DR. GUYOT'S

CULTURE OF THE VINE

AND

WINE MAKING.

"Bradshaw's," King Street East, Sydney,

February 16th, 1866.

Sir,

Having been appointed Agent for the sale of the undermentioned new work on the "Culture of the Vine and Wine-making," I beg to bring it under your notice.

I am, Sir,

Yours respectfully,

W. C. LESLIE.

THE CULTURE OF THE VINE AND WINE MAKING.

BY DR. JULES GUYOT.

Translated from the French by L. Marie.

Super royal 8vo.; *price*, 7*s.* 6*d.*, *by post* 8*s.* 2*d.*

"This is a reprint at Melbourne of a work on vine-culture which has obtained considerable celebrity in France, having in a short time run through four editions. A very slight inspection of its pages is sufficient to account for its popularity. Treating at the outset of the analysis of soils suitable to the different descriptions of the vine, the author proceeds to give detailed instructions for its cultivation, in a form so perspicuous and systematic as to enable any amateur easily to master the principles involved in the art. In addition to the advantages derived from an excellent systematic arrangement, the work is illustrated with wood engravings, from which a precise idea may be acquired of the operations carried on in vine-culture in the southern provinces of France. The author has had an experience of something like forty years in connection with it, and for his labours in that direction he was recently rewarded, by the Emperor Napoleon, with the cross of the Legion of Honour, and appointed to visit and report on all the vineyards of France."—*Argus*, *Jan.* 4, 1866.

The following copy of a letter from JOHN WYNDHAM, Esq., a Vineyard Proprietor, of Dalwood, near Branxton, confirms the opinion of the Work held by the Winegrowers of France:—

Dalwood, *January* 30*th*, 1866.

"To Mr. W. C. Leslie.

"Dear Sir,—I inclose you stamps for the Work of Dr. Guyot, to which I had my attention drawn by your Prospectus forwarded to me, and I beg to say it is a most valuable Work, and should be on the table of every Winegrower in the Colony."

27 Feb 1866 7/6

Thomas Walker
Jarrald
Concord

Dr. Mitchell

CULTURE OF THE VINE

AND

WINE MAKING,

By Dr. JULES GUYOT.

TRANSLATED FROM THE FRENCH BY L. MARIE.

MELBOURNE:
PRINTED BY WALKER, MAY & CO., 99 BOURKE STREET WEST.
1865.

TRANSLATOR'S PREFACE.

THE want of a practical and comprehensive treatise on vine-growing and wine-making has been long felt. It was owing to this want that the Cape vine grower failed in introducing favourably his products into European markets. Four years ago, I thought of attempting to satisfy that want, but as I was far from being sufficiently versed in chemistry to introduce that science into the subjects I would have had to treat, my work would have been a simple statement of the facts and practices with which I am acquainted. What kind of reception such a treatise would have met with can scarcely be a matter of doubt. The public of the colonies were, and are still, but not to the same extent, under the erroneous impression that wine-making is eminently a scientific and complicated art. I was still thinking of carrying out my first idea when Dr. Jules Guyot's treatise on vine-culture and wine-making fell into my hands. The worth of the eminent ænologue's work was obvious. It contained, in my first judgment, which remains unaltered, descriptions of the best practices of the best vignerons of the world, condensed into a comprehensive system, explained and supported by science. I resolved then to give a translation to the Australian vignerons, and, by doing so, I unhesitatingly state that they are offered an opportunity to become soon as advanced in that branch of agriculture as the traditional vignerons of France. Dr. Guyot is, beyond a doubt, the greatest benefactor that wine producing countries have had. He has promulgated a rational system for the culture of the vine, although, he admits, there is nothing new in his book. It is a skilful, concise, and consummate thesaurus of all the best methods of cultivating vines and making wines. Scarcely any of the rules he has laid down have given rise to controversy. The gardener, the farmer, the vigneron of Australia, New Zealand, or Tasmania, while studying Dr. Guyot's treatise, will have no occasion to discriminate between a labyrinth of processes; he will not be bamboozled

by quotations of innumerable methods and opinions of theorists and inexperienced men. From its perusal he will learn a clear and incontrovertible method that will lead him to success in his undertaking, and, provided he obtains a little *practical* assistance, he will soon be on a level with the best vignerons of wine countries.

For his practical and theoretical labours on the culture of the vine, Dr. Jules Guyot has been rewarded by the Emperor of the French with the cross of the Legion of Honour, and intrusted with the important mission of visiting and reporting on all the vineyards of France. This mission gave the greatest satisfaction to the vine-growers. With regard to the testimony of sovereigns on such matters, the *London Agricultural Gazette* of last November, when speaking of the opinion of the King of Saxony on the beneficial effects of Liebig's theories, says:—"Although we are undoubtedly a very loyal people, we attach no special value to the testimony or opinion of a king upon such matters, unless he be at the same time a skilful agriculturist." It will not be believed for a moment that a rebuke, so well deserved in that instance, could apply to the Emperor. He did not assume the judgeship in that matter, but simply supported and confirmed public opinion. The proprietors of vineyards and the vignerons of France are, it will readily be allowed, the best judges of writings on vine-culture and wine-making. I will mention the opinions of several. On the 28th of December, 1863, a *concours* (match) for the pruning of the vine took place at Mirande, where a great number of competitors met. The jury unanimously recommended Dr. Guyot's method. The secretary of the society, in his address to the meeting, observed:—"Your jury of examiners give their preference to the pruning system of Dr. Guyot; it is the easiest in its execution, and the most rational in theory. I know that the mode of pruning must vary according to the soil, its fecundity, and the condition of vines; but it is possible, nevertheless, to lay down general rules applicable to all countries. Let us only say that Guyot's pruning is the type of pruning, and that it is considerately recommended to you by a commission composed of special practical men. If to that system of pruning you add, as recommended by Dr. Guyot, the sulphuring against the oidium, manuring, shallow, and well-timed hoeings; if you tie your vines, and stretch the fruit-bearing branch, if you disbud, nip and clip off the shoots, we can affirm that, under these excellent conditions of pruning and cultivating, the vineyards will give everywhere abundant crops, which care in the cellars will transform into wholesome and generous wines." M. Carreau, one of the most skilful vigneron proprietors of the Moselle, gave on Guyot's system the

following account on the 22nd of October, 1863. "The Tokay (variety of *pineau gris*) produced from 1020 to 1040 gallons per acre; *gros pineau* of Burgundy, called *vert noir*, produced 800 gallons per acre, while the other pruning produced only 700 for the same number of vines." M. Carreau says, that long-pruning is preferable for the fine kinds of vines, and that the spur-pruning suits best the coarse ones. This fact, says Dr. Guyot, is proved beyond a doubt, by the old practice of the Moselle. Mr. Deliasse, a large proprietor, and M. Biarms Barthe, wrote to Dr. Guyot, from Limoux (Aude) that the long branch gave excellent results on the Clairette, Carignan, Grenache, &c., and the department had in general adopted his system of pruning. M. Delcasse has ascertained the identity of the saccharine richness of the musts produced by vines of the same kind, and pruned in spurs or long-wood. M. le Comte Delaistre, (Vienne), Dr. Gonnet, (Beaujolais), M. Barles, professor of agriculture of the Var, have all confirmed the superiority of Dr. Guyot's system of pruning. M. Dellicot, president of the Agricultural Society at Toulon is, more explicit. "On the whole," said he, "the Carbenets, Schyras, Melascones, Pineau Beclaus, Pulsards, produce nearly double with the long fruit-bearing branch; the *pineau gris*, especially, succeeds admirably. The Barborou did not ripen under that mode of pruning which does not suit the white Ugny nor the Chasselas and several others." I could give innumerable testimonies from wealthy, honourable, and competent judges, who have given publicity to their opinions; and what I have seen, when in France led me to conclude that Dr. Guyot's system of cultivating the vines would shortly be universally adopted. Dr. Guyot's treatise, however perfect it is as a system, is still wanting in some details. The great ænologue wrote for vignerons who understood him, but intending vine-growers will find him too laconic in several instances. To remedy what to them is a defect, I at one time thought of supplementing my translation with an appendix; but this would, I fear, make the work too cumbrous, and render the publication almost impossible in the colonies. I have therefore decided to withhold it for the present, but, should I perceive any desire on the part of the Australian public to obtain more information on vine-culture and wine making, I shall endeavour to furnish them with the best that can be gathered from European vine-growing countries, and which can be drawn from my careful observations in Victoria.

L. MARIE.

MELBOURNE,
October, 1865.

INTRODUCTION.

The publication of this essay on the culture of the vine and wine-making has been brought about by unforeseen circumstances.

