rex Arabs, ex Seniore, qui et Marchos dictus est, et Marco et Marcos.*

Marcus chimicus scriptor, idem forsan cum præcedenti p. 248: Marchos philosophus, de arte philosophica. Marei Romani tractatus chimicus.

§ *Fortis del nitro minerale, 1787, 8vo. p. 13.*

|| *De Subtilitate. Basilæ 1582, fol. lib. ii. p. 36.* Hoyer also in *Geschichte der Kriegs-kunst, i. p. 7, calls him Gracchus.*

can be kindled by water, names Marcus Gracchus, but not Græcus. Scaliger who, as is very probable, had this writing also, makes no mention of it or its author.

This Marcus speaks of saltpetre three times; first under the name of *sal petrosum*,* which occurs also in the same prescription in Albertus Magnus; but the addition, which Albertus does not repeat, is very remarkable.† In my opinion, *scrophulæ contra lapides* means the incrustation found on walls, which was represented as a kind of leprosy. The addition of ashes, or lixivious salts, the author either forgot or omitted, because perhaps he did not consider it as indispensably necessary. In another place‡ it is said, *Lapis qui dicitur petra solis*, or, as it is in other manuscripts, *salis*; but whether saltpetre is here understood I will not venture to determine. In a third passage§ we find the words *de sale petroso*, or *de salepetro*.

In the works of Bacon the term *sal petræ* occurs at least three times. || According to Casiri,

* Page 6.

† Nota, quod sal petrosum est minera terræ, et reperitur in scrophulis contra lapides. Hæc terra dissolvitur in aqua bulliente, postea depurata et distillata per filtrum, et permittatur per diem et noctem integram decoqui, et invenies in fundo laminas salis congelatas cristallinas.

‡ Page 11.

§ Page 13.

|| In *Opus majus*, ed. Jebb, p. 474. Also in *Epist. de secretis in Theatrum chemicum*, v. p. 951, and v. p. 962; or in *Mangeti Biblioth. chem.* i. p. 620, 624. These passages have been inserted in

the term *pulvis nitratus* is to be found in an Arabic manuscript, the author of which lived about the year 1249.* If the work of Geber, already quoted, † be genuine, and if this writer lived, as some think, in the eighth century, it would be the oldest where saltpetre is mentioned, in a prescription for an *aqua solutiva* or *dissolutiva*, ‡ which seems to be almost aqua-regia. I have not observed the name *sal petrae* in the works of Vincent Bellovacensis, who lived in the thirteenth century.

In a word, I am more than ever inclined to accede to the opinion of those who believe that gunpowder was invented in India, and brought by the Saracens from Africa to the Europeans; who however improved the preparation of it, and found out different ways of employing it in war, as well as small arms and cannon. § In no country

Gmelin's Geschichte der chemie, i. p. 96. I must, however, here remark that Bæon mentions sulphur and saltpetre, but alluded also to charcoal-powder by a transposition of the letters *luru mope can ubre*, instead of *carbonum pulvere*. Gmelin has the improper reading.

* Biblioth. Arab. Hisp. Eseurial, ii. in Hoyer, i. p. 36.

† De Investigatione perfectionis.

‡ Page 734.

§ See Forster's *Anmerkung zu Sakontala einem Indischen Schauspiel*. Mentz 1791, 8vo. p. 260. *Paw Recherches sur les Chinois*. Berlin 1773, 8vo. p. 366. The works, in particular, quoted in *Fabricii Bibliograph. antiquar.* p. 978, deserve to be consulted. The dissertation also of H. Hegewisch, on the early use of gunpowder among the Chinese, must contain valuable information on this subject; but I have not seen it. In the year 1798 M. Langles proved, in a paper read in the French National Institute, that the

could saltpetre, and the various uses of it, be easier discovered than in India, where the soil is so rich in nitrous particles that nothing is necessary but to lixivate it in order to obtain saltpetre; and where this substance is so abundant, that almost all the gunpowder used in the different wars with which the sovereigns of Europe have tormented mankind, was made from Indian saltpetre.* If it

Arabians obtained a knowledge of gun-powder from the Indians, who had been acquainted with it in the earliest periods. The use of it in war was forbidden in their sacred books, the *veidam* or *vede*. It was employed in 690 at the battle near Meeea.

* I never attempted to give a history of gun-powder enriched with new illustrations, but I have always made a point of writing down every passage on this subject which appeared to me worthy of notice. These I shall here quote for the benefit of those who may be desirous of enlarging farther on this history; but I will not assert that I have examined all these works, or that they contain new information never before used.

Archæologia, or miscellaneous tracts relating to antiquity, v. p. 148.

Kernhistorie der freien künste, p. 570.

Henry's Hist. of Great Britain, vol. iv.

Muratori Antiquitat. Italiæ medii ævi, ii. p. 514.

Lagerbrings Swea Rikes Historie, Part 4.

Documentirte geschichte von Breslau, ii. 2. p. 438.

Algemeine Welthistorie, vol. l. p. 65. A passage from *Kojalowiez* first remarked by *Schlözer*. See also p. 176.

Watson's Chemical essays, i. p. 284. 327.

Histoire de France par Velly, xvi. p. 330.

Von Crell chemische Annalen 1791—2. Wiegles Geschichte des Schiesspulvers. Dow's Hist. of Hindostan, vol. ii.

Brun's Erdbeschreibung der entferntesten Welttheile, ii. p. 159.

It is here said that it was known in Habesch or Abyssinia.

Thomasi observationes selectæ, ix. p. 305.

Stettler Schweitzer Chronik, p. 109. The inhabitants of Berne

be true, that saltpetre was not known in Europe till the thirteenth century, neither gun-powder nor aquafortis could have been made before that time; for the former cannot be prepared without saltpetre, and the latter without nitre. But if it be true, that this neutral salt was known at a much earlier period in India, it is not improbable that both gun-powder and aquafortis were used by the Indians and the Arabians before they were employed by the Europeans, especially as the former were the first teachers of chemistry to the latter. In my opinion, what I have already related proves this in regard to gun-powder; and what I shall here add will afford an equal proof in regard to aquafortis.

It is difficult to discover the first mention of mineral acids in the writings of the ancient chemists. In the course of their numerous experi-

purchased the first gun-powder from the people of Nuremberg in 1413.

Petrus Martyr de rebus oceanicis, ed. Colon. 1574, 8. p. 373. In 1501 he saw at Venice *molæ versatiles, quibus tormentarius conficitur ac teritur pulvis.*

Geschichte der Mauritanischen Könige, übersetzt von F. von Dombay, ii. p. 143.

Magazin Encyclopedique, par Millin, xix. p. 333.

Jagemann's Geschichte der Künste und Wissench. in Italien, iii. 3. p. 320.

Beschryving der Stadt Delft, 1729, fol. p. 564.

Vitterhets historie och antiquitets academ. handlingar, iv. p. 316. History of gun-powder in Sweden. An extract may be found in *Hannöver. Magazin*, 1798, p. 345.

ments they obtained indeed, at an early period, acids, the utility of which they extol; but each concealed the process by which they were made; and as they had no method of obtaining them pure, they were for a long time unacquainted with the difference between the kinds. Their prescriptions, when they are found, are so contradictory and so carelessly written, that it is almost impossible to conjecture which of the known acids forms the principal component parts in their recipes or mixtures.

It appears to me, that the first intelligible account of aquafortis occurs in the writings of the Arabians, or of the pupils of Arabian chemists. At present, I am acquainted with none older than that to be found in the works of Geber.* For though I do not believe that those of which we have Latin translations belong to a Geber of the eighth or ninth century, I am ready to admit that they may be, at any rate, of the twelfth. This appears probable, because, about that period, aquafortis and various arts are oftener mentioned, and in a much clearer manner, in these writings.

* I allude to the end of the work above quoted, *De inventione veritatis*. De aquis solutivis. Sume libram j. de vitriolo de Cypro, et libram semis salis petræ, et unam quartam aluminis jameni, extrahe aquam cum rubedine alembici: nam dissolutiva est multum, et utere ea in capitulis prælibatis. Fit autem multo acutior, si cum ea dissolveris quartum salis ammoniaci, quia solvit solem, sulphur et argentum. Aqua alia philosophica nostra incrativa. Sume oleum distillatum ab ovorum albuminibus, tere cum medietate ipsius salis petræ, et iterum distilla vel salis petræ et ammoniaci, ana - - -

It is to be regretted, in the history of chemistry, that it is impossible to determine the period of the Greek chemist or alchemist known under the name of Synesius; but it cannot be doubted that he borrowed a great deal from the works of the Arabians. This Synesius, among the chemical solvents, mentions water of saltpetre, which might be considered as aquafortis.* But, as he mentions at the same time *aqua facis*, he appears to me to allude to the *nitrum* of the ancients, not to our saltpetre, and in general to strong alkaline leys, which indeed are capable of dissolving many bodies.

The monk Theophilus, of whom I have already spoken,† and who, in all probability, lived in the twelfth century, appears also to have been acquainted with aquafortis. For in some of the passages quoted from his works by Raspe,‡ he speaks of an acid which dissolved all metals. In the writings of Vincent Bellovacensis, in the thir-

* A fragment from the writings of Synesius was printed, for the first time, in *Fabricii Bibliotheca Græca*, viii. p. 236, where the following words occur: Τα γὰρ λυτικά των σωμάτων προεισηνεγκεν υδωρ νιτρου και υδωρ φακλης: Quæ corpora solvunt, attulit Democritus aquam nitri et aquam facis. Of the author some account may be found, vol. xii. p. 752, 757, 756, 769. A manuscript of this work is preserved in the library at Venice, unless carried away by the French. See *Theopoli Græca Bibliotheca Marci*, p. 140.

† See a note in the article on gilding.

‡ Omnia metallorum genera ad acridinem alicujus amari et acetosi liquoris penitus resolvuntur et in mollitiem convertuntur. *Raspe on oil-painting*. London 1781, 4to. p. 145.

teenth century, some traces, but very doubtful, are found of aquafortis. Where he mentions the different sorts of gold he speaks of dissolving it, but by this expression he does not allude to its treatment with fire, which he speaks of separately.* In another place, he mentions the different solvents, and among these names vegetable acids, a water of sal ammoniac, and a water obtained from alum by distillation. He here means undoubtedly a mineral acid. † Michael Meier, the most learned chemist of the seventeenth century, says, that Vincentius speaks of aquafortis as of a secret; but the passage I have not yet been able to find. ‡

¶ Spielman states that Lullius, who died in 1315, in the eightieth year of his age, gave an account of his obtaining aquafortis from saltpetre by the

* Aurum septem modis per magisterium tentatur atque cognoscitur, scilicet in solutione, in lapide (*on the touchstone*) in pondere, in gustu, in igne, in sublimatione, in fusione. *Speculum naturale*, vii. cap. 13. p. 432.

† Lib. vii. cap. 88. p. 480: Solutiva corporum multa sunt, ut aqua limonum, vel pomorum citrinorum, quæ dicuntur melangoli, vel arangii, distillata per filtrum - - - vena etiam vaccæ distillata per alembicum simile, aqua quoque hammoniæ, sed et alumen sparsum in aqua per bullitionem dissolutum, et per alembicum distillatum solvit.

‡ Vincentius adfirmat, se segregandi aurum ab aliis metallis artem tenere - - - hinc apparet, quod segregatio auri ab argento per aquam fortem ejus tempore fuerit adhuc arcanissima, necdum, ut nunc, divulgata. *Symbola aureæ mensæ*. Francof. 1617, 4to. lib. vii. p. 335.

addition of vitriol,* and that Basilius Valentin was acquainted with the use of clay for the same purpose.† Picus Mirandula,‡ however, declares it to be uncertain whether Arnoldus de Villa Nova was acquainted with the acid of saltpetre in the fourteenth century.

It appears to be an old tradition that this acid was first employed at Venice, by some Germans, for separating the noble metals, and conveyed thence as an article of merchandise to every part of Europe. The persons who prepared it were there narrowly watched, in order that the process might not become known. They were employed chiefly for separating the gold from the Spanish silver, and by these means acquired great riches.§ Hence arose the report that the people of Venice understood the art of making gold; and it is certain that in many countries the gold refiners were for a long time considered as gold makers; but in no period were there more gold makers than in that when separation in the wet way became known. I can, however, give less account of this art of the Venetians than of the introduction of it

* Spielman Institut. chem. p. 165, refers to *Lullii Codicillus*, cap. 14. and *Practic.* cap. 9.

† Handgriffe, p. 1076.

‡ I. Franc. Pici Mirandulæ domini lib. de auro. Venetiis 1586, 4to. iii. 1. p. 99.

§ Becher's Nörrische Weissheit. Francfort 1683, 12mo. p. 73.

into France in the fifteenth or the beginning of the sixteenth century.

William Budé, who was born in 1467, and died in 1540,* speaks of it in his book, printed for the first time in 1516, as a thing entirely new at that period.† A man of low extraction, named Le

* Not 1573, as some assert. See Nicéron, viii. p. 420.