After spending thirty years in observations and experiments on vine culture and farming, I commenced, in 1850, upon reliable statistics, derived from our best vineyards and our most progressive agriculturists, the comparative study of vine culture, and farming in soil of poor and mediocre quality, and I have prosecuted that study with respect to private interest, and also with respect to the colonizing power of the vine and its national value. To carry out my views I established, in a locality where the land was thought unfavorable to the growth of the vine, and little better adapted to farming—in truth, of little value for any kind of culture—a vineyard of 84 acres, and a farm double that extent. Wishing to make a thorough study, and to render it profitable to all, I sought the assistance of the authorities of each department, and a commission of men of great attainment in science, and delegates from committees of scientific societies, watched with care and perseverance the progress of my operation until August, 1857, when I gave up to the owner the land which had been the subject of my experiments. In that year, 1857, the vineyard of 84 acres, of which one-half only had arrived, not at its full bearing, but at the production of its fifth year (the other half being only in its third season or leaf), gave a return of 25,200 gallons of wine, two-fifths of that quantity were the produce of 12 acres, protected with straw matting. My anticipations were then surpassed, for my vineyard, scarcely arrived at the third of its bearing capabilities, was giving already 300 gallons per acre. In future, with my mode of culture, I could reasonably expect a return of upwards of 45,000 gallons. My experiments were interrupted three or four years too soon, to enable me to show the world

the respective value of vine-growing and farming in poor soils; but as to myself, I was convinced, and so must have been the commissions of competent men appointed to report on my works, for they did not hesitate giving publicity to their convictions. In its seventh year the farm still required subsidy for its keeping and its amelioration; and when it would have reached its apogee of production, which would be in the twelfth year, it would only give an annual net revenue of some £120 or £160. It would then only sustain two families, whereas the vineyard would keep twenty families, and would give a gross return of from £10,000 to £16,000 for an annual expenditure of from £1,200 to £2,000. Comparing the present wealth of the population of the locality with the poverty which I had observed in my youth, I left Champagne with the conviction that I now publish in this book for the benefit of all. Fearing that my statements should be misrepresented, I hastened to make them public, in a series of articles published in the *Journal d'Agriculture pratique*. Those articles were received in all parts of France with such favour, such *empressement*, that I was convinced the majority of my countrymen love truth yet, and that when it is sincerely expressed it will meet with powerful and sympathetic echoes. That reception proves also that the progress of vine culture and wine-making is still in the mind of the French, and that the time for good wines will be revived. The discovery of a truth or of progress does not belong to one individual, or even to a few. A truth and a progress come in their time and season, as the flower and fruits on the tree; the discoveries and progress of human societies depend upon the harmony of those societies, and are the necessary consequences of their development and of their traditional actions. When a member sees a truth and expresses it the first, he is understood and accepted by all the other members, because all had caught a glimpse of that truth, or because all were prepared to understand it, and that is the reason that the revelation of good and useful ideas, not only honour individuals, but also families, tribes, and nations, which recognise and accept them with earnestness. For myself I know of vine-culture only what I learned by observing the vine and vineyards, by studying the authors, by personally cultivating the vine, and by endeavouring to discover the practice, founded on tradition and observations, that would be best for vinegrowing, for the vinegrower, and for all. I declare that, whenever a solution has appeared to me admitted as the best by experience, I found that that same solution had already been noticed either by good authors or by practice in our best vineyards. Thus, I have done nothing that I can attribute to myself, and I claim

no discovery; I have simply recorded in a concentrated form the most approved system of vine-culture, after long and practical study, on a large scale.

1st May, 1860.

This first edition of my treatise was published in May, 1860. In November of the same year it was exhausted. That unexpected favour, supported by the approbation of vinegrowers of higher standing, encourages me to give another edition of my work in all its primitive simplicity.

DR. JULES GUYOT.

30th November, 1860.

CULTURE OF THE VINE

AND

WINE MAKING.

CHAPTER I.

COLONISING POWER OF CULTURES IN GENERAL, AND OF THE VINE IN PARTICULAR.

What constitutes the wealth of a locality and of its soil? The wealth of a locality is most truly indicated by the number of inhabitants which are enabled to maintain themselves within it in a state of prosperity. The true indication of the wealth of the soil is the amount of population it supports, or, in other words, for whose labor it finds employment in the production of articles, raw or manufactured on the spot. When large populations, agglomerated in certain places, are sustained by commerce, industries, arts, or by the funds of the State, their presence favors the development of cultivation in the neighborhood, so that even from the poorest soils is drawn the produce of which they are in want, by using the resources and wealth that they derive from other places. In that case, it is the population that enriches the soil to support itself, and not the soil that supports the population by its natural richness. This artificial fertility does not extend beyond a certain circuit, and is limited by the requirements of the central group, and by the equilibrium of the prices of its products, and the prices of products obtained in more distant localities. Beyond that limit all intention or attempt to extend great cultures in poor soils can only result in misery and abandonment of the land. When a soil is naturally fertile and produces remunerative crops, it attracts, fixes, and sustains, by itself, a numerous population. It is really then a principle of wealth; it is essentially suited for colonisation. It is very important, in agricultural economy, not to confound the fertility of soil obtained from the resources of the population, and the natural fertility which has created a population and its wealth. The first has only a relative, the second an absolute value, the latter is the cause of the wealth of the locality, in the former case the soil absorbs it.

Signs which indicate the colonising value of a soil.—How can the colonising value, negative or positive, of any given soil be determined? By the nature of its products, and by the prices offered for those products in their raw state, or manufactured on the spot. The gross amount obtained on the spot; such is the sole and true indication of the value of the culture, of the wealth of the colony; the net profit shows only the amount of private revenue. Whether the land produces precious metals, whether it yields tea, coffee, indigo, cotton, the mulberry, sugar-cane, beetroot, vine, olive, cereals, pastures, or forests, the basis on which the wealth of the colony must be estimated remains the same, and strictly proportionate. For example, the produce of an acre may be sold for £40, and give only £2 of net profit. Another acre's produce may be sold for £10, and still give £2 profit. In both cases, the private interest is the same, whilst the colonising power of the first is four times larger than that of the second; for there has been four times more labor paid for, and the population has received a sum four times larger than in the second case, from an equal area of land.

Different modes of cultivation.—Taking, for a starting point, soils which naturally produce nothing, the value of the raw products would be presented in the following order, namely, poor pastures of wastes ; the marshes of which the grasses are used for litter ; the forest ; the good pastures, and meadows. These four first classes may be designated as products that are obtained with little or no labor. The ordinary labor or workmanship is represented by the great class of cereals and artificial meadows. Then follow the feculent and oleaginous plants next, the textile, and then the cultivated fruits and vegetables. The class which may be designated *haute main d'œuvre*, or high culture, comprises the tobacco, indigo, tea, coffee, the vine, beetroot and sugar-cane, the mulberry, cotton, flax, hemp, &c., &c. All kinds of high cultivation have an essential colonising power, and its products have always a high money value, relatively to the products of low and ordinary cultivation. If high cultivation can be established upon an abandoned soil, and, if it is made prosperous, even only by a large expenditure, it will draw a population which it will fix, and thereby will force the inferior cultivation, necessitated by human wants, to prosper also.

Advantages of the culture of the vine in poor soils.—The raw products of poor soils, which realise the highest prices, are the best adapted for the development of any colony, because, by the culture of such products, the colonist is certain to insure the cultivation of all the others. The capitalist, that powerful agent of progress, will not waste his means in furthering the cultivation of inferior products. He will soon discover that one acre of the Chateau-Lafitte, or of the Clos-Vougeot, gives more wealth for the public than one hundred acres of poor wastes, planted with a forest or turned into an ordinary farm. To speak more precisely, in poor soils, the production of bread and meat will not create wealth, whereas wealth will always produce bread and meat. Never will the cultivation of corn or artificial prairies, either alone or supported by all the stock that it will keep, people the deserts of Champagne, Sologne, or the Landes, without some sort of subsidy, and that subsidy can only be permanent for products of high cultivation, such as the vine, which suits perfectly those kinds of soil, and which always realised a gross price from three to eight times as much as the products of farms of the same acreage. In 1857, the average gross return of an acre of vineyard was above £60 ; the average gross return of wheat, the dearest of all cereals, did not reach £12, and that on the farms surrounding the Champ de Chalons. Taking for a basis the average of the last twenty years, we are led to the conclusion that the colonising power of the vine is from three to eight times greater than of farming ; that in the present circumstances the vine employs and gives food to from three to eight times the number of people, and affords, besides, net profits in the same proportion. If the culture of the vine was as perfect as it might be ; if the disastrous effects of frosts and *coulure** were prevented, the colonising power of the vine would yet be doubled. When I said that the wastes of Champagne, Sologne, &c., were well suited for the vine I did not mean to say that all those wastes should be planted ; but that, if a small portion were, say one acre for every twenty-five, it would start and support all other kinds of culture. And I unhesitatingly state it as a fact that capital would be squandered for twenty-five years, if applied only to the cultivation of corn and artificial grasses, and that it would double itself if spent in the plantation of vineyards.

Comparative returns of one acre of vineyard and of oneacre of farm in Champagne—The following are extracts from my diary—Statistics of a vineyard and a farm in Champagne, arrondissement of Rheims :—" After twelve years of high cultivation, the farm, containing sixty acres, gave the following results :—

* *Coulure* means the dropping, or falling off, of the grape blossom. Some of the bunches disappear, others retain only a few berries. Cold rain causes the *coulure*.

7½ acres of wheat, sold standing,	£48	0	0
Do do oats do ..	24	0	0
Do do rye do ..	40	0	0
Do do fallow do ..	0	0	0
Do do barley do ..	28	0	0
Do do artificial grasses, first year	24	0	0
Do do do do, second do ..	32	0	0
Do do do do, third do ..	28	0	0
Average gross return for sixty acres	£224	0	0

Or £3 14s 8d per acre.

Sixty acres of land, planted with good vines (known by the name of *fine blacks* in Champagne), give, after eight years of advances, and deducting for all unfavorable contingencies, an average gross return, calculated upon twelve years of produce, of six casks of wine per acre, the cask, containing 45 gallons, realised upwards of £4. The total gross return for the sixty acres would be, then, £1440, or £24 per acre. That average price will never decrease, as facts for the last forty years will prove. It is needless to illustrate further the advantages of the vineyard over the farm, it is an undeniable fact. But, to convince the most sceptical that it is not an arithmetical paradox. it will be sufficient to ask him to compare the populations of the vine and the farming districts, In the latter he will see immense plains, dotted here and there with small oases ; in the former, rich villages are crowded together in every valley.

Comparative price of labor in vineyards and farms.—Another proof of the superiority of the colonising power of vineyards over farms is found in the prices of labor. On farms the annual expenditure per acre seldom exceeds eight shillings; on vineyards, it is never less than £5, and it often reaches, as in Champagne, for instance, as high as £8. These figures show that the vineyard keeps from five to sixteen times more hands than the farm.* And, as long as the culture of the vine will continue to improve, more labor will be required. Farming will be subjected to a result diametrically opposed. Machinery for mowing, reaping, threshing, &c., &c., will greatly reduce hand labor. Although that must be admitted to be a decided progress—cheap cultivation gives cheap produce. But we must take care that the laborers rejected by the farmer be employed in cultures of the highest and most remunerative order, otherwise we shall unpeople the country, and crowd the cities.

Influence of the division of the property. —The division of landed property, for these last sixty years, has caused the increase of both labor and population. But, if that decision at first rendered agriculture more productive, the latter soon felt the additional hands that it had to support ; and, at the present day, to produce more and cheaper, agriculturists are aiming at re-establishing large farms, to facilitate the use of perfected machines, and to enable them to move their flocks and herds at ease. I repeat it here, and will repeat it again :—" Bread and meat are the consequences, but not the principles, of colonisation. They constitute necessities, but not riches. They are to the population what the wages are to the laborer : an expenditure, but not the treasury which supplies the pay. The vineyard is, at the same time, the workshop and the banker of the vine-grower. It pays a large tribute to the State, exports to far lands its productions, and yet remunerates the proprietor if he be a real vine-grower."

* On the river Vesle, between Rheims and Sept-Saulx, there are about 1500 acres of marshes, the reeds of which produce a litter of inferior kind. These marshes are worth about £10 the acre, and give a net revenue of about four per cent., which is certainly good for private interest. But this return of sixteen shillings per acre is a poor produce for the commonwealth. Near Rheims, fifty or seventy acres of those marshes were brought into garden culture, after large expenditure of time and money. Each acre is now worth from £200 to £240, and gives annually a gross return of from £20 to £25, or a net produce of about £8. Certainly, the proprietor obtains only five per cent., or a trifle more than he would if the land was unreclaimed ; but who can doubt of the benefit to the public when the land is used as in the latter case ? If the 1500 acres were cultivated, it would maintain twenty families to every one that could live from the produce of the reeds.

CHAPTER II.

OF THE VINE IN GENERAL.

LIMITS OF THE CULTURE OF THE VINE—FAVORABLE SOILS—VEGETATION—METHODS OF CULTURE.

Limits of the culture of the vine in France.—The vine is the easiest tree to cultivate and to propagate in all the districts in France comprised between the Pyrenees and the Mediterranean, and a line starting from Vannes in Brittany and reaching Mezieres through Alancon and Beauvais. The vine will grow well beyond that line but its fruit will only ripen in certain aspects, and that with the assistance of special means.

Soils favorable to the growth of the vine.—The soils calcareous, silicious, aluminous, and magnesious ; the primitive, transitory, secondary, tertiary, and volcanic soils are all suitable, provided that they be not impregnated with water and not situated in low gullies, the abode of cold vapors. The excess of humidity, both in the soil and atmosphere, is prejudicial to the growth of the vine. The vine thrives well in poor soils, pervious to air and water, where any other vegetable will scarcely grow. Before long experience had taught that the culture of the vine was the most remunerative of all kinds of culture, and, therefore, caused its extension to richer soils, it was considered only suited for abandoned lands, and our best vineyards actually are situated on spots unsuited for farming.

Vegetative power of the vine.—The vine is so hardy and powerful in its vegetation that in all climes it throws out its shoots to prodigious lengths. The gigantic vine of Hampton Court, the vines that arch over the great American rivers, are living proofs of the vegetative power and longevity of that plant. Confined to a limited space by the knife of the vignerons, it still retains its productive capabilities for centuries. Upon rocks, trees, against walls, running over or creeping under ground, wild or disciplined, free or tortured, the vine lives everywhere and against everthing, provided that it can obtain the necessary ratio of soil, nourishment, air and sun. But it is not sufficient for the vine to live, it must give fruit, fruit in abundance and of good quality, and, under such circumstances that its culture will leave a profit, large, regular, and permanent.

Methods of cultivating the vine.—For centuries the problem of producing abundance of grapes of good quality has been solved in a thousand different manners. Each mode of vine culture is perfectly practised in special localities, and each is also as well described in so many excellent treatises, and, if the old saying, "there is nothing new under the sun," may be applied at all it is certainly in this particular instance. But are all these modes of culture necessary? I think not, and I unhesitatingly affirm, whilst acknowledging that vineyards are generally well conducted for the interests of both the proprietor and vigneron, by their traditional systems, that one method may be advantageously substituted for all those systems, excepting, however, with regard to the cultivation of table grapes and certain kinds of vines cultivated in rich soils and warm climates, where the cultivation of other crops may be profitably mixed with that of the vine. The method that I am going to explain is not new, and I do not claim it as my own ; it stands on facts and precepts practised from time immemorial—I have taken them from our oldest vineyards; I have selected, controlled, and practised them according to the principles and conquests of modern science :—

THE PRINCIPLES OF VINE-CULTURE.

Culture on stem and close to the ground.—The vine must be planted, cultivated, and maintained on the stem and as near the ground as possible.

Distance between the vines.—The distance must be 3½ feet at least.

Provignage.—The vines must never be provigned or underlaid.

Pruning.—Each vine must every year carry at least one shoot for wood and one for fruit. The shoot for the fruit carries almost exclusively the grapes ; and it must be tied horizontally to a wire or a stake and near the

ground. This shoot must be cut off every year at the end of the winter. The bearing branch must be kept clear of laterals, and nipped off above the sixth leaf. The wood-branch does not require nipping. That produces only a small quantity of grapes; its shoots must be trained vertically and tied up in one bunch. The wood-branch must carry every year two good shoots, one of which will replace the fruit-branch of the previous year. The other shoot pruned with two eyes will then become the wood branch.

Manuring.—The vine must be manured in direct ratio to the quantity of grapes expected to be borne by it, and in inverse ratio with regard to the richness of the soil.

Number of bunches of grapes.—Each vine occupying 3½ feet square of ground, and proportionately manured, will carry 16 bunches on its fruit-branch and 4 on the wood-branch—in all 20, averaging each in weight a little above 1½ ounce or about 2 lb per vine.

Tying and disbudding.—Three times each season, the branches must be tied up, and trained on the supports; and all the unnecessary shoots cleared off.

Hoeing.—There must not be any weeds in the vineyard. The light hoeing should be often repeated, and the deep one seldom resorted to.

Cuttings.—Vineyards should be planted with the best kind of vines, which, by a judicious mode of culture, will produce as much as the coarser sorts.

Straw-matting.—In every locality where the wine will reach an average value of 1s per gallon, the vine should be protected with straw-matting against frost, hail, and *coulure*. The straw-matting would also ameliorate and perfect the ripening of the grapes. Without protection, the vineyard often gives large profits, but it is subjected to grievous intermissions.

Application of sulphate of iron and flour of sulphur against the vine disease.—Every year from the 15th of April to the 30th of May 16 lb of powdered sulphate of iron should be spread over every acre of vines. In vineyards where the ravages of the disease are manifest 16 lb of sulphur should be added. At the same time care must be taken that all the shoots be nipped off above their sixth leaf.

I will demonstrate successively each of the above processes and my demonstration will be supported by example and practice.

CHAPTER III.

CULTIVATION OF THE VINE.

In France, the vineyards are planted in squares or quincunx. In certain districts the shoots of the first growth are underlaid in every direction, so as to fill up all the available ground, without any regard to regularity. This kind of planting is called *culture en foule.** This method is followed in the Haute Champagne and in many parts of Burgundy. Such is the case where the provignage is the basis of planting. In Medoc, the regularity of the rows is preserved during the whole existence of the vineyard. The vine there is cultivated on the same stem, and it is called *culture en lignes.* † These two modes of cultivation are not always rigorously followed, but are modified in an infinite number of ways.

CULTIVATION OF THE VINE ON STEM, AND TRAINED ON LOW SUPPORTS.

Advantages of the culture in regular rows.—The cultivation in rows is the best,

1st. Because it permits the application of all means, and the use of all instruments worked either by hand labor or by cattle. The employment of cattle in working vineyards is of considerable importance as a measure of economy; for, in that case, the only hand labor required is the clearing between the vines.

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* Cultivation in mass. Notwithstanding Dr. Guyot's statement, this cultivation is almost unknown in Burgundy; he should have said, *Franche-Comte*.

† Vineyards where provignage is resorted to, regularity in rows is strictly preserved. Further on, Dr. Guyot gives better reasons for discontinuing that operation.

2nd. Because it facilitates the supervision of the vineyard. At a glance the proprietor can ascertain the work of his vigneron, and the overlooker, in turn, can control with the same facilities the work of each of his laborers.

3rd. Because the means resorted to for supporting, protecting, and trellising the vines are much easier, stronger, and more economical than in any other mode of plantation.