† De asse Basiliæ, 1556, fol. lib. iii. p. 101. Apud nos non pridem vir quidam obscuræ sortis chrysoplysium instituit, id est, lavandi auri officinam, rem omnino quæstuosam, sed paucissimis hominibus eognitam. Hujus est id artificium, ut vi aquæ medicatæ, quam chrysuleam appellant, quantulameunque auri partem argento aut cuius metallo illitam aut confusam, nullo propemodum dispendio adimat, ita ut in auraturis nihil jam ferme depereat mundo, nisi quod usu interteritur. Res omnino stupenda, auri argentique quotameunque portionem ex ære eximere, etiam (quod magis mireris) manente vaseuli forma quassa interdum, et inani, veluti quadam idea a materia abstracta. Is moriens filio artem eum patrimonio non medioeri reliquit, qui nunc unus chrysoplytæ appellatione dignus esse existimatur. Usque adeo ea in arte præstat, alioquin a paucis tentata, ceterum valetudini noxia. Fumus enim bullientis ejus aquæ haustus vitalia tabescere dicitatur; et eum artificem magna vigilantia satagere circa aquam neesse est, occasionesque horarum identidem observare et temperaturæ modum nosse. Qua propter in ea functione alieno sæpe ministerio utitur, eminus ipse respectans, in primis jam locuples eo artificio factus ac secunda etiam fama celebrer. Cointius appellatur. Quæ autem aqua vim habet chrysuleam (id est auri ab argento abstrahendi) in ea aurum sidit eum aqua deferbit, argentum autem aquæ confusum visitur, et demum auro exempto, alio artificio ab aqua elicitur et eluitur. The comparison of an idea abstracted from matter will appear the more ingenious, when it is known that the finest gilt silver wire, when put into pure aquafortis, loses the silver in the inside, so that nothing remains but a small and exceedingly thin tube of gold. I have frequently made this experiment, but it succeeded only sometimes; and is one proof of the almost infinite divisibility of gold, as has been already remarked by Keyssler in his *Reisen*, ii. p. 1225.

Cointe, first undertook to separate gold from silver at Paris, by means of a water which Budé calls *aqua chrysulca*. It is very remarkable, that by means of this water he could separate the smallest particle of gold from silver, and from every other metal; nay, he could even take from vessels their gilding without altering their form. By this art he acquired great wealth; and Budé says that both were inherited by his son, who, at the time he wrote, was the only gold refiner at Paris.

He adds, that the art was exceedingly dangerous as well as unhealthy, and required great precaution. The possessor of it, when he became rich, left the execution of the work to a servant, whom he directed at a distance, that he might not expose himself to the pernicious fumes of the effervescing liquor. The fumes of saltpetre are indeed prejudicial to the health; but the danger has been much exaggerated, and, no doubt, with a view to deter people from attempting to discover the art, and to furnish a pretence for raising the price of the production.*

Budé relates also, that the gold was left behind undissolved. The silver only was dissolved, and,

* Les anciens mineralogistes de France, par Gobet. Paris 1779, 2 vol. 8vo. i. p. xxxiv. i. p. 51. 284. and ii. p. 847. Nicol. Gobet, the author of this work of so much importance in the history of chemistry, was *secrétaire du conseil de M. le comte d'Artois*. He was no friend of Buffon, and had the misfortune to lose his senses, in which state he died in confinement at Charrenton. See *Physikal Oekon. Biblioth.* xxi. p. 295.

by another art, was separated from the water and washed. It may here be easily perceived that Le Cointe employed aquafortis; but if he was able to loosen the gold from gilt vessels without destroying them, he must have used aquaregia, which consequently was not then unknown.

From other information it appears, that the mint at Paris purchased the art from Le Cointe's son, but still kept it a secret. On this account Francis I, by a decree issued at Blois on the 19th of March 1540, authorised the raising the value of coin, in order to defray the expense of fuel and assaying-water. In the middle of the seventeenth century, the preparation of aquafortis and the process of assaying in the wet way were fully known in France. At any rate, in the month of January 1637, the distillers obtained a guild letter, in which aquafortis is mentioned among the articles sold by them. Those who may hereafter be desirous of turning their attention to the history of the art of separating the noble metals, may improve and correct what I have here said in regard to the history of aquafortis.* I shall leave them also to determine how we are to under-

* In the *Algem. Welthistorie*, xxviii. p. 396, it is said the wonder-worker Mohdi jumped into a vessel of aquafortis, which destroyed every part of him but his hair. What kind of aquafortis must this have been? In all probability a fault has been committed here by the modern historian or his translator.

stand the relation, that on the 18th of September 1403, a Genoese, named Dominic Honeste, obtained permission to maintain an establishment at Paris for the separation of gold. In my opinion, separation in the wet way is not here meant, though the author from whom I derived this information maintains the contrary.* To determine this point with certainty, the patent ought to be examined.

When saltpetre became necessary to governments for the manufacture of gun-powder, they endeavoured to obtain it at as cheap a rate as possible. No one before suspected that rulers would be justified in exclusively carrying away the incrustation of walls from private houses, which, when it could be used, became *accessorium fundi*. But the idea of regalia, so often abused, was extended so wide under various pretences, that the saltpetre regale and the letting of it was one of the severest oppressions to which the people were exposed by their rulers, and which occasioned almost as bitter complaints as the hunting regale, founded on no better grounds. I shall not here

* Almanach des monnoies, Année 1786, 12mo. p. 180. Domin. Honeste, Genoïis, obtint le 18. Sept. 1403 des lettres, portant permission de former un etablissement à Paris, pour départir les matières d'or et d'argent, ce qui induiroit à croire que la découverte de ce procédé remonte au-delà du quinzième siècle, époque à laquelle les auteurs de l'Encyclopédie l'ont fixée, ainsi que celle des acides minéraux, qu'ils attribuent aux Vénitiens.

attempt to delineate the sufferings which were thus occasioned in many countries ; they are still fresh in remembrance. I should, however, mention the names of those sovereigns who first ventured to torment their subjects with this regale ; but, I have in vain sought for them in the writings of the old jurists and cameralists,* who, as is well known, were inclined, for the most part, to subject the people to slavery, and to contribute to enrich their rulers.

The oldest mention of this hated regale which I myself have found is of the year 1419.† At that time Gunther, archbishop of Magdeburg, granted to some person the right of searching out saltpetre and boiling it, during a year, in the district of Gibichenstein, for which he was to pay a barrel of saltpetre, and deliver to the archbishop the remainder at the rate of five cross-groschens per pound. The succeeding archbishop, Frederick, let, in the year 1460, to a burgher of Halle, all the earth and the saltpetre that could be collected from it in the bailiwick of Gibichenstein, for four years, at the annual rent of a barrel of good refined saltpetre. On the same conditions bishop Ernest, in 1477, let to some one for his

* For example *H. L. Gockel diss. de regali fodiendi nitrum.* Altorfii 1740. *F. W. Streng consultationes et informationes.* Nürnberg 1703. 4to. p. 370.

† *Von Dreyhaupt Beschreibung des Saalkreyses,* Halle 1749, fol. i. p. 653 ; and in the extract, Halle 1772, 8vo. i. p. 750.

lifetime the collection of the saltpetre. In 1544, a certain person obtained the collection of saltpetre from two heaps of rubbish before the gates at Halle. The magistrates of Halle also in 1545 had a saltpetre work and a powder-mill. In the year 1560, John VI, archbishop of Triers, gave to some one permission to search for and dig up saltpetre.* In 1583, the saltpetre regale was confirmed by a Brandenburg decree as a thing long known,† and the case was the same with a Hessian of the year 1589. ‡

It is very probable that this example was soon followed by most sovereigns; but even if they had collected and scraped together the nitrous incrustation of all the walls in Europe, they certainly would not have found a quantity of saltpetre sufficient for the gun-powder used in the numerous wars which took place, had not a much greater supply been obtained from India, and particularly from Patna. I do not know whether the Portuguese brought this article to Europe; but that it was imported at a very early period by the Dutch is proved by the oldest loadings of their return ships; and they at length found means to appropriate this branch of trade so entirely to themselves that the other Europeans, for a long time, could not obtain any saltpetre in India.

* Hontheim Hist. diplom. Trevir. ii. p. 862.

† Beckmann's Beschreibung der Mark. i. p. 903.

‡ Sammlung Hessischer Landesordn. i. p. 460.

In the seventeenth century, when chemistry began to be studied with more care and attention in Europe, and particularly in Germany, and the component parts and production of saltpetre became better known,* many conceived the idea of improving the methods of obtaining it in Europe so much, that it might be possible to dispense with the Indian saltpetre, and flattered themselves with the hopes of thence deriving great advantages. Some proposed to fill tubes with putrifiable substances and earth susceptible of the nitrous acid; others preferred building vaults of these substances, and Glauber recommended the filling of pits with them. The proposal, however, which met with the greatest approbation was that of building walls of them. Through a confidence in this idea, towns and villages were compelled to erect and maintain a certain number of saltpetre walls, under the most gracious promise that the collectors of saltpetre should no longer be allowed to spoil private dwellings, or render them unhealthful.

But experience has shown that all the means and coercive measures hitherto employed have rendered the European saltpetre much dearer than

* The oldest method of boiling saltpetre is described in the work of Blasius Villafranea, page 8, already quoted, vol. iii. p. 340. That saltpetre manufactories were very numerous in the sixteenth century may be seen in Agricola and Conrad Gesner, where J. Kentman, in *Lib. de omni rerum fossilium genere*, p. 3, mentions nine in Thuringia alone.

that obtained by commerce from Bengal. This will be readily comprehended, when it is known that earth richly impregnated with saltpetre abounds in India, and that it may be extracted by lixiviation without any addition, and brought to crystallise in that warm climate without the aid of fire; that the price of labour there is exceedingly low; that this salt is brought from India instead of ballast by all the commercial nations of Europe, where the competition of the sellers prevents the price from ever being extravagantly high, while the preparation of it in Europe, in consequence of the still increasing price of labour, fuel, and ashes, is always becoming dearer. This regale will, at length, be every where scouted. In the duchy of Wurtemberg and the Prussian states, where it was most rigidly enforced, in consequence of an urgent representation from the states it was abolished in 1798; but in both countries an indemnification was given to government for the loss. The case also has been the same in Sweden. In the duchy of Brunswick it was soon suffered to drop; but in the electoral dominions it never was introduced.

PAPERS FOR CONVEYING INTELLIGENCE. REGISTER OFFICES.

THERE are many articles of information, the speedy and general publication of which is of importance not only to one individual, but very often to the inhabitants of a town, and even of a whole country. The oldest method employed for this purpose was that of causing the information to be announced by a public cryer. Thus Moses caused to be proclaimed by a cryer whatever he wished to make known to the whole body of the people.* Among the Greeks and the Romans these cryers were under the inspection of the police; and those, for example, who had lost any thing, and wished to advertise it in that manner, were obliged to seek for permission. Among the Greeks these cryers were called *κηρυκες*, and among the Romans *præcones*. One of them introduced in Petronius, accompanied by a police officer, is made to proclaim that a youth with curled hair, named Gito, about sixteen years of age, of a fair complexion and handsome countenance, had been lost from a bath, and that any one who should bring him back, or give information where he might be found, would receive a reward of a thou-

* Genesis, chap. xli. ver. 43. I Kings, chap. xxii. ver. 36. II Chronicles, chap. xxiv. ver. 9.

sand sesterces.* In Plautus† also we read of enquiry being made after a young woman by the cryer; and, according to Apuleius, Psyche was proclaimed in the like manner. ‡

Another method of making any circumstance generally known, was to write it down and expose it in some public place. An instance of this is given by Propertius :

I, puer, et citus hæc aliqua propone columna,
Et dominum Esquiliis scribe habitare tuum. §

A proof that things found at Athens, and in all

* Puer in balneo paullo ante aberravit, annorum circa xvi, crispus, mollis, formosus, nomine Giton; si quis eum reddere, aut monstrare voluerit, accipiet nummos mille. *Petron. Satyr. cap. 97.* A very full illustration of this passage may be found in *Maternus von Cilano Abhandlung der Römischen Altcrthümer.* Altona 1775, 8vo. i. p. 476.

† Certum est præconum jubere jam quantum est conducier,
Qui illam investigent, qui inveniant. Post ad prætorem ilico
Ibo, orabo ut conquisitores det mihi in vicis omnibus.

Plautus, Mercat. iv. 1. 78.

‡ Nil superest, quam tuo præconio præmium investigationis publicitus edicere. Fac ergo inandatum matures memm, et indicia quibus possit cognosci, manifeste designes; ne si quis occultationis illicitæ crimen suberit, ignorantia se possit excusatione defendere. Et simul dicens, libellum ei porrigit, ubi Psyches nomen continebatur et cætera. Quo facto protinus domum secessit. Nec Mercurius omisit obsequium; nam per omnium ora populorum passim discurrens, sic mandatæ prædicationis munus exquebatur. Si quis a fuga retrahere, vel occultam demonstrare poterit fugitivam regis filiam, Veneris ancillam, nomine Psychem, conveniat retro metas Martias Mercurium prædicatorem, aaccepturus indicinæ nomine ab ipsa Venere septem snavia, et unum blandientis adpulsu linguæ longe mellitum. *Apuleius Metamorph. lib. vi. p. 176.*

§ Eleg. iii. 22, 23.

probability information of every kind, were announced by bills posted up, may be found in the account given by Lucian of the philosopher Demonax.* Were the addition to Petronius, which Francis Nodot caused to be printed in 1693, genuine, one might conclude from it that, in the time of that Roman writer, all strangers who arrived in town were visited by servants of the police, and that their names were announced in a kind of gazettes.† But this relation seems to prove that the pretended fragment is a forgery.