4th. Because, in rows, manures can be equally distributed at the root of each vine; the clearing of wood after pruning, or shoots after disbudding; the carrying of the grapes during the gathering; in fine, all operations in the vineyard are facilitated by the cultivation in rows.

5th. Because the rays of sun warm the ground between the rows, and that without reducing their beneficial power upon the tied or trained shoots of the vine, the earth returning to the vine, when the sun ceases to shine, the heat which it had received during the insolation.

6th. And because the circulation and renewal of air, needed for all good vegetation, cannot take place in a vineyard planted *en foule.*

Advantages of training the vine near the ground.—The shorter the stem the more evident are the advantages of low training, the work done by hand or by cattle, the importation and exportation of refuse or produce, the materials to support or protect the vine, the supervision, the insolation and airing,—everything becomes easier, more economical and more efficacious.

Necessity of the insolation.—When the rows of the vines are low, and directed from north to south, the sun, from its rising to its setting, strikes constantly the vines, it heats equally all the surface of the ground, which then fulfils the place of a wall, and accelerates vegetation in its several stages. It is the reverse when the vines are trained high, and also when they are planted without any order, for in that case the ground is always in the shade, and therefore damp. This dampness causes the *coulure* and impedes the ripening of the fruit.

Necessity of good airing.—The free and regular circulation of air is still more important for the fertility of the vine than the insolation itself. Evident proofs may be obtained by a simple inspection of the vineyards in Champagne when the grapes are in maturity. The paths that separate the different vineyards are generally narrow and shaded, but they are free and straight, and the quantity of fruit on the vines bordering those paths is more than double that obtained from the vines in the centre of the vineyard. This exuberancy of production can only be attributed to the superiority of ventilation, for generally air circulates with difficulty when there are sixteen thousand vines upon an acre of land, especially if those vines are planted *en foule.*

Disadvantages of training vines *too* low.—The *too* low trained vine has a real disadvantage. It is more subjected to the disastrous effects of winter or spring frosts * ; thus very low training can only be considered the best when the vine be preserved from the inclemency of the weather. But, even when exposed to climatic changes the low trained vines will be more profitable than the others.

Cultivation of the vine on stems.—The vine must be grown on a stem, and never underlaid. This is an absolute condition for the making of good wine; it is a truth of the physiology of vegetation as well as an incontestable truth derived from observation and experience. So long as the vine is not properly formed, so long, in fact, as fresh roots keep adding to the wood of the preceding year, the elaboration of the juice of the grape is imperfect, and the wine made from it is not good. I will not say that the older the vine the better is the wine; I do not know it; but this I know, that a vine under eight years old never gives a good wine, whatever may be the quality of the plant. I know also that an underlaid vine shoot, even the growth of an old wine, if roots have been allowed to grow on the portion under ground, gives only a wine of inferior quality, and that

* In this colony that drawback rarely exists, neither is there any danger of humidity. The climate and soils, seem to have been made for Dr. Guyot's method.

that inferiority is in direct proportion to the number of rootlets rings that grow upon the productive shoot. All vignerons know that the wine from a young vineyard, or from vines subjected to provignage, is of very inferior quality. To make good wine the grower must, therefore, respect old vines, and not fill up his vineyard with young plants.

PROVIGNAGE, RECOUCHAGE*, AND GRAFTING.

Provignage.—The provignage consists in burying in a hole of the extent required for the replacing of the vines destroyed a number of one year old shoots; each vine to be replaced will of course require one shoot, so that if there are two or three the buried vine becomes the mother of so many young ones. The shoots are covered over with earth, or earth and manure, according to the requirements of the soil.

Recouchage.—This operation consists in bending the stem under three or four inches of soil and allowing only the bearing shoot or shoots of the year to remain out. In certain districts the recouchage is applied to all the vines and renewed every year. It is even important in certain places, and in Champagne and Argenteuil it is the first operation of the spring. Into a trench, opened with the spade or hoe, the vigneron bends each stem and covers it over with earth as he goes on with the digging; and after this operation the vineyard has the appearance of a field of cuttings. The provignage is executed in different ways, and with different objects. The first, and the most resorted to, especially in Burgundy, is the burying of the vine in a hole as described above. The second is the same as the recouchage with the object of rearing layers; a third consists in putting in the ground the extremity of the shoots so that that portion will emit roots. There are other modes but all are intended to increase the production of the vine and as a substitute for manuring. Provignage, of any kind, is prejudicial to the quality of the grapes, and is not essential to the development of its bearing capabilities which may certainly be affected by proper cultivation on the stem. Provignage causes disorder in the ages, the regularity, the requirements, and the keeping of the vines, and that to such a degree that old vineyards can only be profitably cultivated by the original vigneron or his traditional successor. The proprietor or the purchaser must possess or buy the vigneron with the vineyard or give up all hope of improvements.

Grafting.—Recouchage takes the name of *ensouchement* when it is employed only to form a permanent underground stem, supplied with roots in sufficient number to provide for an extensive outward development of the vine, and also when its object is to furnish increased nourishment to vines planted in uncongenial soil. Provignage and recouchage should never be applied to vines, except in thin and shallow soils, where the process of grafting can be carried out once only in the third or fourth year. Grafting, although indispensable in the production of table grapes, should never be employed, except in cases of absolute necessity, for wine grapes.

OPPOSITE QUALITIES OF THE TABLE GRAPE AND WINE GRAPE.

The qualities sought for in grapes for the table are exactly the reverse of those required for making good wine. The Chasselas of Fontainebleau, or rather of Thomery, the type of all table grapes, gives the most detestable wine that can be imagined. The wine from all the Chasselas is far inferior to the Gouais, the least alcoholic of all wines, and that is the reason why the Gouais is a wholesome grape to eat. The same contrast exists between the fruits suited for cider and those suited for the table; however, the pineaux blancs, the Mesliers, and the Fromentes, which give the best wines, are very sweet and very agreeable to eat, but possess a kind of vinous acridity, and the smallness of their berries excludes them from our tables.

* Recouchage is a sort of laying.

EXAMPLES OF CULTIVATION IN ROWS AND PLANTING EN FOULE OR PELL-MELL.

It is in the magnificent vineyards of the Medoc, at the Chateau-Laffite, Chateau-Margaux, Chateau-la-Rose, &c., that the oldest and most intelligent modes of culture on stem and low training are found. Provignage there is strictly prohibited. I must mention the peculiar and excellent mode of cultivation followed in the vineyards of Chablis. It is a type of culture on stem remarkably well understood.* One can compare the two opposed methods in the neighborhood of Paris, in the same kind of soil, and planted with the same kind of vines. On the slopes of Argenteuil, the cultivation *en foule* is adopted; at Mount Valerien, at Puteaux Suresnes, &c., the cultivation on stem, and low training in regular rows, without provignage. In both cases the production is the same as to quantity, but the cultivation on stem is more economical, and the grapes ripen earlier and better. And, since Argenteuil resorts to annual provignage, Suresnes produces better wines. Unfortunately, the best wines of the district are not good, because the gamai predominates.

DISTANCES BETWEEN THE VINES.

Disadvantages of close planting.—The vineyards planted with from 8000 to 16,000 per acre, are striking instances of mistaken greediness, adopted through ignorance. A vineyard planted with 4000 to the acre produces even more than one planted with 16,000. One may imagine an acre of ground planted with 8000, cherry, plum, or apple trees, or, to render the comparison more analogous, take plants similar to the vine in arborescence, such as the glycines, bignonias, or clematises; it will readily be understood that etiolation, white blight, scarcity of flowers and fruits, and the development of all sorts of injurious insects and diseases, will be the consequences. No horticulturist or arboriculturist could expect fecundity and health in his plants under such circumstances. Well, the vine is a shrub that requires more space than any of those mentioned above. Trained on a trellis, one vine will cover upwards of 100 square yards, or will envelope a tree of the largest dimensions. Such is the natural power of the vine, and it is only by infinite care and special contrivances, that the vigneron can make it produce fruits in a limited space. And all modes of cultivation, the pruning in particular, have for their object the solution of that problem.

Space required for each vine.—There is a minimum of space under which the vine cannot obtain its necessary physiological development, and observation has demonstrated that in less than one square yard of ground the vine will not retain its bearing capabilities without provignage, and of this process I have already stated it is injurious to the quality of the fruit.

PRUNING.

Necessity of keeping a fruit bearing branch and a spur for wood only.—A single vine, to which one square yard of ground is allotted, could cover with its shoots a still larger area; therefore, to subdue its expansibility and confine its growth within the fixed space without prejudice to its fecundity, a skilful pruning must be resorted to; one must, so to speak, satisfy nature by deceiving it, as a squirrel is satisfied by being allowed to run in a revolving cage which is not much larger than the animal itself. It is well-known that trees left to themselves require no care, while those trained in espalier, or in the form of a pyramid, need all the skill of the arboriculturist. The vine is similarly constituted.