Ulpian says, that he who finds any thing is accustomed to make it publicly known by a bill posted up.‡ In later times, when divine worship

* *Invenerat aureum anulum ineedens per viam, tabellaque in foro proposita postulabat, ut qui perdidisset, dominus anuli, veniret, dietoque pondere illius et gemma et imagine, eum reciperet. Venit adoleseentulus formosus se perdidisse dicens. Cum vero sani nihil diceret, abi, puer, inquit Demonax, et tuum ipsius anulum serva; hunc quidem non perdidisti. Edit. Bipont. v. p. 241.*

† *Ad sciendum quid esset, deseendi, aeeepique prætoris lietorem, qui pro officio eurabat exterorum nomina inseribi in publicis eodieibus, duos vidisse advenas domum ingredi, quorum nomina nondum in aeta retulerat, et ideireo de illorum patria et occupatione inquire. cap. 15. p. 42.*

‡ *Ulpian in L. Falsus ereditor § Solent π de furtis, tit. 2. l. 47. or Digestor. lib. 47. tit. 2, 43, 8: Solent plerique etiam hoc facere, ut libellum proponant continentem invenisse et redditurum ei, qui consideraverit, hi vero ostendunt non furandi animo se fecisse. The ancient orator Chirus Fortunatianus says: Cujus servus fugerat, libello proposito, vel per præconem nuntians, dixit: daturum se denarios mille ei qui ad se servum perduxisset. See the notes to Propertius in the elegant edition printed at Padua in two quarto volumes, ii. p. 865.*

according to the Christian form was established, another method was devised ; that is, to cause the information to be announced by the preacher to the congregation. All these methods of advertising are still employed ; but they are all subject to inconvenience and limitation. It is indecent to disturb, during divine service, the devotion of the hearers by intelligence which in many cases is not calculated to excite the most edifying thoughts. The announcing by a public cryer must not be too often repeated, else at length no one will attend to it ; and when the information is long, it becomes obscure and unintelligible. The posting up of bills in public places is only of partial utility ; many persons never frequent these places ; some cannot read, and others are unwilling to stand reading in the streets. It seems almost to be a mark of greatness not to read that which is presented to every one to read without expense.

In the sixteenth century a much better method of spreading intelligence was invented. At first, offices only were opened where information of every kind was entered in a book or register, so that people could obtain answers there in regard to different things after which they enquired. Thus, for example, if any one wanted a clerk, he made known his wish at the office, and if a person had entered his name in that quality, the enquirer was informed where he could be met with. Had no one, however, presented himself in that ca-

capacity, the enquirer waited till one applied for such a situation. But people must soon have fallen upon the method of printing all these articles; and hence arose those periodical papers called in Germany *Intelligenz-Blätter*, in which, besides advertisements, useful information of every other kind was announced. These papers in France were named *Affiches*, because they contained those things which before had been publicly posted up in bills.

The oldest proposal for an office, such as that above mentioned, was made in the middle of the sixteenth century by the father of the well-known Montaigne. He died in 1569, in the seventy-fourth year of his age; and, as the son, whose death took place in 1592, extols this proposal as new,* no attempt of the same kind must have been made in his life-time in France, or in any of the neighbouring countries. Some are of opinion that such establishments were first formed in Italy, and

* Essais de Michel seigneur de Montaigne, liv. i. chap. 34, according to the edition of Pierre Cosse, printed at London 1739, six vol. 12mo. i. p. 470: Feu mon pere, homme pour n'estre aydé que de l'experience et du naturel, d'un jugement bien net m'a dict autre fois qu'il avoit désiré mettre en train, qu'il y eust és villes certain lieu designé, auquel ceux qui auroient besoin de quelque chose, se peussent rendre et faire enregistrer leur affaire à un officier estably pour cet effect - - - Et semble que ce moyen de nous entr' advertir, apporterait non legere commodité au commerce publique. Car à tous coups, il y a des conditions, qui s'entrecherchent, et pour ne s'entr'entendre, laissent les hommes en extreme necessité.

deduce the word *Intelligence* from the Italian and Latin. But of this there is no proof, and the word in that signification is not to be found in the Italian dictionaries. In my opinion, the first intelligence-office is that which was established at London by John Innys, in 1637, and which was confirmed by Charles I for forty years. In the patent it was called *the office of intelligence*.*

The first person who proposed a similar establishment in Germany, as far as I know, was William Baron von Schröder, who presented a plan for that purpose to the emperor Leopold, in which he referred to the chamber of intelligence established a few years before at the royal exchange London; but, at the same time, recommended that a paper of intelligence of the like form as the news-papers should be printed every week, or fourteen days. I have not been able to find when this proposal was made; but the author was murdered in 1663; and I doubt whether a chamber of intelligence was established in the seventeenth century at Vienna; for many of Schröder's plans were not carried into execution long after his death.†

* An. 1637, the king, the 20th day of December, granteth to John Innys, the office of intelligence, and of entering the names of all masters, mistresses, and servants, and of all goods lost and found, &c. within the cities of London and Westminster, and three miles distant, for forty-one years. *Foedera accurante Rob. Sanderson*, Lond. 1735. vol. xx. p. 201.

† The proposal may be found in *von Schröders fürstlicher Schatz- und Rent-kammer*. Leipsic and Königsberg 1737, 8vo. p. 335.

The same proposal was afterwards made by Boden.* An *Intelligenz-blatt* was published at Hamburgh in 1724, † and the first appeared at Berlin on the 3d of February 1727. One was begun at Halle on the 1st of August 1729; and soon after, similar ones were printed and distributed in all the provinces. ‡ The *Wochen-nachricht*, which was published in a quarto half-sheet weekly, appeared at Hanau on the 27th of September 1725. §

An *Intelligenz-blatt*, in which all the news of the city and surrounding district were announced, began to be published at Hanover in the month of January 1732. This, at least, is said in the *Hamburgh Berichten von gelehrten Sachen* for the month of April the same year. How long this journal was continued I do not know, and I have never seen any remains of it. We are told in the same work, that a weekly paper of intelligence was begun at Dresden about the same period, that is, in 1732. In Vienna, a general register-

* Fürstliche Machtkunst oder Abhandlung von Manufakturen und dem Commercio. Franckfort and Leipsic 1765, 8vo.

† It was entitled *Wöchentliche Hamburger Frag-und Anzeigungs-Nachrichten*. See Mr. Günther's account in the *Reichs-anzeiger*, 1794, N° 77. p. 723.

‡ Von Dreyhaupt Beschreibung des Saal-Kreises in einem Auszug gebracht von Stiebritz. Halle 1773, 2 Theile, 8vo. ii. p. 598. See also *Anmerkung über den Nutzen und Gebrauch des so genannten Intelligenz-werkes* 1728, 4to. *Umständlicher Bericht von dem Nutzen der v. 3. Feb. 1727. ausgerichteten Frag-u. anzeigungs-Nachrichten*. Berlin 1728, 4to.

§ Journal von und für Teutschland Jahrg. 4. St. 9. p. 269.

office was established under Charles VI. A similar office was established at Hanover by the syndic von Wüllen in 1750, and an intelligence paper was begun at Leipsic in 1763.

However modern these intelligence papers may be, it can be asserted, on good grounds, that the Romans, and in all probability the Greeks, had real news-papers. I here allude to the *Acta populi Romani*, or *Acta diurna*, or *urbana*, which were different from the *Acta senatus*. The latter were the journals of the senate; and, in general, were not made public. The former, however, could be read by every person, and contained a list of births and deaths, marriages and divorces; also the names of those persons, as far as known, who were punished with death, adopted, or manumitted; also the arrival of distinguished personages, so that they formed a kind of fashionable gazettes. Some assert that the prices of corn, meat, and other things, were announced in them. In what manner these *acta* were published or made known, I have not been able to learn. In all probability they were only hung up in some public place, where every one could read them; and perhaps some caused them to be transcribed. This much is certain, that they were written by the *scribæ tabellariæ* or *actuariæ* (*qui ab actis erant*), and hung up in the *Atrium Libertatis*, or in the *Ædes Nympharum*, where they were sometimes consulted. It is well known also that the best historians

often refer to these *acta*, as the most authentic sources.*

EAU DE LUCE.

THE article sold under this name by perfumers, when properly and well made, is a fluid volatile soap, of a pale white or milky colour, with an exceedingly strong and pleasant smell, which, instead of fixed alkali and tallow or fat oil, the component parts of common soap, consists of caustic volatile alkali and highly purified oil of amber. When of the best quality, it always retains its milky colour; but this is not the case when spirit of sal ammoniac and oil of amber are mixed together. The making of this article requires operations which were long an object of research to chemists, who have given different recipes for preparing it, each said to be superior to the other. Some assert that this liquid can be made per-

* The best account of these *acta publica*, together with the necessary proofs, may be found in *Lipsii excursus A ad lib. v. Annal. Taciti*, in *Taciti Opera, edit. Lipsii*. Antverpiæ 1627, fol. p. 5265; or in *Taciti Opera, edit. Burmanni*. Trajecti 1721, 2 vol. 4to. i. p. 743. Also in *Maternus de Cilano Römischen Alterthümern*, i. p. 401. The latter remarks, that Lipsius has admitted, without any proof, that these *acta* were ordered to be published even by Servius Tullius, king of Rome. He thinks he found some articles from these Roman news-papers in *Th. Reinesii Syntagma Inscriptionum*, p. 140, which he has inserted.

fectly pure and bright without any prejudice to its quality.

As a soap, it is employed to remove from cloth many spots which cannot be removed by common soap; and it is the fitter for this purpose as it very speedily evaporates. Mixed with water it is administered also for various diseases and accidents; such, for example, as the bite of some snakes; and in consequence of its strong smell, it acts, when held to the nostrils, as a powerful stimulant in cases of fainting. But it is requisite that those who use it for the latter purpose should know, that a small drop of it, if it came in contact with the eye, would occasion blindness.* This caution ought to be affixed to each bottle in which it is sold.

That this *Eau de Luce*, was first made known towards the middle of the last century, appears to be certain. In the writings of Neumann, Hoffmann, Boerhaave,† and other cotemporary writers,

* Some melancholy instances of this are given in the *Gazette salutaire*; but in that work, which has no index, I have not been able to find them.

† See Boerhaave *elementa chemiæ*, Lugd. Bat. 1732. 4to. ii. p. 370. and *Fr. Hoffmanni observat. physico-chymic.* lib. ii. obs. 11, which in Gesner's edition of his works stand in vol. iv. p. 492. Where he speaks of the spirit of sal ammoniac prepared with lime, he says: *Externe in affectibus soporosis, apoplexia, ad excitandum non sine insigni commodo naribus applicari potest, et quia cum spiritu vini rectificatissimo amice jungitur, quod non fit cum spiritu salis ammoniaci, ex cineribus clavellatis vel sale alcali et sale ammo-*

I do not find any mention of it, though they treat of similar mixtures, *alkali volatile oleosum*, and the so called *off'a Helmontii*.* In the year 1741, when Geoffroy's *Materia medica* was printed, it must not have been very common; for the author, where he speaks of all the preparations of amber, takes no notice of it; and yet it is known, that this chemist afterwards gave himself a great deal of trouble to discover the method of preparing it. In the continuation of that work, which was not written by Geoffroy, it is mentioned.† Dumachy said, in 1756, that *Eau de Luce* had been known at most half a century.‡ The Chevalier de la Chapelle, which however is a fictitious name, says that he had a bottle of this water made in 1742; and this is the earliest mention of it with which I am acquainted.§

The name of the inventor also I cannot state with certainty. It seems to be denoted by the appellation *de Luce*; but this is explained so many ways, that nothing can at last be deduced from it.

niaco parato, maxime inservit ad extemporaneam salis volatilii oleosi, secundum Sylvii methodum, præparationem.

* It is generally believed that this soap was first made known by von Helmont, in his book *de lithias*, c. 7. § 5. under the barbarous name of *Duelech*; but it was before described by Raymond Lullius, Exper. 7 and 8.

† According to the German translation, i. p. 248. and vii. p. 52.

‡ Recueil periodique d'observations de médecine par Vandermonde, tom. iv. an. 1756. p. 460.

§ Ibid. tom. 7. an. 1756. p. 224.

Some translate it *Aqua Luccana*,* others *Aqua St. Lucie*;† some *Aqua Lucii*,‡ and some also write it *Eau de Lusse*. Many, however, are of opinion that an apothecary at Lisle in Flanders, or at Amsterdam, named Luce, was the inventor. This is said also by Malouin,§ the new editor of Lemery's chemistry, || *Lier*¶ and others.

On the other hand, most of the French writers assert that this water was first made at Paris; and for a long time by one apothecary only, named Dubalen, who, as well as his successor Juliot, carefully kept the process a secret.** Others afterwards endeavoured to imitate it, and among these, was the apothecary Luce at Lisle, who however gave to the water a blue colour, because he was not able to make it of a milky appearance. The

* Wallerius *physische Chemie*, ii. p. 348.

† Gmelin *apparatus medicaminum*. *Regnum miner.* i. p. 101.

‡ Stockar de Neuforn *diss. de succino*. Lugd. Bat. 1760. p. 65.

§ *Medicin. chemie*, i. p. 146, and ii. p. 307.

|| *Cours de chymie par Lemery*. The new edition, enlarged by Baron. Paris 1756. 4to. p. 517.

¶ *Verhandeling over de slangen en adders door I van Lier*. Amst. 1781. 4to. p. 177. On nomme'ce mélange Eau de Luce, vraisemblablement d'après un certain Lucas, Apoticaire à l'Isle, qui s'est fait un nom par la préparation d'une pareille liqueur penetrante. I have mentioned this book in *Physikal ækon. Biblioth.* xii. p. 450. Demachy says, in *L'art du distillateur d'eaux fortes*, p. 126: L'état constamment laiteux lui a fait donner le nom d'Eau de Luce. This derivation I do not understand.

** See the before quoted collection of Vandermonde, v. p. 237, 239, 307, 308.

novelty of this blue water, which had its colour from copper, procured it great approbation; so that the blue *Eau de Luce* banished, for a long time, the genuine kind.*

I have given this account, though uncertain and defective, that others may have an opportunity of correcting or enlarging it; which, as the invention is so modern, there is reason to hope may be done. I shall remark also, that Dossie, an Englishman, is among the first who gave a proper account of the preparation of this water, namely in his *Elaboratory laid open*, printed in 1758.

SUGAR OF MILK.

SUGAR of milk is an essential salt, obtained from milk by evaporation and crystallisation. It differs in its nature, according to the method of preparation; and by repeated purification it becomes always less saccharine, as common sugar by being refined loses some of its sweetness, although the contrary in general is believed. The invention

* In Dictionnaire des origines, iv. p. 313, is the following article: *Eau de Luce*. Cette liqueur laiteuse, volatile, tres-pénétrante, formée par la combinaison de l'esprit volatil de sel ammoniac, avec une petite portion d'huile de karabé, fut inventée par M. du Balen, apothecaire de Paris. On ne doit point la confondre avec un autre eau volatile de couleur bleue qui eut beaucoup de vogue sous le nom du Sieur Luce, apothecaire à Lille.

of this salt, from which the sweet taste of milk arises, seems to belong to the Italians; for though Haller says,* that he read in Kempfer, that the Brachmans knew how to prepare sugar from milk, he was not able to quote the place where this is mentioned, and I have hitherto sought for it in vain. If this testimony be inadmissible, till the place where it occurs be again found, the Italian Bartoletti, as far as I know at present, is the first person by whom this salt was mentioned, in a work entitled *Encyclopædia Hermetico-dogmatica*, which, as Mazzuchelli says, was printed in quarto, at Bologna, in 1615 and 1619. This Fabrizio Bartoletti, or Bertoletti, was born in 1586, and after being professor at Bologna and Mantua died in 1630. Merklin, Jöcher in his Dictionary of learned men, and others, make the year of his birth to be 1588; but this is an error.† He, however, named this salt, not sugar of milk, but *manna seu nitrum seri lactis*. I do not believe that he gave himself out as the inventor of it; at any rate Peitonti, where he enumerates his services, takes no

* Boerhavi prælectiones acad. tom. v. P. ii. p. 430. Elementa physiol. vii. 2. p. 38: Hoc salis genus etiam Brachmanes, ut ex aliis dulcibus, ita ex lacte norunt parare. Hoc in adversariis meis ex Kæmpfero citavi; locum non adjeci.

† A circumstantial account of the life and writings of this Italian may be found in the 21st part of *Opuscoli scientifici e filolog.* which contains, p. 393. *Paitoni commentarius de vita et scriptis Fabricii Bartholetti*. His life may be found also in *Mazzuchelli scrittori d' Italia*, ii. 1. p. 429.

notice of it. Spielman* and others say that Etmüller gave Bartoletti's recipe for preparing this salt from the above-mentioned book. But in that edition of Etmüller's work which I quoted in the first volume of this History of Inventions,† I find only the following passage: Serum lactis habet in se sal volatile nitrosum; unde Bartholetus præparat ex sero lactis remedium, quod vocat mannâ seu nitrum seri lactis.‡ Suavis est saporis, cujus uncia una largius operatur quam mannæ vulgaris uncia tres. The recipe, however, must be in the older editions; for it was thence copied into an academic Dissertation, *de saccharo lactis* in 1713; and as I have not yet seen Bartoletti's book, I shall here give the recipe taken from it, as being the first ever publicly made known. Destillatur in MBneo calore leni serum lactis, donec in fundo butyracea fex subsideat, cui adhaerebit, et quasi superinstrata erit salina quaedam substantia subalbida quae curiose separat; est enim sal seri essentielle, seu eius nitrum cuius caussa serum nitrosum dicitur, et huic tota alterandi et abstergendi vim seri inest. Solvit hanc substantiam separatam in aqua appropriata et coagulat, opus repetit, donec seri cremorem habeat, sapore omnino mannâ referentem. It is, however, singu-

* Institut. chemiæ. p. 71: Etmüller in *Collegio pharmaceutico in Schröderum, sub titulo bovis*, Op. i. p. 770.

† Page 204.

‡ In Encyclop. 400.

lar that Haller could not find this unintelligible recipe in his edition of Bartoletti.*

The person, however, who chiefly contributed to make this salt known was the Italian Ludovico Testi, who gave it out as an invention of his own, and recommended and sold it as a powerful medicine for the gout and other diseases, but on that account concealed the method of preparation. This Testi, whose father is said to have possessed various chemical secrets, was a native of Reggio, and practised with great success as a physician at Venice, where he died on the 3d of September 1707, in the sixty-seventh year of his age. A short time before his death he requested the well known Vallisneri, his friend and countryman, to publish his book *de praestantia lactis*, as a work in which he had described the preparation of his celebrated medicine.† From this manuscript, therefore, Vallisneri made the prescription known: it differs a little from the common process, and on that account he chose to call Testi's salt, *il sale di sero dolcificato*, rather than sugar of milk.‡

In modern times the sugar of milk is made chiefly in Swisserland. Crèuz a physician, and

* Haller says, in the place quoted: *Mea editio Encyclopædiæ neque eum locum habet neque tot paginas.* The recipe, as Etmüller says, ought to stand in p. 400.

† *Giornale de' letterati d'Italia*, 1715. p. 129.

‡ The Latin prescription of Testi may be found in *Ephemerides naturæ curiosorum*, cent. 3. p. 69. The Italian translation stands in the above quoted *Giorn. de' letter.* p. 143.

an apothecary of Bern named Prince, for a long time prepared this salt, and carried on with it a very great trade. The latter, in particular, found an extensive sale for his article in France; but it decreased when this salt, of a quality equally good, began to be manufactured in Lorraine, and particularly at Sarlouis.* At present, however, it is made no where but in the canton of Bern, from which it may be obtained in casks weighing several hundred pounds.†

It is prepared from new milk by boiling it with eggs, and when an imperfect separation of the milk is effected, straining it; then boiling it, and suffering it to crystallize. This sugar therefore is fatter, and more liable to spoil, than that given by milk from which the butyraceous and caseous parts have been carefully separated.‡

GUNS. GUN-LOCKS.

THE first portable fire-arms were discharged by means of a match, which in the course of time was fastened to a cock, for the greater security of the hand while shooting. Afterwards a fire-stone was

* *L'art de distillateur d'eaux-fortes.* Par Demachy, 1773. fol. p. 128.

† *Andreas Briefe aus der Schweiz.* Zurich 1776. 4to. p. 307.

‡ *G. R. C. Storr Alpenreise.* Leipsic 1784. 4to. i. p. xxxii.

screwed into the cock, and a steel plate or small wheel, which could be cocked or wound up by a particular kind of key, was applied to the barrel. This fire-stone was not at first of a vitreous nature, like that used at present for striking fire, but a compact pyrites or marcasite, which was long distinguished by that name. But as an instrument of this kind often missed fire, a match, till a late period, was retained along with the wheel; and it was not till a considerable time after that men, instead of a friable pyrites, so much exposed to effloresce, affixed a vitreous stone to the improved cock or present lock. On each new improvement, the piece, the caliber and length of which were sometimes enlarged and sometimes lessened, obtained various new names; such, for example, as *Büchse*, *Hakenbüchse*, *Arquebuse*; Musket, Pistol, *flinte*, &c. But I shall leave it to those who are able to write a history of artillery, to determine the difference between these kinds; and shall here add only what follows.

The first name undoubtedly arose from the oldest portable kind of fire-arms having some similarity to a box. There were long and short *büchse*, the latter of which, as Hortleder says, were peculiar to the cavalry. The long kind also, on account of their similarity to a pipe, were called *rohr*. Large pieces, which were conveyed on cars or carriages, were called *Karrenbüchse*, but soon

after also *canna*, cannon. Instead of artilleryman, artillery, and arsenal, people used the terms *büchsenmeister*, *büchsenmeistery*, *büchsenhaus*, &c. The *hakenbüchsen* were so large and heavy that they could not be carried in the hand; it was necessary therefore to support them with a prop, called *bock*, because it had two horns, between which the piece was fixed with a hook that projected from the stock.* Hence arose the name *hakenbüchse*, *hakenbüsse*, which the French and different nations, along with many other German words, adopted, and corrupted till they at length became *arquebuse*, *archibugio*, *archibuso*, &c.† From the passages of ancient writers collected by Daniel, it may be concluded that these *hakenbüchsen* with a wheel were invented in Germany, in the beginning of the sixteenth century; ‡ and

* A figure and description of the *Hakenbüchse*, the *bock*, the wheels, and key, may be found in *Histoire de la milice Francois par Daniel*, Amst. 1724. 2 vol. 4to. i. p. 334. At Dresden there is still preserved an old *Büchse*, on which, instead of a lock, there is a cock with a flint stone placed opposite to the touch-hole, and this flint was rubbed with a file till it emitted a spark.

† Kaisers Leo Strategie und Taktik. Wien. 1777. 2 parts 8vo. ii. p. 160. A derivation undoubtedly false is given in *Polydori Vergilii lib. de rerum inventoribus*. Lugd. Bat. 1644. 12mo. p. 123. Alio nomine appellatur *Areusbusius*, a foramine opinor, quo ignis in pulverem fistula contentum immittitur; nam Itali *busium* vulgo foramen dicunt, et *arcus*, quod instar arcus pugnantis sit; quippe hodie hujusmodi tormenti usus in primo statim pugne loco est quem olim sagittariis dabant.

‡ As I have no opportunity of consulting the books quoted by Daniel, I shall here insert his own words. *Fabrice Colonne dans les*

this is confirmed by the testimony of Martin Bellay. Speaking of the league formed between the emperor Charles V and pope Leo X against France, and the siege of Parma undertaken in the year 1521, he says: *de ceste heure là furent inventées les harcquebouzes qu'on tiroit sur une fourchette.**

Pistols also, which at first had a wheel, seem to have been used at an earlier period by the Germans than by the French. Bellay mentions them in the year 1544, in the time of Francis I; and under Henry II the German horsemen, *des reiters*, were called *pistoliers*. De la Noue, who served under both these kings, says, in his *Discours politiques et militaires*, that the Germans first employed pistols. I know no probable derivation of this term. Frisch conjectures that it may have arisen from *Pistillo*, or *Stiopo*, because pistols used to have large knobs on the handle. Daniel and others think that the

Dialogues de Machiavel sur l'art de la guerre, parle de cette arme comme d'une invention nouvelle et de son tems. L'arquebuse, dit il, qui est un bâton inventé de nouveau, comme vous sçavez, est bien nécessaire pour le tems qui court. L'auteur de la Discipline militaire, attribué au seigneur de *Langei*, en parle de même; la harcquebuse, dit il, a été trouvée de peu d'ans en çà, et est très-bonne. Il écrivoit sous le regne de François I. Si nous en croyons *Luigi-Collado* dans son Traité de l'artillerie, imprimé à Venise l'an 1586, on ne commença que de son tems à se servir des arquebuses à rouet en Allemagne. Nell' Alemagna etiandio fu ritrovata l'invention de gl' Archibugi da ruoto.

* Les mémoires de mess. Martin du Bellay. Paris 1588. fol. p. 55.

name comes from Pistoia in Tuscany, because they were there first made. He says he saw an old pistol which, except the ramrod, was entirely of iron.

Muskets received their name from the French *mouchet*, or the Latin *muschetus*, which signifies a male sparrow-hawk. This derivation is the less improbable, as it is certain that various kinds of fire-arms were named after ravenous animals, such, for example, as *falconet*. Daniel proves that they were known so early in France as the time of Francis I. Brantome, however, asserts* that they were first introduced by the Duke of Alva, in the year 1567, when he exercised his cruelty in the Netherlands, in order to overawe and keep in subjection the people of that country; and that they were not then known in France. In another place he says, that they were first made general in France by M. de Strozzi, under Charles XI.