Winter pruning.—Two, at least, of the shoots must be kept, and the others cut off close to the stem. One of the two reserved is then pruned two or three eyes above the stem, and the other is maintained in or nearly all its length. This last is the branch that, cut off every year in the spring and replaced by another, better satisfies the activity of the

* Chablis is no exception in Burgundy. There are but few instances of any other mode of culture. I cannot understand how Dr. Guyot fell into such a great error.—TRANSLATOR.

vine. The engravings 1 and 2 show the principle and effect of the most perfect pruning. A wood-branch, CD (Fig 1), has produced four shoots; one of them, CE, the nearest to the old stem, is pruned with two eyes, at E, so as to give from two to four new

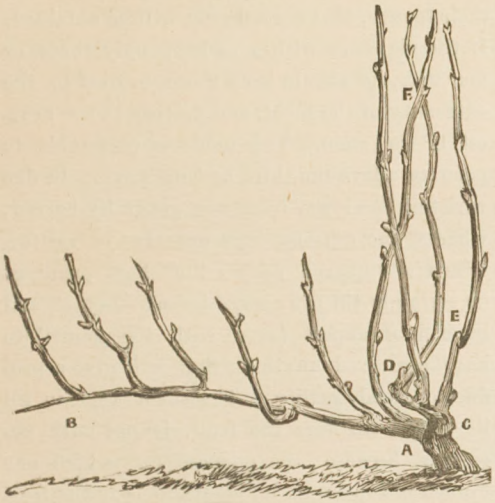

FIGURE 1.—Full-grown branch, before winter pruning. A B—Fruit branch. C D—Wood branch.

shoots according to the vigor of the tree, and those shoots will be supported by a stake from 3 feet 6 inches to 4 feet 6 inches high. One of the three remaining branches, DF, is kept to bear the fruit. It is not necessary that it should be the largest, but the one which appears to have the most projecting eyes and that can be brought easily to a horizontal position, as AB, (fig. 2.) As to the fruit-bearing branch of last year, AB, it must be cut off close to the stem. This method of pruning, the best of all to insure the fecundity of the vine and to sustain its vigor, is extremely simple and may be carried out annually with a marvellous facility. It is well adapted for vineyards planted in regular rows, and if it so happen that the wood-branch does not throw sufficient shoots, or that the fruit-bearing branch has been destroyed, an intelligent close pruning will soon bring back the vine to its normal state. This method that I recommend, because I have practised it with the greatest success, is not new; it has been applied from time immemorial, but without well-founded principles or rules. The shoot left in all, or nearly all, their length, bent in half circle, and tied up to the stem, or planted in the ground or laid down horizontally, and fastened close to the soil under the names of pleyons, pics, racquettes, longs-bois, verges, hastes, courgees, &c., &c., are nothing else but the fruit bearing branches and the wood branches that I have advocated. I advance nothing new, but I put in order and bring to light the best methods, and explain why they are so.

Relations between the production of wood and the production of fruit.—With vines as well as fruit trees, the shorter the pruning the more vigorous are the shoots and the fruit in smaller quantity; long pruning gives more fruit and weaker shoots. A long branch (A'B'), and one pruned short C'D', (fig. 2) tend to the healthy production of wood, and to the regular fructification of the vine, especially if the fruit bearing branch is maintained at a length in proportion to the vigor and age of the vine. Experience and observation only can guide the vigneron with regard to the pruning. As long as the branch kept for wood gives sufficient shoots for the following year, the vigneron can lengthen the fruit-bearing branch; and, when it gets weak, the latter must be reduced in length.

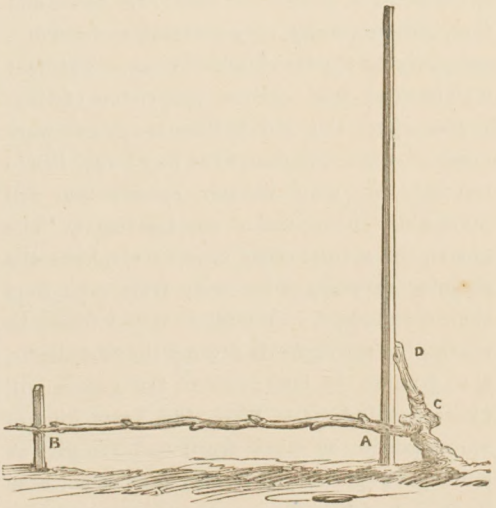

FIGURE 2.—Full-grown branch, after winter pruning. AB—Fruit branch before the growth of the leaves. CD—Wood branch.

This distinction between the fruit-bearing branch and the wood branch is far from being so absolute for the vine that it is for most other fruit trees. For every bud or eye of every shoot of the year contains fruit and wood from its base to its extremity. One can always reckon that two or three bunches of grapes are in embryo in each bud ; true, sometimes there is only one, but absence complete is a rare exception ; and, when the vine does not show any at the start in the spring, it is evidently the result of an internal abortion, or the consequences of a disease.

Theory of pruning.—If every eye contains on an average two bunches of grapes, what reason can be given for keeping one branch with eight or twelve buds, instead of three or four branches with two or three eyes upon each? Why the pruning with long shoot, instead of the cat's head or stump fashion ? Why a fruit-bearing branch, and a branch for wood only ? There lies the fundamental question of the cultivation of the vine. In all kinds of vines, observation shows that in the eye nearest to the extremity of the shoot the embryo of the fruit is strongest. No vigneron has failed to notice that the upper buds always give *some* bunches of grapes, and that they grow there healthier and larger than upon any of the lower eyes. The vigneron knows well that there are oftentimes no grapes on the lower buds, and that, if there are any, they are small and slender, especially on the best kinds of vines. This fact is so obvious that certain proprietors of vineyards, where the old barbarous systems were followed, have rooted out the finest varieties to replace them with inferior species that will give some fruit under any treatment. The gamai, and several other coarse sorts, have the singular property of throwing fruit even from their old stumps. Whether the winter be severe, the spring frosts destroy the first shoots, the pruning be long or short, the gamai will produce some fruit. Well, the finest kind of vines possess as much fruit, and can give as much as the coarsest sorts, only they do not bear it in the same places, nor give it under the same system of pruning ; it is in the higher portion of the shoot that the embryos are the best, and it is at a certain distance from the soil that they can be preserved from the injurious influence of humidity, and snow during the winter. It is on those shoots, judiciously trained in proper season, and in all their length, that a good crop will be obtained. If the vigneron wishes to keep only three or four eyes, he should keep those nearest to the extremity of the shoot, and destroy those nearest to the stem. This mode is preferable to pruning above the third or fourth eye. In fine varieties the lower buds are generally barren, whereas the extreme ones are always fruitful. When a vigneron adopts the short pruning, he certainly throws away his best harvest, and he cannot expect (even with the gamai) to have preserved anything that will give a produce of good quality. The shoot kept in all its length to bear the fruit, is not only necessary because the purpose for which one branch is kept in all its length to bear the fruit does not consist only in the preservation of the best eyes, but also because, and this is the main point, it satisfies the spreading propensity of the vine, preserves its vigor and therefore its fecundity. A few weeks ago the savant Payen was admiring a *Pineau* vine which had been kept barren by short pruning, bearing now a large crop since it had been allowed to run on a trellis. This fact, noticed by a man not less eminent than Payen, M. Becquerel, and therefore of an indisputable exactitude, comprehend all my method of pruning.

Time for the pruning.—The latest the pruning can be done the better. It enables the pruner to judge the vine with more certainty. If artificial means are employed to protect the vines against the spring frosts, the pruning should be effected only when the buds begin to swell, that is to say from the 15th of March to the 15th of April, under the mean climate of Paris.

The bleeding of the vine after pruning.—The bleeding of the vine must not alarm the vigneron ; it does not exhaust it in any way. The water which then runs in abundance is not the sap, it is the stream that feeds each bud as

it passes over it according to its wants and the elements of its sap. The running of that stream does not render it weaker nor unhealthy, but it simply proves that its power of irrigation works, and works well. Acting upon the advice of M. Dugue, the engineer-in chief of the department of the Marna, a man well learned in the practice and theories of natural sciences and mathematics, I have experimented extensively upon the bleeding of the vine; I selected 120 vines of the same age and in the same soil, and before the sap had begun to move I pruned 60 according to the method advocated, and 60 with three spurs, each spur having one or two eyes; I then pruned 60 more with three spurs with one and two eyes, the vines bleeding freely; and 60 treated in the same manner were cauterised with a hot iron so as to stop the bleeding. And, lastly, 60 were pruned with a spur and a long fruit-bearing branch while the vines were bleeding. The shoots and the fruits of the vines subjected to the last treatment were not in the least inferior to those of the vines pruned before the rising of the sap. The vines pruned spur fashion and cauterised gave shoots and foliage evidently inferior, and produced comparatively less fruit than the others. It is by such experiments and by repeated observations as conclusive that I am now in a position to affirm that the bleeding is more beneficial than injurious to the vegetation of the vine.

Advantages of pruning whilst the ascent of the sap is taking place.—Pruning at that particular time offers to the intelligent vigneron a very great advantage: that of adapting his operation to the state of the buds and their degree of preservation. I have often seen the three or four lower buds destroyed during the winter, but in no instances have I seen any of the upper buds injured by the winter frosts. In all countries subject to the effects of a severe winter, pruning must only begin when the sap rises; and in my opinion it would be yet too soon if the vineyard is not to be protected by straw-mattings, or by any other means. In the absence of any appliances for protection, and when it is intended to abandon the vineyard to all risks, the pruning may be effected without any inconvenience or damage from the 15th to the 30th of May, after the buds are all out. The vigneron can then choose the fruits and leave only the quantity proportionate to the energy of the vine. I subjected this method to experiments in 1845, 1846, and 1847, at Argenteuil, with complete success, and that in an old vineyard which had not produced any fruit for four years to my knowledge, and for many more according to the report of the vigneron. In March I cleared off all the small shoots, leaving only from one to three of the best on each stem, I then gave it a good digging, and planted the stakes in lines, although the vines were not regularly planted; I also united the stakes by passing two wires through. From the 15th of May to the 15th of June, according to the season, the spring shoots were from 2 to 5 inches long, and the fruit-bearing ones were easily distinguished from the barren. Most of the upper buds had their two bunches each, and all the inferior ones were absolutely sterile. I then chose one or two of the best branches which I bent horizontally and fastened to the wire, taking care to pull off all the barren buds, and, lastly, I pruned another branch, spur fashion, leaving two or three eyes destined to produce wood for the next year's pruning. In three years I rendered the vineyard very productive. The vines, far from suffering from the late pruning, seemed to gain more vigor every year; the grapes ripened as early as in the other vineyards. With regard to the choice of varieties, of manuring, and of the shallow and deep cultivation, I will return to my experiments and observations made in the neighborhood of Paris in general, and at Argenteuil in particular, for the examples and practical solutions on viniculture, are all to be found in the departments of the Seine and Seine-et-Oise.