That the lock was invented in Germany, and in the city of Nuremberg, in 1517, has been asserted

* Il fut le premier qui leur donna en main des gros mousquets, et que l'ont vit les premiers en la guerre et parmy les compagnies; et n'en avions point veu encore parmy leurs bandes, lorsque nous allâmes pour le secours de Malthe, dont depuis nous en avons pris l'usage parmy nos bandes, mais avec de grandes difficultez à y accoutumer nos soldats. Et ces mousquets étonnèrent fort les Flammands, quand ils les sentirent sonner a leurs oreilles; car ils n'en avoient veu non plus que nous; et ceux, qui les portoient, on les nommoit Mousquetaires. *Ouvres du seign. de Brantome*, à la Haye 1740. 15 vol. 12mo. iv. p. 89.

by many, and not without probability; but I do not know whether it can be proved that we are here to understand a lock of the present construction. In my opinion, the principal proof rests on a passage made known by Wagenseil,* from an unprinted Nuremberg Chronicle, the antiquity of which he has not determined. The same year is given by J. Guler von Weineck,† Walser,‡ Mr. von Murr, and others. It is also certain that in the sixteenth century there were very expert makers of muskets and fire-locks; for example, George Kühfuss, who died in 1600, and also others, whose names may be seen in Doppelmayer. I must not omit here to remark, that many call the fire-lock the French lock, and ascribe the invention to these people; yet as, according even to Daniel's account, the far more inconvenient wheels on pistols were used in France in 1658, it is probable that our neighbours, as is commonly the case, may have made some improvement in the German invention.

* J. C. Wagenseilii de civitate Noribergensi commentatio, Altorfi 1697. 4to. p. 150: In chronico quodam MS. legitur: the fire-locks belonging to the shooting tubes were first found out at Nuremberg in 1517.

† Raetia das ist Beschreibung der dreyen loblichen Grawen Bündlen und anderer Rætischen Völker, Zurich 1616. fol. p. 152: The ingenious fire-lock was invented, after the year 1517, at Augsburg and Nuremberg.

‡ Gabriel Walser Neue Appenzeller Chronik oder Beschreibung des Cantons Appenzell. St. Gall 1740 8vo. p. 194, where the same account is given as by Guler.

In the History of the Brunswick regiments, it is stated that the soldiers of that duchy first obtained, in 1687, flint-locks instead of match-locks. It has often been asserted that fire-tubes, which took fire of themselves, were forbidden first in Bohemia and Moravia, and afterwards in the whole German empire, under a severe penalty, by the emperor Maximilian I; but I have not found any allusion to this circumstance in the different police laws of that emperor.

That the first fire-stones were pyrites, appears from various accounts;* and as a vitreous kind of stone was introduced in its stead, this circumstance gave often rise to confusion, some instances of which are related by Henkel, so that many applied to the stone what was related by our forefathers of pyrites. In the greater part of Europe,† people use at present that *hornstein* called by Wallerius *Silex igniarius*, and by Linnæus *S. cretaceus*. In Germany it was formerly called *Flins* or *Vlins*, which some consider as more proper; and in the Swedish, Danish, and English *Flinta* and *Flint*. This appellation is of great antiquity;

* A good number of them may be found in the second part of *Sammlung der Reichsabschiede*, Frankfort on the Maine, 1747. fol.

† This kind of stone is not every where used for this purpose. In the Tyrol, for example, the hardest ferruginous granite, which consists of corneous, partly irregular and partly polyedral pieces, is employed as flints, which therefore are called Tyrol flints. In other places jasper, such as that found in great abundance in Turkey, is formed by grinding, and used in the same manner.

for the Wends had a pagan deity of that name, which they erected on a stone called *Flynstein*.* In some districts of Germany this word has been still retained; for example, white or grey ferruginous spar, *Minera ferri alba* WALL. is called in Stiria *Flins*, or, as it is often improperly written, *Pflinz*; and in Bayreuth that fire-stone is still called flint-stone.† In our neighbourhood the same name is still used by the stone-cutters. It cannot be doubted that the weapon which is fired by the help of this stone, obtained from it, in German, the names of *Flintgewehr*, *Flint*, or *Flinte*; but since the old name of the stone has been forgotten, it is, in general, named from the weapon flint-stone. Those acquainted with the German and northern antiquities, know that the knives employed at the ancient sacrifices, and other articles, were made of this kind of stone, as appears by the

* Of this deity an account may be found in *Eliæ Schedii Syn- tagma de diis Germanis*, Halæ 1728. 8vo. p. 726. also in *Albinus Meisnische Landchronica*, Dresden 1589. fol. p. 149. and in *Scriptor. Brunsvic* iii. p. 336: De Wenden de hatten weder up ören olden Afgot, de het Flyn, wente he stod upp eynen Flynsteine.

† Esper *Nachricht von neu entdeekten zoolithen*, Nurnberg, 1774, fol. of which expensive work I gave an account in my *Biblioth.* vi. p. 349. Mr. Esper says, those fire-stones only which contain fossils or petrifications are called *flins*, flint; and it is possible that the singular formation may be the cause why they have retained longest the name of the pagan deity: *Omne eximium diis dicatum*, says Pliny. Fulda also, in *Samlung und Abstammung Germanischer Wurzel Worter*, Halle 1776, 4to. p. 337, translates *Flint*, *silex petra*, and *Flintern*, *fulgere*.

remains still found in old barrows and between urns.* This proves that these stones were much used by the ancients. In England and France old buildings constructed of them are still to be seen, and the stones appear to have been cut with the greatest care.† The above articles, which have lain in the earth more than a thousand years, and these edifices, among which some at Norwich were inhabited in 1403, shew the wonderful durability of this kind of stone. Some imagine that the art of working it has been lost; but though our artists prefer employing their talents and dexterity on stones which have a more beautiful appearance and less brittleness, they are able to cut also the fire-stone. Enamel painters, for the most part, rub their glass enamel on plates made of it; but they are obliged to purchase them at a very dear rate.‡

Many of my readers will perhaps be desirous to know in what manner our gun-flints are prepared. Considering the great use made of them, it will hardly be believed how much trouble I had to obtain information on this subject. One would

* Figures of such instruments may be found in *Beckman's Beschreibung der Mark*, and in the fifth volume of the *Archaeologia Britannica*.

† *Philosoph. Transactions*, No. 474. *Hamb. Magazin*, ii. p. 487.

‡ A polished plate a foot square is sold at the Vienna porcelain manufactory for five hundred florins. See *Beschäftigungen der Berliner Naturf. Gesellsch.* ii. p. 213.

laugh were I to repeat the various answers which I obtained to my inquiries. Many thought that the stones were cut down by grinding them; some conceived that they were formed by means of red-hot pincers; and many asserted that they were made in mills. On the least reflection it may be readily conjectured, that the double cuneiform shape is given to these stones without much labour, because they are so cheap; and as every country, at all times, with whatever other it may be engaged in war, can obtain them in sufficient quantity, no nation can have an exclusive trade in them. It is nevertheless difficult to discover the places whence they are procured; and in works which give an account of the different articles of merchandise they are not named. The best account with which I am acquainted, is that collected by my brother, and published in the Hannoverian magazine for the year 1772. Shepherds, and other persons who gain little by their service, break the flint-stone merely by manual labour, and chiefly in Champagne and Picardy. Some years ago Gilbert de Montmeau, a merchant at Troye, carried on the greatest trade with them, and sold them at the rate of five livres six sous per thousand. The Dutch always buy up large quantities of them, which they keep in reserve, in order to sell them when the exportation of them is forbidden by France, in the time of war. Savary, however, relates that the largest quantity and best

stones come from Berry, and particularly the neighbourhood of St. Agnau and Meusne. I know also that a great many are made at Stevensklint in Zeeland,* and exported from that country. In the year 1727, the chancery of war at Hanover sent some persons to learn the art of breaking flints; but after their return, it was given out that our horn-stone was unfit for that purpose. It is possible that those stones which occur in continued veins, may be split easier in any required direction than those found in single pieces, as it appears to me that the latter are harder and more compact than the former. Perhaps the case is the same with flints as with vermilion, the preparation of which we endeavoured to learn from the English and Dutch, though from the earliest periods it had been made better in the very centre of Germany than any where else.

Long after the wheel with pyrites and fire-stone was invented for discharging fire-arms, many connoisseurs in the art of war preferred matches. Among these may be mentioned John Jacobi, named in general, from his native place, von Wallhausen, who in the year 1621 was a lieutenant-co-

* No account, however, of this use of flints is given in *Abildgaard's Beschreibung von Stevens Klint*, Copenhagen and Leipsic 1764. 8vo. though they are mentioned p. 32. Chemnitz regrets, in the before quoted *Berliner Beschäftigungen*, p. 213. that the largest and most beautiful pieces are broken in many thousand fragments, and afterwards sold for a trifle as gun-flints.

lonel in the service of the elector of Mentz, and afterwards town-major of Dantzic. In nocturnal attacks, however, which required to be made speedily and without noise, and in which three or four discharges only were necessary, he thought Netherlandish or well made fire-locks might be employed without any detriment.*

That stones were used at least in the middle of the sixteenth century, is confirmed by the account of an ingenious Italian, named Francis Angele-rius. This artist had constructed a short piece of wood, to which he applied a wheel, and instead of a cock a dog, which held the stone in its mouth, the whole so ingeniously made, that a person who appeared with it at a masquerade was arrested by the guard, because it was considered to be a real pistol.† I have thought it proper to mention this circumstance, because it proves that the wheel was then invented and known under the appellation of pistol. In old arsenals and armouries, large collections of arms with the wheel are

* Defensio patriæ oder Landrettung durch Johann. Jacobi von Wallhausen. Franckfort on the Mayn, 1621 fol. p. 54 and 55.

† Hippolytus Angelerius, in a work entitled *de antiquitate Ate-stinæ*, p. 14, in the seventh volume of *Thesaurus Antiquitat. Italiæ*: Franciscus Angelerius finxit aliquando ex ligno et foliis auri scelopum quam brevissimum una cum rota et cane silicem in ore habente ita exacte et ingeniose, ut quidam personatus, qui in bacchanalibus illum circumfererat, in carcerem fuerit detrusus a lictoribus putantibus illum esse æneum et verum scelopum et ejus generis quod pistola vocatur.

still to be seen. Major-general von Trew and Mr. Owenus had the goodness to show me those still preserved in the arsenal at Hanover. Those which I consider as the oldest, had on the barrel the figure of a hen with a musket in its mouth, because perhaps they were made at Henneberg. A pistol of this kind was entirely of brass without any part of wood, and therefore exceedingly heavy. On the lower part of the handle were the letters J. H. Z. S. perhaps John duke of Saxony. A piece with a wheel, which seemed to be one of the most modern, had on the barrel the date 1606.

Together with fire-stones, properly so called, pyrites, which is sometimes named fire-stone, continued long in use. In the year 1586, under duke Julius of Brunswick, when abundance of sulphureous pyrites was found near Seefen, the duke caused it to be collected and formed it himself into the necessary shape, though in doing so he often bruised his fingers, and was advised by the physicians not to expose himself to the sulphureous vapour emitted by that substance.* G. E.

* Rehtmeiers Braunsch. Lüneburg. Chronica, p. 1070. Damit nichts zu spilde sondern alles zu Nutz käme, liess er solche Nieren und Steine alle Tage durch die Edel-Knaben und Trabanten herein holen und schlug die selber klein, etzliche Tönnichen voll und zog den Schwefel ins Gehirn, dass ohn Zweifel derselbe, vorerzählter Maassen, die weisse phlegmatische Materie rege gemacht und zum Fluss gebracht. Er wolte sich aber davon night abreden lassen, ungeachtet er oftmals die Finger entzwey schlug, dass das Blut darnach folgete so er doch nicht achtete.

Stahl, in a dissertation published in 1716, mentioned an observation he had made in regard to that pyrites, which, as he says, was then used for fire-locks, under the name of *Feuer-Büchsen* stone.*

SEIGNETTE'S SALT. SAL POLY- CHREST.

THIS neutral salt, which consists of the mineral alkali, soda, and the acid of winestone, was prepared and made known, about the end of the seventeenth century, by a Frenchman named Seignette. The confidence with which he recommended it, and the care he employed to keep the process for making it a secret, produced, as in general, so much effect, that it was used in preference to other medicines long known, which had been of no less service; so that the inventor was enabled to acquire a fortune without much trouble. It must, however, be confessed, that he was an expert chemist, who had before gained the

* Joh. Stretz Dissertat. de vitrioli elogiis, Halæ 1716. p. 13 :
Minera illa sulphureo-martialis, in Variscis fodi solita, e qua pyritæ
pro bombardis Germanici ignitabuli formantur vulgo *Feuer-
Büchsen-Steine*.

esteem of naturalists and physicians by some learned dissertations, and by various medicines which he had invented. Peter Seignette was an apothecary at Rochelle. He wrote an account of some remarkable natural productions in that neighbourhood, in the Transactions of the Academy of Sciences at Paris, or in other works, and died on the 11th of March, 1719.* This salt, by which he acquired celebrity as well as riches, he recommended in some papers printed separately, and particularly in the year 1672. He called it sometimes alkaline salt, sometimes *sal polychrest*, and sometimes Rochelle salt; and after his death it continued to be sold by his son for a long time, with the best advantage.