Pruning of the young shoots.—This pruning is very simple, it consists:—1st. In stopping all expansion of the young shoots on the fruit-bearing branches, by nipping them off at the second leaves, above the last bunch of grapes.

2nd. In favoring the growth of the shoots on the branch for wood, by training them up a stake, and by taking great care not to cut them off before they have reached a few inches above that stake. 3rd. By removing from both branches all the sterile shoots, which cannot be of any use to the fruit nor to the formation of the vine in the following year.

PINCAGE. *

The effects of the pincage, although invented some fifty years, have only been studied for these fifteen years, and to this day its application to the vine is far from being general. The benefits derived from the operation, executed with intelligence and discrimination, are, however, of great magnitude. I will try to explain them. The pincage is an operation that consists in stopping the expansion of a shoot of the season, by nipping off the top with the nails of the thumb and the forefinger. The pincage differs from the "rognage" † in that respect

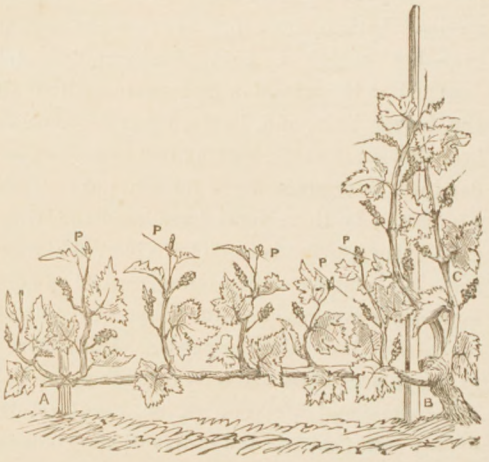

FIGURE 3.—Vine, 15th of May to 15th of June. A B—Fruit branch. P P P P—Point where nipped off.

that the pincage suppresses only the extreme bud of the young shoot (P P, fig. 3), whereas the "rognage" suppresses the fourth, the third, or one half of the shoot The pincage has for its object—1st. To prevent the sap and strength of the vine from being wasted in the development of useless shoots. 2nd. To divert them to the fruits and remaining shoots, and to assist the growth of the latter, and the maturity of the former. The pincage, applied to melons, tomatoes, and other vegetables, has clearly shown that it fulfils effectually these objects. In arboriculture Argenteuil has derived great benefit from its fig trees. By practising the pincage, the young figs are saved from the coulure; they promptly acquire a large size, they ripen sooner, and are richer in saccharine matter. The pincage applied to increase and perfect the production of figs is an old and general practice at Argenteuil, and that practice is a source of wealth for the intelligent population of that district. They often sacrifice a large number of the figs that crowd each shoot to increase the volume of the remaining ones, and the same operation will be applied to the vine when the vigneron will dare to allow it to show all its fecundity, so as to enable him to choose with ease the quantity and quality of fruit that he wishes to obtain. * The pincage has been, and is yet, applied to the vine by very intelligent vine-growers; and it has been experimented and recommended by eminent professors. Nevertheless, the laws for its application are yet rather obscure. For my own part, I can vouch for the facts that follow. If the pincage is applied to all the shoots of a vine without a fruit-bearing branch, all the bunches of grapes succeed well, and the crop is abundant for the first year, provided, however, the number of bunches is proportionate to the strength of the tree; the second year the grapes are not so plentiful, they are thinner and smaller; the third year, the vine has lost much of its vigor, and its buds are very nearly sterile. It remains in that state the following years, and only recovers its fertility by discontinuing the pincage, and allowing it to grow freely. If the vine upon which the pincage has been applied is very strong, the barrenness will take place sooner.

* Nipping off.

† Cutting or clipping off.

* In all places that I know, in Burgundy, pincage is a common, and considered a necessary, operation.—TRANSLATOR.

The pincage applied to one or two fruit-bearing branches prevents the *coulure*, and applied to all the shoots of the vine causes barrenness and final destruction.

I do not know how the vegetable fluids form the wood and the fruits, nor even if those fluids can form the fruit and wood; but what is certain is that, by various chemical processes a woody substance may be converted into sugar, and that nature, during a certain period of the vegetation lignifies and converts into feculæ the saccharine matter of gramineous plants. It is not less evident in arboriculture that an abundance of fruit is detrimental to the growth of wood, and *vice versa*. Thus, there is at least some relation between those two products or results, although differing so much in appearance; and it is obvious that the pincage fixes the grape, prevents coulure, makes it grow larger and ripen sooner. It is easily proved, also, that, when the shoots are allowed to grow much above the fruit, it causes a loss of saccharine matter; for, if those shoots are pressed and put in a cask, they ferment and produce a certain quantity of alcohol. I will relate here an observation that every vigneron could make, but which was never brought out so as to attract the attention of scientific men. A shoot that proceeds from the bud of old wood, or from an old stem, never carries fruit the first year, and that shoot, no matter how healthy and strong it may be, does not even carry a fertile bud; wood only will come out of it. It is only the third wood produced from the old stem that will give fruit. This fact proves clearly that there is in the young wood itself some predisposition, or element, essential to the production of the fruit, and that neither the old, nor even the two year old wood possesses those elements. There are also some shoots that the vigneron recognises as rarely fruitful —shoots large and straight with eyes far apart, and a well developed medullary canal, or, in other words, a large pith—their appearance indicating a large production of wood only. The vigneron prefers a middling sized shoot with close and well-formed projecting eyes. I have practised the pincage on a large scale for several years on the fruit bearing branches which always bore a large quantity of grapes, without affecting in the least the vigor of the vine. To the contrary my experiments showed me that the fruit branch, without the operation of the pincage, rapidly exhausts the vine of all its fruit-bearing shoots, and their growth, which had only been checked by a late clipping off (rognage). The first pincage must be applied as soon as two small leaves have grown above the second or the last bunch of grapes, and above the fifth or sixth leaf, if there is only one bunch. The rule for its application, after the development of the two leaves above the second or last bunch of grapes, is precise and does not allow of any doubt with regard to the time when the operation should be effected in all countries. Of all the pincages the first is the most important.

CHAPTER IV.

MANURES AND AMENDMENTS.—NECESSITY OF IMPROVING AND MANURING THE SOIL.

There are soils of a rich nature where the vine may grow for many years without the assistance of any kind of manure or of any amendment, especially if the vines are at wide distances. But those privileged soils are scarce, and they are planted so thickly and expected to give such large returns that in general the vineyards require the frequent assistance of artificial nourishment. This comprises amendments, composts and ordinary manures.

AMENDMENTS.

Sand, marl or clay.—The amendments consist in putting silicious sands in vineyards planted on calcerous soil, and reciprocally calcerous marl, or chalk in sandy soils. In all countries, and all vineyards, this mixture of sand or marl adds to the fertility of the vines and the quality of the wines. A calcerous and chalky soil always gives the purest wine and the freest from earthy taste. All

kinds of vine will improve under such treatment, and it may even be applied to vineyards in flinty soils—such as those of Medoc—where it certainly perfects the product.

Earthing.—This operation consists in carrying over the vineyard, the soils washed down the valley. This soil should remain twelve months in heaps, so that the weeds and seeds may perish before it is spread over the vineyard. The earthings and amendments must be frequent to supply the place of manures, which, after all, they never do sufficiently. They are nevertheless very important, especially in shallow ground, and their employment is altogether subordinate to their proximity and to other local circumstances.

MANURES.

Composts.—The manufacture and use of certain composts are only a sort of onerous compromise between the earthing and manuring. The labor attached to their preparation, and the reactions that take place amongst their elements are a loss, if not also detrimental to the vine. The stable manure, stratified between two layers of soil, put in heaps, for six or twelve months, has lost one half of its power when it is used in that state. The vine, an energetic plant, does not require a manure wholly decomposed ; unlike an annual, which requires for its rapid development food ready for assimilation, it derives more advantage from manures which take a long time to decompose. Thus, heath, fern, straw, vine shoots, branches of pine &c., which, when buried, rot within two or three years, are excellent manure. Woollen rags, horns, hoofs and leather are precious on account of the long time they take to decompose.

Stable manures.—The farm manure is on the whole, the surest and the most regular in its effects, and it is the only one that can be used when comparative experiments are made on the vine. It was by employing farm manure that I was enabled to study and understand the wants of the vine, and to find decided rules (almost certain) to satisfy those requirements.

Relation between manuring and the produce of the vine.—Upon a chalky, silicious, or aluminous soil, that is to say sterile by nature, a vine, planted in a hole, one foot deep, and 15 inches wide, filled up with a compost containing 8 parts of soil and 2 of stable manure, will be perfectly devolped in the fourth, fifth, or sixth year, according to the climate. From that time, 5 lb of stable manure, spread yearly around the vine, over a surface of about a square yard, and dug in and mixed up with the soil when hoeing, will be sufficient to preserve its vigor and to make it produce a large quantity of fruit. After the eighth year, the soil having become rich by cultivation and manuring, 4 lbs of manure will suffice to maintain the vineyard in the same state of fertility. In soils of middling quality, moderately fertile, I can affirm as the results of my own experiments, that the vine, without injury to its energy, will always yield grapes equal in weight to the quantity of manure used. In highly fertile soils, manure, one-half in weight of the quantity of grapes obtained, will be sufficient. To form an approximate idea of the expense of manuring, relatively to the value of the gross produce, one must suppose a vineyard planted with 4000 vines per acre, each vine giving about 2 lb 3 oz of grapes, or in round numbers, 9000 lb, or 720 gallons of wine, of a mean value of 9d per gallon. The product of an acre would be worth then, £27, and it would have required 8000 lb of manure in a soil of ordinary quality, and double that quantity in poor land. The manure costs about 12s per ton, therefore the manuring in the first case would cost about 45s, and in the second £4 10s, or from the twelvth to the sixth part of the gross returns.

Effects of stable mauure upon the vine.—The question of manuring has been agitated for a long time, especially with regard to the vineyards which produce the finest wines :—Ought the vineyards to be manured, and can they be manured without altering the qualities of the wine ? This question suggests another :—Should they be manured directly with natural stablemanure ? The double answer is simple and

sure. The vineyards should be manured directly with natural stable manure, to insure to the wines their quantity and their normal quality. The only precaution that ought to be taken (and yet it is unnecessary in vineyards planted with regularity) is that the manure should be spread and dug in after the gathering of the grapes, and before the following vegetation. Experience amply proves that for all juicy and pulpy fruits containing saccharine matter, the normal and complete development of the vegetation is an essential cause of perfection, and that, when the vegetable languishes (a general consequence of the poverty of the soil), it yields fruits possessing much acerbity, and wanting aroma or other valuable qualities. The first condition to be observed in order to obtain good wine is to insure to the vine its normal and complete vegetation, and the surest and most economical means to arrive at that end is a judicious manuring. Thomery,* that produces for our tables the richest grapes, and the most delicate in perfume, manures its espaliers abundantly and directly every three years. The vignerons, who are jealous of the reputation of their produce, could never perceive any bad influence from manuring. They suspect, however, that, in the first year of the manuring, the skin of the berry rots more easily. But, for ample compensation, they unanimously state that the produce of unmanured vineyards is inferior, and more so with regard to quality than quantity. The prejudice and error concerning the employment of manures have their origin in a mass of vague observation. Thus, in all cases it has been remarked that the wines from vineyards owned by large proprietors, who do not perform the labor themselves, are better than from vineyards owned by vignerons. The former used little or no manure, the latter resorted largely to all processes of manuring; therefore manuring deteriorated the produce. This deduction was arrived at without considering that the large proprietors trained their vines on stems, that they seldom had recourse to provignage, and thus allowed air and sun to circulate freely; that they were occupying the best sites and most favored aspects; and that, the last and not the least important point, they never changed their fine varieties for coarse ones. Therein lies the secret of the superiority of their wines over those of the vignerons'; and, if they had manured their vineyards, their produce would have been considerably improved. I have heard, for nine consecutive years, the vignerons and proprietors of Argenteuil repeating emulously that the sweepings of Paris had caused their wines to leave the table of the kings to go to the *cabaret des barrieres**. They forget that, since Louis XIV., they have not preserved one single fine variety; they have rooted them all out to plant the gamai. I make a mistake, they have left here and there a few vines of Meslier Francois, and those varieties, of which I fortunately discovered a small plot in a vineyard that had been the property of Roquelaure, which gave me, even with the Paris sweepings, a wine worthy of its old reputation. The hills and slopes of Argenteuil, admirably situated, and possessing a soil well adapted to the growth of the vine, would give, as of old, if planted with pineaux, morillons, mesliers, fromentes, &c., some of the best French wines, even in conjunction with the use of manures. However, I must confess that I have observed that the emanations from fresh stable manures cause a deposit upon the berries of the grapes, and render them detestable. I had a trellis, a branch of which passed in front of a stable window, that was constantly open. Around that window, and especially opposite, the grapes were not eatable; everywhere else they were delicious.

But this is the direct action of the fresh stable manure. This manure, by the absorption of the roots, or the work of vegetation, will never impart to the fruit anything else but its elements of perfection. The utility of stable manure in promoting the vegetation and fructification of the vine is established not alone by the long and sound experience of Thomery, but also by the facts observed in the finest vine-

* A village near Fontainebleau. It enjoys a great reputation for its Chasselas.

* Low inns outside the city of Paris. In general bad wines are sold in these places.

yards in Champagne at Sillery. During seven years, for which period I observed and cultivated the vine there, I ascertained that the two largest proprietors who manured the most and the best have constantly sold their wines to merchants (the very best tasters) from 10 to 20 per cent. dearer than the other proprietors, who did not manure so highly.

Method of manuring.—To save labor, especially in large vineyards, it is advisable to manure every three years, and to put in at once the needed quantity for that time, that is to say, three pounds for every vine on the best soils, six pounds on soils of medium quality, and twelve pounds on the bad ones, or from one to four tons of manure per acre. It will easily be perceived then, that, to maintain the fecundity of the vine, it requires less manure than for the cultivation of corn, in the best as well as in the worse lands, and this proportion in favor of the vine increases still if earthing is sometimes applied. The stable manure must be applied from November till March, and must be dug in and covered over with not less than six inches of earth. It is especially when manuring that the advantage of cultivating in regular rows may be remarked. Long and deep furrows are easily opened between the vines, the manure is distributed equally, and covered over with facility and speed. The manures deposited on the surface, or near the surface, are a double cause of disadvantage and disease to the vine :—1st. The weed grows rapidly and in large quantities, and these maintain a dampness unfavorable to the growth of the vine, and deprive it of sun and air; they cause the dropping of the blossom, and are opposed to the development and maturation of the grapes; and, moreover, they absorb the best part of the manure. 2nd. The small roots of the vine are attracted to the surface, where they grow rapidly, and are exposed to the mutilation of the hoe and to the droughts of the season. It is thus that some vineyards have suddenly turned yellow, and have been reduced to a sickly growth. After the foregoing statements had been published in the *Journal d'Agriculture Pratique*, M. Joigneaux wrote a criticism upon it, which appeared in the *Feuille du Cultivateur de Bruxelles*, October 1858, under the title of "Should the vineyards be manured with stable manures?" That criticism is so much more interesting for all, and serious for me, that it expresses the traditional public opinion, in which I as well as all vinegrowers had been brought up. M. Joigneaux is not satisfied with giving his authority to the opinion that "stable manures applied to vineyards alter considerably the quality of the wines," but he calls the support of other eminent men, such as Roger Schabol, Quintinye, Bose, Noel Chomel, of the Comte Odart, and of the Des Baumes and Merelot, all men that I recognise as my masters, and not as my rivals. That opinion is, therefore, worthy of respect, and I have neither the power nor the wish to combat it with an opinion personal and opposed. Therefore, when repeating here that "stable manure, judiciously employed, never gives to the fruit of the vine anything else but the elements of production and perfection," I do not put forth an opinion, I affirm a fact, the result of experience and observation, a fact that I deliver up to the control of observation and experience. I have ascertained by several years' experimenting upon the chasselas, gamai and pineau varieties, that vines trained on low stems and kept in good state by the application of two pounds of stable manure every year have constantly given fruit not only larger and more savory, but also richer in saccharine matter by one degree than those under the similar condition, but not manured. The experiment is simple and easily carried out, and I earnestly invite the vinegrowers to repeat it, in the hope that in a few years their testimony will have dissipated all doubts upon that important subject.

I could confine my answer to the above statement, but the question is so serious that it cannot be considered too fully. In 1846, in the interest of a commercial house in Champagne, I examined the relative value of the juice of grapes obtained from different proprietors, who had sold "to be delivered" (in advance). One of those proprietors, a very careful and intelligent vinegrower, residing near

Epernay, where he possessed large vineyards, that he manured extensively, was in consequence suspected of increasing his products to the detriment of their qualities; his vineyards, compared with others, were clean and well aired, the grapes were well developed and the berries large; these two last conditions, of course, confirmed the suspicions. But the delivery took place, the juice of his vineyards showed a density of 1.125; that density was the highest in the district for that year. Another proprietor, very scrupulous about stable manure, brought to his vineyard a large quantity of rich soil, the vines flourished well, but the density of the juice was only 1.116—this being below the average of the district. By promoting to excess the growth of the vines in vineyards planted too close, and therefore deprived of air and isolation, it is possible to lower the qualities of the wines, as well by earthing as by the use of composts or stable manure; but if only a vegetation sufficient and normal is maintained, the quality of the wines can be improved as well by stable manure as by composts or earthing. This fact was well understood, and perfectly expressed by M. Ladrey, professor at the Faculty of Sciences, at Dijon, in his excellent work on the chemistry of vine culture and winemaking, and the Comte Odart, a practical man who does not boast of relying upon science, approves, however, the manuring of vineyards and often direct manuring. Therefore, science and practice recognise the advantages of manuring. and prove that it is injurious only when excessively and unintelligently applied. In that respect then, and still relying directly upon observation and experiment, I quite agree with M. Ladrey and M. Odart. The overgrowth of the vine, promoted by earthing, by composts, or other manures, or by provignage, lowers the qualities of the wines, by overloading the tree with wood and grapes filled up with albumen and water. But, when I recommend manuring, I do not mean to advise to make a sewer or a charnel of every vineyard. *Est modus in rebus.* (There is a rule for everything).