The mechanics have often been reproached with a want of confidence in the learned; but, in my opinion, the latter give too much cause for it. To the great mortification of human pride it must be confessed, that the most useful inventions occur to the former amidst their continual labours; and their merit consists chiefly in this, that they prosecute the discovery, seize it, and turn it to advantage. If they succeed, their interest requires that they should keep it a secret, in order to gain

* In *Bibliothèque historique de la France* par Le Long, augmentée par Fevret de Fontelte, Paris 1778. 5 vol. fol some of Seignette's writings are quoted; such, for example, as a paper in *Memoirs de l'Acad.* 1707. p. 115, also in *Histoire de la Rochelle*, par M. Arcère, ii. p. 424.

by a monopoly. No sooner has the literary man heard of a new art, than he wishes to become the second discoverer; and with the greater anxiety the more important the invention is, and the more it has been concealed. If he discovers it, he hastens to communicate it to the public; because, in general, he gains only by making his exertions known. The man of letters, therefore, has a great advantage over the mechanic. He acquires the character of a patriot and friend to mankind, who endeavoured to render the important advantage public; and his exertions being more applauded, he is thus enabled to throw a shade over the merit of the mechanic. These contending interests, however, are of great advantage to the whole society of which both parties are members, I mean to the public good. When the mechanic invents any thing new, the man of letters diffuses a knowledge of it, and makes it generally useful; takes care that no injury arises from it by a monopoly; that it does not die with the inventor; and, by examining the causes and defining the laws of the invention, he renders the application of it more certain, and shows how it may be employed for purposes of which the inventor never perhaps entertained an idea.* If in this manner he lessens

* Nam invenire præclare, enuntiare magnifice, interdum etiam barbari solent; disponere apte, figurare varie, nisi cruditis, negatum est. *Plin. epist. iii. 13.*

the merit of one, he, on the other hand, creates employment to many, and gives rise to researches in which thousands participate with advantage.

In this manner, Seignette the apothecary discovered sal polychrest, while engaged in making soluble tartar. Having employed salt of soda instead of winestone, under the old idea that there was only one kind of fixed alkali, he unexpectedly saw produced a salt different from the common soluble tartar which he wished to make, and from every other known saline substance. On examination he found it to be a new laxative, recommended it as such, and by the sale of it acquired a fortune. Scientific men examined this secret salt; found out the component parts of it; made them publicly known; and caused the difference between the mineral and vegetable alkalies, before overlooked, to be more accurately examined,* by which means much light was thrown on chemistry, and many of the arts were improved.

Among those who contributed to bring the new salt into vogue was Nicholas Lemery who received a large quantity of it from Seignette, and distributed it at Paris, but without making known its

* Who first discovered the difference between the vegetable and mineral alkali? To this question professor Gmelin returned the following answer: That, at any rate, it had been accurately defined by Stahl. See *G. E. Stahl's fundamenta chymicæ dogmaticæ et experimentalis*. Norimbergæ 1746, 3 vol. 4to. iii. p. 268 and 304.

component parts.* These, in the year 1731, were discovered at the same time by two French chemists, Boulduc and Geoffroi. The former announced his discovery in the Memoirs of the Academy of Sciences,† and the latter communicated his to Sir Hans Sloane, who caused it to be published in the Philosophical Transactions.‡ What therefore has been said by J. H. Schulz, in his Chemical Experiments, that Neuman in his Treatise on Saltpetre made known Seignette's salt, is entirely false; for Neuman's sal polychrest is essentially different; and he himself acknowledges§ that he was not acquainted with Rochelle salt. || After this, the properties of salt of soda were examined by Grosse, Duhamel, Brande, a Swedish chemist, and others.¶

* Lemery vollkommene chymist. Dresden and Leipsic 1734. 2 parts, 8vo. i. p. 521.

† Memoires de l'Academ. des Sciences. Année 1731, p. 124.

‡ Philos. Transactions, N^o 436, p. 37.

§ Neumann's Chymie nach Kessels Ausgabe, i. 3. p. 160.

|| The principal works in regard to Seignette's salt are mentioned in *Weigel's Chemistry*, Greifswald 1777, 2 parts, 8vo. ii. p. 225. To which, however, may be added *Georgii Ludov. Enckelmann Diss. de Sale alkali de Seignette ejusque natura et usu*. Argentorati 1756. 4to.

¶ Weigel ut supra, ii. p. 144, 147.

PLANT IMPRESSIONS.

IF it be true that the extreme boundaries of all things approach or touch each other, one might almost believe that the arts of drawing and engraving on copper must have attained nearly to the highest degree of perfection. At present, while we have among us a Tischbein, a Haid, and other great artists, whose portraits of the persons whom they honour with their pencil or graver are such striking likenesses that they appear to live, we return again to the commencement of the art of drawing, the paltry outline of a shadow, like the love-sick daughter of Dibutades,* and think we ornament our apartments and books with these dark and dismal profiles, and that we can discover by them the talents and disposition of the

* A young woman, who was obliged to separate some time from her lover, endeavoured to discover some means by which the pain occasioned by his absence could be rendered more supportable. While engaged in these thoughts, she observed the shadow of her lover formed by the light of a lamp on the wall. Love, which is fertile in invention, suggested to her the idea of obtaining this likeness of her beloved object, by drawing a line round it on the wall, following exactly the circumference. We are further told by history, that the father of this maid, to whom the Greeks trace back their art of drawing, was a potter at Sicyon, and named Dibutades. Having considered the drawing of his daughter, he conceived the idea of applying clay to these traces. He thus made a profile of clay, which he burnt in a furnace; and this was the origin of portraits in relief in Greece. *Plin. lib. xxxv. ii. p. 710. Gouet, ii. p. 194.*

persons they are supposed to represent. Instead of imitating the great masters, our young gentlemen and ladies are satisfied if they can draw as well as the Grecian potter's daughter; and this they may easily do if they have not lost the use of their hands. While Ehret, Miller, and others have given us the most perfect representation of plants in engravings elegantly coloured, we daub over with lamp-black the dried plants themselves; take impressions of them on paper, and place a collection of such shadows by the side of these productions of the arts. I call them shadows, because indeed they are nothing else. They, however, exceed the former in this respect, that they express better some of the internal prominent parts, fibres, veins, &c.; on the other hand, they exhibit only the contour of dead and bruised plants, whereas the former present the living image.

I am ready, however, to acknowledge the utility of these impressions; they are cheap, and preserve so well what botanists call the appearance, *habitus*, of the plant, that they afford no small assistance towards acquiring a knowledge of many vegetable productions. I do not blame mankind for returning sometimes to the commencement of an art, from which those have deviated who carried it to the summit of perfection; for people overjoyed at a new discovery reject the first idea, though it very often possesses peculiar advantages,

which might be increased by new improvements. In the course of time, occasions also occur when the oldest inventions can be employed with more advantage than the new, by which they have been thrown into oblivion. Thus artists forgot the preparation of metallic mirrors, which had been long used; and, after the invention of the telescope, found themselves obliged to make numerous experiments in order to re-discover it. But these plant impressions cannot be considered as a new invention; they may rather be called the precursor of engraving.

Directions for making these impressions may be found in the oldest books on the arts. The writer meant under the name Alexius Pedemontanus* spoke of such works in the beginning of the sixteenth century; and his account was afterwards copied by Wecker† and others, who believed that very beautiful tapestry might be made in this manner, and of various colours for ornamenting rooms. At that time, however, such impressions had been used to assist persons fond of botany in the study of that science; for professor Baier had a collection of this kind formed in the above century. ‡ Cardan also learned this art;

* Kunstbuch des Alexii Pedemontani—in Teutsch gebracht dur Wecker 1570, 8vo. p. 423.

† De Secretis, p. m. 829.

‡ Buchneri miscellanea physico-medico-mathematica, 1730, p. 1358.

and that it was never forgotten is proved by its being mentioned from time to time in various works.* In the year 1664 it was described by Monconys,† and in 1687 by Geyer,‡ but it was not till the beginning of the last century that it was employed in a serious manner. Omitting those who made plant impressions of this kind for their own use, among whom Linnæus § mentions Hessel; I shall here notice those only who formed whole collections of them, in the same manner

* Ejusdem argumenti est herbas ad vivum, ut dicunt, in chartis pingere. Herba virens ærugine carbonibusque tritis, imbuta pro coloris ratione alterutrum augentes chartæ imprimitur, ut vestigium quasi ichnographiæ remaneat. *De Subtilitate*, lib. xiii. *Sec Curdani Opera*. Lugd. 1663. 10 vol. fol. iii. p. 581.

† *Journal des voyages de M. de Monconys*. A Lyon 1665, 1666, 3 vol. in 4to. ii. p. 450.

‡ Si accuratissime quis velit dictamnum ejusque species depingere, tali modo poterit excellentissimum pictorem superare, nimirum si sumat atramentum impressorium (printer's ink) opeque pilæ (printer's balls) superillinat folio plantæ, ac illa vel manu, vel trochilca, vel sucula leviter imprimat chartæ nonnihil madefactæ, egregie depictam habebit plantam, adeo ut uno in momento vix accuratior effigies exhiberi poterit. In hoc tamen adest difficultas, quod in striatis aliisque floribus major requiratur labor ratione colorum, qui subtilissimo penecillo debent distribui, insuperque notandum, in omnibus coloribus vernice appropriata opus esse, quemadmodum illi norunt, qui Almanach imprimunt. Egregium certe artificium et perquam utile illis botanophilis, qui nullam artis pictoriæ notitiam habent, hocque modo egregium poterunt sibi comparare herbarium. *J. Dan. Geyer Thargelus Apollini saccr diss. iii. de Dictamno*. Francof. 1687, pag. ultima.

§ Linnæus says in his *Philosophia Botanica*, p. 9, that Hessel made similar impressions in America in 1707; but in regard to that man I know nothing farther.

as of engravings, for the purpose of illustrating botany.

The first printing establishment of this kind was formed by J. H. Kniphof, in 1728, with the assistance of J. Michael Funke, a printer and bookseller at Erfurt. The whole work, delivered at that time, consisted of twelve hundred impressions; but few complete copies now exist. One of them is preserved in the library of the *Academia naturæ curiosorum* at Erfurt.*

In 1727, this art was improved, and so far extended by Trampé, a bookseller at Halle, under the patronage of Mr. Büchner, a privy counsellor, with the assistance of professor Ludwig, at Leipsic, that any number of copies required could be taken. Hence was produced that large work consisting of twelve centuries, the first of which is entitled, *J. H. Kniphofii Botanica in originali seu herbarium vivum, in quo plantarum tam indigenarum quam exoticarum, peculiari quadam operosaque enchiresi atramento impressorio obductarum, nominibusque suis ad methodum Linnei et Ludwiggii insignitarum elegantissima ectypa exhibentur, opera et studio Joannis Godofredi Trampe typographi Halensis.*† The succeeding centuries seem to

* See Buchneri Catalogus bibliothecæ academix naturæ curiosorum, p. 71.

† Halæ Magdeburgicæ, 1758, fol.

have been printed at different times.* The figures are not numbered, but arranged alphabetically according to the names placed beneath them. Each century has prefixed a catalogue of all the plants contained in it.

In the year 1741, Henning, printer to the court at Berlin, began to publish such impressions, under the title, *Specimen floræ Berolinensis*. These were afterwards edited, but anonymously, by J. J. Heker, counsellor of the consistory and director of the royal school at Berlin. I have seen two centuries with black impressions. The title is, *Flora Berolinensis*, that is, Impressions of Plants and Flowers, published by the royal school at Berlin, for the purpose of promoting a knowledge of the vegetable kingdom, 1757, fol. Each leaf has the Linnæan name imprinted on it, and at the end of each century there is an index of the impressions.

Between the years 1760 and 1764 Trampe, with the assistance of professor Ludwig, published, in folio, coloured impressions of two hundred medicinal plants, entitled *Ectypa vegetabilium—ad naturæ similitudinem expressa*—Natural Impressions of Plants destined for medicinal purposes—together with a short account of the method of cultivating them, executed by J. G. Trampe, under the inspection of C. G. Ludwig, of Halle. This

* The other centuries have, on the title pages, the dates 1759, 60, 61, 62, 63, 64.

collection consists of eight fasciculi, to each of which is prefixed an account of the plants both in Latin and German. The copy I now have before me exceeds in beauty all preceding works of the same kind, yet it is much inferior to one published at Hamburgh in 1777, with this title: *Icones plantarum: partes, colorem, magnitudinem, habitum earum examussim exhibentes, adjectis nominibus Linneanis, ediderunt P. D. Gieseke, J. D. Schultze, A. A. Abendroth, et J. N. Buck, opera et sumptibus J. von Döhren.** It appears that, in this work, much assistance has been given with the pencil; but I do not know whether it was continued.† It is to be regretted, that those who exercised this art on a large scale, did not publicly make known the means they employed, and the advantages attending them. ‡

* A similar work, in small folio, without a title, and consisting of three *fasciculi*, each containing twenty-five impressions, is mentioned in *von Cobres Büchersammlung zur Naturgeschichte*, 1782, 8vo. p. 491. The first plant is *Boerhavia hirsuta*, and the last *Fucus siliquosus*.

† I have given an account of all the parts of it with which I am acquainted in *Physikalisch. ökonom. Bibliothek*. viii. p. 121.

‡ Some further account of this art may be found in the following works: *F. E. Brückman Sendschreiben von der Art, Krauter nach dem Leben abzudrucken. Kniphof Sendschreiben die Krauter abzudrucken betreffend*. Both these are printed separately, but they are inserted also in *Büchner's Miscellanea physico-medico-mathematica*. 1730, p. 1346, 1353. *Observations sur la physique, sur l'histoire naturelle*—par Rozier. Tom. ii. part. 2. in 8vo 1771. Octob. p. 146. *Oekonomische Nachrichten der patriotischen Gesellschaft in Schlesien. Erster Band*, 1773, 4to. p. 84. 91.

Professor Blumenbach showed me a folio book, lent him from the library of our friend C. W. Büttner, of Jena, which consisted of coloured drawings of many plants and animals, executed in the sixteenth century, partly by John Kentman and partly by his son Theophilus. Among these, is a numerous collection of the impressions of various green leaves, with the following title: *Icones stirpium impressæ a Theophilo Kentmanno, medico, anno 1583.* These impressions evidently belong to the infancy of the art; and it is not improbable that those of the sixteenth century, which Baier, as above stated, had in his possession, were executed by Kentman also.

That the art, however, at that time was new, or at any rate little known, is proved by two commendatory poems prefixed to Kentman's collection before mentioned, and subscribed M. Michael Bojemus, Pirnensis. In one of these the utility, but at the same time the inconvenience and perishableness of dried plants, are mentioned; after which come the following lines, alluding to Theophilus Kentman:

Ille igitur pingui tingens fuligine plantas,
 Cum fibris omnes exprimit articulos.
 Ista nova est ratio plantarum discere vires,
 Ignota aut certe pluribus ante fuit.

The same thing nearly occurs in the other poem:

Sed pingui inducens virides fuligine plantas,
Cum fibris oculis objicit articulos.*

I shall here remark, that the celebrated botanist Paul Herman took impressions in this manner, and left behind him a collection of them, which Von Uffenbach † saw in the possession of J. Aymon, at the Hague; also, that the book quoted from the catalogue of the library of Cobres, is the same which was edited by Gieseke and others at Hamburgh, and that, in general, it contains only seventy-five plates.

Those who wish to examine the history of silhouettes, above mentioned, should compare what has been said on the subject by Athenagoras. ‡

* It is to be hoped that professor Blumenbach will publish a fuller account of this important codex, which contains many things relating to the history of botany and some of its kindred branches of science. I shall, therefore, transcribe only the following lines, from an account given by Theophilus of himself, in order to rectify what has been said in the *Gelehrte. Lexicon*. Joan. Kentmanus Dresdæ natus an. Christi 1518 die 21 Aprilis hora 2. m. 30. p. m. Medicinam in urbe Misna fecit 1551, deinde Torgam se conferens, ibi mortuus est an. Chr. 1574 die 14 Junii, cujus anima requiescat in pace—Theophilus Kentmanus Joannis F. natus est anno Chr. 1552. die 21 Januarii hora 1. m. 15. p. m. qui Torgæ atque Halæ Saxonum medicinam fecit.

† Von Uffenbach *Reisen*, iii. p. 488; where much information in regard to Herman's family may be found.

‡ Athenagoræ *legatio pro Christianis*, p. 141, in the Wirzburg edition of the *Opera Patrum*, vol. iii.

CALIBRE-ROD.

CALIBRE-ROD, or artillery measuring-rod, is a rod on which the diameters of iron, stone, or leaden balls of different weights are marked, so that the calibre or diameter of a gun or cannon being known, one can discover the weight of the iron, stone, or leaden ball which it will carry. The weight of the ball also being given, it serves to determine the calibre of the piece.* It might naturally be supposed that this simple and convenient instrument must have been invented soon after the invention of heavy artillery. But, according to Hulsius,† Vossius,‡ Doppelmayer, §

* Instructions for making this calibre-rod may be found in *C. A. Struensee Anfangs-gründen der Artillerie*, Leipzig und Liegnitz 1760. 8vo. p. 65, and in many other works.

† *Ander Tractat der mechanischen Instrumente* Levini Hulsii. Franck. 1603. 4to. p. 5. "This measuring-rod is commonly made according to the Nuremberg foot and pound, because it was invented and arranged so by that experienced mathematician George Hartman, who lived about the year 1540."

‡ *G. J. Vossii de universæ mathesios natura et constitutione* liber. Amst. 1650. 4to. p. 424: Anno 1540 vixit Georgius Hartmannus, qui primus reperit baculum bombardicum, quo adhibito, scire possumus pondus globi ferrei, aliave materia constantis, pondere coignorato, aberrabitur in pulvere tormentario, quo onerandum est tormentum. Ejusdem baculi beneficio metimur orificium tormenti, ut constet, quot librarum globum ex eo possimus jaculari.

§ *Historische Nachricht von den Nürnbergischen Mathematicis und Künstlern*. Nurnb. 1730. fol. p. 56. *G. A. Will. Nürnbergisches Gelehrten-Lexicon*, ibid. 1755. 4 Theile. 4to. ii. p. 40.

and others, it was first announced, in the year 1540, by George Hartman, at Nuremberg. This Hartman was born at Ekkoltsheim, a market village in the bishopric of Bamberg, in 1489, as is proved by the still legible epitaph made known by Doppelmayr. It is therefore a mistake in Jöcher's Dictionary, when he is called a native of Nuremberg. He studied theology at Cologne in 1510; but directed his chief attention to mathematics, and for his improvement made a tour through Italy. On his return he settled, in 1518, at Nuremberg, where he employed himself in the construction of mathematical and astronomical instruments, such as globes, astrolabes, sun-dials, compasses, &c. He published also, in 1542, *Johannis Pisani perspectiva communis*, with proofs and illustrations; and in 1554, an astrological work entitled *Directorium*. He was afterwards vicar of the church of St. Sebald at Nuremberg, and died there in the month of April 1564. The calibre-rods which he prepared were adapted to the Nuremberg foot and pound; and for a long time all the calibre-rods in Germany were constructed according to this standard.

Since the above was written, professor Meister has shown me that Fronsperger makes it doubtful whether Hartman was really the inventor of this instrument. The passage in his book on war* re-

* Kriegsbuch. Andrer Theil. Frankfurth 1596. fol. p. lxxxix. a.

lating to it I shall here transcribe. "Among the ingenious gauges and gauging-rods for measuring many bodily things by geometrical means, the gauging-rod for great guns, first brought into use at Nuremberg in Germany, as I understand, by that well-experienced mathematician M. George Hartman, as he asserts, but first properly described in the Italian language by Nicholas Tartaleo, of Brixen, near Venice, is not the least important." Fronsperger then gives an accurate account of the method of constructing and using the calibre-rod, and shows how it may be made to agree with the weights of different nations. He gives also a figure of one constructed according to the Bavarian or Austrian standard, and says, that one corresponding to the Nuremberg weights had been made by Dr. Walter Reyffen, and given to him as a keep-sake. From these two also the proportion between the different weights could be determined.

Nicholas Tartaglia, for so the name ought to be written, was not a native of Brixen in the Tyrol, as Fronsperger says, but of Brescia, a town in the Venetian territories. He is styled in the title to some of his works *Brisciano*, and in that to Gosse-
lin's French translation of his Algebra, *Brescian*. Some account of the life and services of this mathematician may be found in Bayle's Dictionary, and a list of his works is given in *Teissier Eloges des Hommes savans*. In one of them, called Que-

siti et inventioni diverse, the second book has the following title: *Supra la differentia, che occorre nelli tiri & effetti fatti con balla di piombo, over di ferro, over di pietra & altre varie particolarità, circa la proportione, peso & misura nelle dette balle*, where the principles on which the calibre-rod must be made are explained. I do not know in what year the above work was printed; the first book has the date 1538. I shall leave others to examine whether more particular directions for constructing this instrument may not be found in other works of the same mathematician, and shall only observe, that the *Quesiti & inventioni* were several times printed separately; but I find them also in a collection entitled: *Opere del famosissimo Nicolo Tartaglia, cioè Quesiti; Travalgliata inventionione; Nuova scientia; Ragionamenti sopra Archimede.* In Venetia, 1606, 4to.

T U R F.*

[Vol. I. p. 333.]

SCALIGER has erred † no less than Monconys, whose account was doubted by Uffenbach. ‡ According to the first-mentioned author, turf had been used in the Netherlands only about three hundred years before his time, and he adds that he did not know that this kind of fuel had ever been mentioned by the ancients.

Those, however, are mistaken also who believe that it is to be found in the Salic laws and those of the Alemanni. It is true that the word *turpha* occurs in the former, and that Wendelin and others have declared it to mean turf; but the assertion of Eccard that it signifies a village, called in German *dorf*, § is more probable. Still less can the doubtful word *curfodi*, in the laws of the Alemanni, be supposed to allude to this substance,

* This and the two following articles are Addenda to some given in the first and second volumes.

† Scaligerana, ii. p. 243: Je ne sçache aucuns anciens, qui fasse mention de tourbes. I must here observe, in regard to the passage of Antigonus, quoted by me p. 189, that we ought not to read there, according to the opinion of Meursius, των Πυρρῶν, but, as amended by Bentley των Συρακων, as I have remarked in my edition of Antigonus p. 215.

‡ In his *Reisen*, iii. p. 263.

§ Leges Salicæ ed. Eccardi. Francof. et Lips. 1720. fol. p. 42.

though we are assured by Lindenbrog that he found in a manuscript, in its stead, the term *zurb*.* It is also not credible that turf should be employed at that period, as wood was every where superabundant.

The oldest certain account of turf in the middle ages, with which I am at present acquainted, is that pointed out by Trotz, † who says that it occurs in a letter of donation of the year 1113. He has given the words in the Dutch language, as if they had stood so in the original. But he has quoted his authority in so careless a manner, that I have not yet been able to conjecture what kind of book he meant. I have, however, found a Latin copy of the letter of donation in a work pointed out to me by Professor Reuss. ‡ An abbot Ludolph, in

* Codex legum antiquarum ex bibliotheca Lindenbrogii, Francof. 1613. fol. and the annexed *glossarium*.

† C. H. Trotz *jus agrarium foederati Belgii, Francuæ 1751—1754*. 3 vol. 4to. ii. p. 643: *Seculo minimum xi et xii publicis in instrumentis occurrunt jam pacta de Veenis seu muriis apud H. van Ryn Historiant 't Utréchtsche Bisdom, T. i. p. 589: ibi vero in instrumento de anno 1113 abbas Ludolfus sibi reservat: de veenen om er turven uit te graaven. Echter hebben wy aan onse zusters voornoemd, niet uyt eenig recht, maer uyt gunst, een gedeelte van de veenen toegestaan, om er turven, die zy tot haar gebruykt van nooden hadden, uyt te graaven. Fuit itaque illa res tunc jam in commercio magnique momenti, quia sibi hoc jus reservat, usum tantum, non venditionem turfatum monialibus concedens. Fischer has inserted this without any amendment in his *Geschichte des Handels*, i. p. 484.*

‡ *Sororibus mansionem concessimus sub hac forma, ut venas ad cespites fodiendos - - nobis reservaremus. Prædictis tamen soro-*

the year 1113, permitted a nunnery near Utrecht to dig *cespites* for its own use in a part of his *venæ*, but at the same time he retained the property of these *venæ*. Now there can be no doubt that *vena* signifies a turf bog, and *cespites* turf. The former is the same word as *Fenne* or *Venne*, which occurs in the old Frisic, and the present *Veen** of the Dutch. The nuns also could make no other use of the turf but employ it as fuel. This passage, however, proves nothing; though Trotz says that a great trade was carried on with turf in the twelfth century, and that the abbot wished to interdict the nuns from using it.

It is worthy of remark that the words *turba*, *turbo*, *turbæ ad focum*, *turfa*, occur for turf, in the years 1190, 1191, 1201, and 1210; as is proved by the instances quoted by Dufresne. *Turbaria* for a turf-moor is found in Matthew Paris, who died in 1259; *Turbagium*, in a diploma of Philip the Fair in the year 1308, signifies the right of digging turf, as *turbare* does to dig up turf. The word *mor* also is found in a document of the year 1246, quoted by Dufresne; who however has not

ribus nostris non ex aliquo jure, sed de gratia, partem de venis ad cespites fodiendos usibus suis necessarios indulimus - - - *Historia episcopatum foederati Belgii—per II. F. V. II.* Lugd. Bat. 1719. 2 vol. fol. i. p. 130.

* Wiarda *Altfrisisehes Wörterbuch*. Aurich 1786. 8vo. p. 127; where it is conjectured, not without probability, that the name Finland is thence derived. *Du Fresne Glossarium*, under the word *Fenna*.

introduced it into his dictionary.* It seems to be the same as *mariscus* and *marescus*. Brito, who lived about 1223, describing the productions of Flanders, says: *Arida gleba foco siccis incisa marescis*.† That the last of these words signifies a turf-bog is proved by a passage of Lambert, who lived at Ardres about the year 1200: *Quendam similiter mariscum, ut aiunt, proprium perfodi fecit, et in turbas dissecari*.‡

I now know on what is founded the assertion of Winsem and others, that the practice of digging turf first became common after the year 1215. Winsem undoubtedly obtained the information which I have quoted in the first volume, in his own words, from Sibrand Leo's *Vitæ abbatum horti divæ virginis seu Mariengard*;§ but this writer died in 1588, and can by no means be adduced as an evidence: he even says himself, that turf-digging in 1212 was a new occupation.

* The words are, *Morum dedit dictus comes dictæ ecclesiæ ad turfes fodiendas*.

† Britonis Aremorici philippidos lib. ii. v. 144. ed. Barthii. Cygneæ 1657. 4to. p. 35.

‡ Lambertus Ardensis, p. 257.

§ These lives are inserted in the new edition of *Antonii Matthæi veteris ævi analecta*, printed at the Hague 1738, in five vol. quarto, v. p. 247. The words of this biographer, which are quoted in *Fischers Geschichte der Handlung*, i. p. 484; as occurring in a diploma of the year 1200, are as follows: *Sylvani, quorum tunc temporis summæ in cespitum fodinis erant divitiæ, lata admodum prædia hujus viri (abbatis Syardi) amore ob sanctitatis opinionem capti, latissimos agros in Bachaleem ultro ipsi offerunt*.

The conjecture that the Netherlanders, who in the twelfth century established themselves as colonists in some districts of Germany, and particularly Lower Saxony, first made known there the preparation and use of this kind of fuel, is improbable, or at any rate not proved.* It is improbable, because the Chauci, the oldest inhabitants of that country, burnt turf before that period.

It is related by the Icelanders that Einar, Count or Earl of Orkney or of the Orkney islands, discovered turf there, and on that account was named *Torffeinar*. He was the son of Raugnwald, or Rognwald, earl of Mören, Sued, and Nordmör in Norway, in the time of the celebrated Norwegian King Harald, commonly called Haarfager or *Pulcricomus*, on account of his beautiful hair.† He must have lived, therefore, in the middle of the ninth century; but on so trifling a subject I shall enter no farther into the labyrinth of the Islandic Saga.

* I find quoted, for this conjecture, the Dissertation, *Eelking de Belgis sæculo xii. in Germaniam advenis*, Gottingæ, 1770. p. 162, 164. But nothing farther is found there than that the right of digging turf was, in all probability, confirmed to the colonists. This important Dissertation was written by professor Wundt of Heidelberg.

† This information may be found in *Crymogæa, sive rerum Islandicarum libri iii. per Arngrimum Jonam Islandum*. Hamburgi. (1609). 4to. p. 50: *Torf* cujus inventor perhibetur in Orcadibus dux quidam Orcadensis, Einarus Raugnvaldi ducis Norvegici de Maere filius, tempore pulcricomi Norveg. regis, qui idcirco *Torffeinarus* dictus est.

In Sweden turf was first made known at a very modern period by some navigators in the district of Halland; and in the time of Charles XI much trouble was taken to introduce it as fuel. In 1672 the town of Laholm obtained an exemption from duty for the turf dug up in the lands belonging to it.*

The practice of charring turf is much older in Germany than I stated it to be in the first volume of this work, if it be true that charred turf was employed about the year 1560 at the Freyberg smelting houses, though that undertaking was not attended with success.† At the Broken the first experiments were made in 1744, with turf which had been dug up several years. This was announced by F. C. Brückman in 1745,‡ as a new invention; but an anonymous writer stated,§ soon after, that this charring had been long used in the district of Hadeln, and that the smiths there employed no other kind of coals for their work.

* See *Neue Abhandl. der Schwed. Akademie*, ii. p. 255.

† This I found in a small work of five sheets octavo, written by Mr. Hoy, counsellor of mines at Dresden, and printed at Altenburg in 1781, entitled *Anleitung zu einer bessern Benutzung des Torfs, vorzüglich im Churfürstenthum Sachsen*.

‡ In *Hamburgischen Berichten von gelehrten Sachen*, p. 93.

§ *Ibid.* p. 170.

C O R K.

[Vol. II. p. 108.]

THAT the use of cork for stoppers was not known in the sixteenth century may be proved from this circumstance, that it is mentioned neither by Ruelius* nor Aldrovandi,† though they describe all the other purposes to which this substance was applied. How great the consumption of it is at present, will appear from the quantity used by the directors of the springs at Niederselters alone; who in the year 1781 employed 2,208,000 stoppers, each thousand of which cost four florins, making a total of 8832 florins. They were furnished by a merchant at Strasburgh, who was obliged to take back the refuse, which he then caused to be cut, on his own account, into smaller stoppers, and many of these could be used by the people at the springs. The experiment also was once made of causing the corks to be cut on account of the directors of the springs; but the carriage of the refuse became too dear, and there was no sale for the stoppers of the apothecary phials which were made of them.‡

* De natura stirpium, p. 256.

† Dendrologia, p. 194.

‡ This I know from Mr. Schimper, whom I had the pleasure of seeing with me in 1788.

Before cork came to be used in this manner pitching was more necessary, and therefore mention of pitch occurs so often in the Roman writers on agriculture. When the farmer, says Virgil,* has brought his productions to the city, he carries back articles of every kind, such, for example, as pitch. On such occasions our poets would have mentioned articles entirely different. Strabo† also extols Italy, because together with wine it had a sufficiency of pitch, so that the price of wine was not rendered dearer.

Flasks covered with basket work, which I have already mentioned, must have been common among the Greeks, if it be certain that *πυτινη* signifies a flask of this kind. It appears indeed to do so, because Hesychius says it was a plaited wine vessel,‡ like the baskets which prisoners were accustomed to make. Suidas, however, states that it was a vessel woven of twigs, named in his time *φλάσκειον*, from which is derived our word *flask*. It is probable that these wine vessels covered with basket work were only of earthen ware, as glass ones were at that time costly and scarce. But I do not think it can be proved that a flask of this kind was called by the Romans *tinia*.

The use of cork for fishing nets is mentioned by

* Georg. i. 275.

† Lib. v. p. 334.

‡ Πλεκτη λαγυνος οινου. See professor Beck's annotations on the *Aves* of Aristophanes 795. p. 83.

Ausonius;* and Alciphron† describes so abundant a capture that the net and the cork floats sunk by the weight.

At present when any one has the misfortune to fall into the sea, a buoy and rope are thrown over board, in order that the person in danger may catch hold of it; and formerly, on similar occasions, the cork affixed to the anchor, *ancoralia*, was employed in the like manner. This we learn from the account of Lucian,‡ when two men, one who had fallen into the sea and another who jumped after him to afford him assistance, were both saved by these means.

I have before remarked, that naturalists were not agreed whether the cork tree loses its leaves in winter or not. According to Jaussin§ it is in Corsica an evergreen; and Carter|| says that the case is the same in Spain, but he expressly adds that beyond the Alps it loses its leaves in autumn.

What I have said in regard to the pores of cork has been stated, in general, by Lucretius.¶

* Mosella 246.

† Epistol i. 1. p. 7.

‡ Toxaris, according to the edition of Deux-Ponts vi. p. 80 : *φελλους πολλους αφειναι αυτοις* : and p. 82.

§ Memoires sur les événemens, arrivés dans l'isle de Corse. Lausanne 1759. 8vo. ii. p. 398.

|| Reise von Gibraltar nach Malaga. Leipsic 1799. 8vo. p. 190.

¶ Atque aliis aliud citius transmittere eadem. Scilicet id fieri cogit natura viarum, Multimodis varians, ut paullo ostendimus ante. vi. 5984—99.

Among those trees, the spongy bark or wood of which may serve as a substitute for cork, must be mentioned the black poplar, for its bark is employed by the Cossacks* as stoppers to their flasks, and the *Aeschynomene lagenaria*, which is used instead of cork in CochinChina.† The wood of the *Marum arborescens* is used as floats in Guiana,‡ and that of the *Hibiscus cuspidatus* in Otaheite.§

QUARANTINE.

[Vol. II. p. 145.]

IN regard to the plague several very important works have lately appeared,|| but none of them

* Gmelins Reise durch Russland, i. p. 138. *Pallas flora Russica*, i. p. 66.

† Loureiro flora Cochinchin. p. 447: Caulis spongiosus et facile cedens, ac elasticæ resiliens, commode aptatur ad obturandas lagenas, defectu suberis, quo regio illa caret.

‡ Barrere in *Göttingischen Sammlung der Reisen* ii. p. 58.

§ Journal of a Voyage to the South Seas by Parkinson, London 1773. 4to.

|| A treatise on the Plague, by Patrick Russel. London 1791. 4to. —*Russels Abhandlung über die Pest*. Leipsic 1792. 1793. 2 Theile 8vo.

Adam Chenot hinterlassene schriften über Anstalten bey der Pestseuche. Wien 1798. 8vo.

An account of the various establishments for preventing the plague in different countries, with a reference to the best works on the subject, may be found in (*Niemanns*) *Schleswig—Holsteinschen Blättern für Polizey und Cultur*. 1800. 2. p. 341.

which I have seen contain any new contributions towards the history of quarantine. Chenot, however, has made many remarks which deserve here to be mentioned.

In the first centuries of the Christian æra, it does not seem to have been known that infection could be communicated by clothing, and other things used by infected persons. The Christians all considered the plague as a divine punishment, or predestinated event, which it was as impossible to avoid as an earthquake; and the physicians ascribed the spreading of it to corrupted air, which could not be purified by human art. The Christians therefore gave themselves up, like the Turks at present, to an inactive and obstinate resignation in the will of God, and hoped by fasting and prayer to hasten the end of their misfortune.

But after the plague in the fourteenth century, which continued longer than any other, and extended over the greater part of Europe, the survivors found that it was possible to guard against or prevent infection; and governments then began to order establishments of all kinds to be formed against it. The oldest of which mention has yet been found in history, are those in Lombardy and Milan of the years 1374, 1383 and 1399.*

* They may be found in *Muratori Scriptores rerum Italic.* tom. xvi. p. 560. and xviii. p. 82. thence copied into Chenot. p. 147. See also *Boccacio decamer.* Amst. 1679. p. 2.

In the first mentioned year the Visconte Bernabo made regulations, the object of which was to guard against the spreading of the plague by intercourse and mixing with those who were infected; and with that view it was ordered, that those afflicted with this disease should be removed from the city, and allowed either to die or to recover in the open air. Those who acted otherwise were to suffer capital punishment, and their property was to be confiscated. But twenty-five years after it was strictly commanded, that the clothes and things used by those who had the plague should be purified with great care; and in 1383 it was forbidden under severe punishment to suffer any infected person to enter the country. These means, however imperfect, must have been attended with utility, because they were again employed during a new danger of the same kind in the fifteenth century.

The Venetians are entitled to the merit of having improved the establishments formed to prevent infection; and that their example was followed in other countries is generally admitted. But the year in which quarantine was first ordered by them to be performed is uncertain. Muratori,* following Lorenzo Candio, gives the year 1484, and Howard† says that the college of health was instituted in 1448.

* Lib. i. cap. 11. p. 65.

† An account of the principal Lazarettos. Lond. 1789. 4to. p. 12.

This much is certain, that all these means against infection, which, though far from being perfect, have secured Europe from this misfortune, were not invented or proposed by physicians, but ordered by the police, contrary to their theory. The latter seems to have known, at an early period, the most dangerous causes of infection, and to have formed at a very great expense precautionary means, the observance of which was enforced under pain of the severest punishment.

The reason why forty days were chosen to be a proof whether people were infected or not, arose, no doubt, from the doctrine of the physicians in regard to the critical days of many diseases. The fortieth day seems to have been considered as the last or extreme of all the critical days; on which subject many physicians appear to have entertained various astrological conceits.* On the Turkish

* See G. W. Wedelii exercitatio de quadragesima medica, in his *Centuria exercitationum medico-philologicarum*. Jenæ 1701. 4to. Decas iv. p. 16. Quadragesima medica terminus est morborum acutorum; terminus limitaneus inter acutos et chronicos, ultimus acutorum, primus chronicorum, inde productorum, ut, qui ultra quadragesimum diem durat morbus, febris in primis primaria vel comitata, ex acutorum classe in chronicorum transcat. p. 17. Non minus et idem terminus criticus hinc est ad indagandam contagii latentis in corpore vim, unde frequentissimus est terminus *la quarantaine*, seu ab aliorum societate quadragenia sejunctio indicta illis, qui a locis peste infectis vel suspectis appellunt. p. 20. Wedel mentions various diseases in which Hippocrates determines the fortieth day to be critical. Compare *Riegers Anmerkung zu Hippocratis Aphorismi*. Hagæ Com. 1767. 8vo. i. p. 221.

frontiers this period was reduced, under the emperor Joseph II, to twenty days.*

The bills of health are older than they are said to be by Brownrigg, † for Zegata ‡ asserts that they were first established in 1527, when the plague again made its appearance in Europe.

* Martini Lange rudimenta doctrinæ de peste. Offenbachii 1791. 8vo. See *Gottingische Anzeigen von gelehrt. Sachen*, 1791. p. 1799.

† In the book quoted by me vol. ii. p. 147. In the *Gotting. gel. Anzeigen* 1772. p. 21, the name of the author is improperly printed Brewerigg, and in consequence of this error it was impossible for me to find the work, in which the year 1484 is given, p. 2, but without any proof, as the time when quarantine was established.

‡ Cronica di Verona, in Verona 1747. 4to iii. p. 93: Fede di sanita - - - la quale precauzione non era mai stato per l'addietro praticata.

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