TRUE CAUSE OF THE FALLING OFF IN THE VALUE OF THE WINES OF CERTAIN VINEYARDS.

It is true now that judicious manuring does not alter the savor nor the taste of the grapes; if it is also true that it does not lower in the least the value of their juice measured by the gleucometer, what then is the cause of the reduction in the value of the wines of certain vineyards? The cause lies as I have observed and asserted, in the close planting, in the provignage on too large a scale relatively to the old stems, and above all in the changing of the kinds of grapes. On that point there can be no doubt, when the gamai shows 4° with the gleucometer, the pineau shows 10°; and when in excellent years the gamai rises to 9° the pineau rises to 14°; the chasselas remains at 3° and 6°. These are stubborn facts and not mere opinions. Manure as you may an inferior apple, you will never extract from it a juice equal to that of a superior variety. Neither will you, by the the use of manure, turn the the Mirabelle plum into a pig plum. On the variety of vine employed depends the character of a vineyard. The soil indubitably raises or reduces the quality of the wine; it also gives to it a special taste and bouquet, but it does not transform the produce of certain varieties, nor does it reverse their respective values. No soil will cause the chasselas to give a better wine than the pineau; the chasselas, gamai and pineau, might give better or worse wines according to the soil, season, cultivation and aspect; but they retain their respective value, or in other words, the pineau and the other fine plants will produce the good wine, the gamai and the like, the mediocre, and the chasselas and other analogous varieties the bad. I will conclude this chapter by defending myself from the insinuation of personal interest and partiality that M. Joigneaux has so very pleasantly directed against me concerning the re-establishment of the vineyards of Argenteuil, which I have declared possible, even with the manuring. The hills of Suresnes and Argenteuil are admir-

ably well exposed, and the soil and subsoil well suited to the growth of the vine. If the manures from Paris were the cause of the decline in the quality of their wines, in less than two years the intelligent vignerons of those localities could restore them to their primitive fineness, by stopping manuring, for the effect of the manure employed is short-lived. But the vignerons know that their attempts in that respect would be fruitless. They see vineyards unmanured for several years, either through neglect or economy, and the wine from the gamai is far from bein the best of Argenteuil. During nine years I have ascertained those facts on the spot; during nine years I have obtained gamais, chasselas and others from the old vine trees of Roquelaure (the *Meslier Francois*) at Argenteuil, in an old and large vineyard that I had rented. The property in question had preserved its old vine-arbor, its old stem of chasselas, and its other old vines, except two acres that a silk merchant of Paris, the proprietor, had allowed to be planted with gamai by his vigneron That proprietor, careless and indifferent, had never put any manure on his vineyards. In 1842 and 1846 I obtained some magnificent gamais, of which I made pure wine which I sold, after ascertaining that I could never drink it. The wine from the Meslier Francois, made separately, was excellent, and of a rare quality. Since 1849, I left Argenteuil to establish a vineyard of 80 acres at Sillery, in Champagne. After seven years I left Sillery, the vineyard being in full produce. I have no wine for sale. I buy good wines when I find any, which is rare now-a-days; I preferred Burgundy wines to all others, when they contain no juice of gamais, nor glucose, nor beetroot sugar; the white wines of Sauterne, Chablis, and those of Champagne, when they are true and pure, are also the object of my predilection. Lastly, I accept, for their bouquet and their valued hygiene, the good wines of Medoc. It is with the most complete impartiality and disinterestednsss that I undertake a crusade for the benefit of French viniculture. I am quite convinced that the use of French wines and, particularly those of first and second class, has contributed from generation to generation, to found our national character, rich in wit and generosity. I am also convinced that the sovereigns of France who have made the vineyards a serious object of their solicitude have, after Noah and the intelligent chiefs of Abbayes contributed greatly to fraternal utilisation and intellectual progress.

Chapter V.

CEPAGES.

Influence of the cepages upon the products. —Importance of a good choice of cepages.— The vine has its species and varieties, qualities and character essential and distinctive, which are preserved in all varieties of soils, under all climates and aspects. The site, the soil, and especially the climate, enrich or impoverish their vegetation and products, but do not transform one into another. The idea of the cru * has absorbed the idea of the cepage, whereas in reality the cepage rules the cru. If Chateau Laffitte was planted with gamais it would produce a very inferior wine, and if the old stems of the Clos-Vougeot were replaced by that variety the wine would be worth 50 francs the cask instead of 1400 or 2000. But if the Carbenet Sauvignon of Medoc and the franc-pineau of Burgundy were cultivated at Madeira, at the Cape, in Spain, in Algeria, or at Auxerre, in each locality they would produce good wines which would remind one of the best Bordeaux or the finest Burgundies; they will be worth more or less according to the soil, aspect, climate, season, mode of culture and wine-making, for each of the above has unquestionably a great influence upon the delicacy, richness, taste, and bouquet of the wine; but the Cape, Navarre, Madeira, or Auxerre wines will resemble good Bordeaux and Burgundies. That experiment has been repeatedly made, and made on a large scale.

* Cru is employed for vineyard, and also for the produce of the vineyard. The crus of Tonnerre mean the produce of the vineyards of Tonnerre.

The sovereigns supply their tables with good Burgundies and Bordeaux from the Madeira and the Cape, grown on two of the largest vineyards, and the Duke de la Vittoria (Espartero) can produce some Medoc grown in his vineyards of Navarre, which one would declare to be true Bordeaux, only that it retains the acrid taste common to most of the Spanish wines, and that taste is due to a wrong process of making and keeping. The Auxerrois has never had a high reputation as a cru. Well, the wines from the best cepages are as good as any of the best crus. So in 1858 the gamai wine was sold at 50 and 60 francs the 45 gallons, and the pineau wines at 300 and 400 francs. It would be idle to allege that those pineaux are produced on privileged sites. Those sites would soon lose their reputation if they were planted with gamais, and the wines would only realise 10 or 15 francs per cask of 45 gallons more than the wines of other crus of the same district. The cepage is, therefore, the principal basis. We should speak of wines as the Pineau wine of Burgundy, Carbenet of Bordeaux, wine of fine cepages of Champagne, and not Champagne wine, Bordeaux wine, Burgundy wine; for under these three denominations and in the same vineyards the most exquisite as well as the worst may be and are produced. Those wines are entitled to the same brand, but the deceit becomes impossible if they are made known under the names of fine cepages or coarse cepages. The renowned vineyards have preserved their high reputation because they were planted with superior cepages and kept by wealthy and intelligent men, and that those cepages have remained almost an object of worship. This sort of worship for the cepage preceded that apotheosis of the cru; the superstition for the cru has destroyed the respect due to the cepage, the principle has disappeared in the selling of a good name. While advocating the cultivation of the finest varieties, wherever they will grow in France I do not intend to disturb the equilibrium of the cultivation and production now in existence; it is not destruction but amelioration that is meant. I have no intention either to become the Don Quixote of the connoisseurs in wines, by conjuring the vinegrower to sacrifice the substantial benefits of the *quantity* to the chimerical value of the *quality*. On the contrary, it is in the name of private and public wealth that I address myself to the vigneron, to the proprietor of vineyards, and to society at large.

Increase of the quantity and quality in the products by the substitution of fine for coarse cepages.—If the vigneron receives a higher salary for his labor, the proprietor higher interest from his vineyard; if France finds an article of exchange more advantageous in the *quantity* of her wines without *quality* than in the quantity with the quality, I shall insist no longer in my attempt to change the present course of ideas on vine-culture, for my sole aim is to prove that it is possible now to obtain both quantity and quality. This can be effected simply by replacing, as the case arises, the coarse varieties by fine ones, and by planting new vineyards only with the latter; cultivating of course according to the method I have recommended. It is scarcely twenty years since arboriculturists first knew how to make fruit trees produce as much fruit, and as fine and good, as they choose; they have extended their science to the production of grapes, and there is not one who would be embarrased to make a vine bear the very sort of fruit that its development and vigor would permit. In this respect the arboriculturist is far in advance of the vigneron, because he has been better instructed, more encouraged, and more publicly rewarded than the latter.

Comparative value of different vines.—Even to this day there is nothing fixed on that point; in fact we have scarcely anything else but obscure reports upon the comparative value of the different vines for winemaking. A few observations with the gleucometer, a few chemical analyses upon a dozen species of vines—these are all the acquirements in œnological science. In 1819 the Duke Decaze, impressed with the importance of vine-culture in France, being desirous also of establishing it upon positive basis, and insuring its progress

by diffusing a knowledge of vines and their respective qualities had founded the ampelographic school of the Luxembourg under the direction of M. Hardy. But that school could not lead to any practical results which have their sanction only in the making of the wines. It was on too small a scale, the observations were restricted to leaves, wood, and fruit; it was only a chapter of botany, confused and obscure, which did not fulfil the purpose of the illustrious Minister. Since the foundation of the ampelographic institution by the Duke Decaze till the publication of the French Ampelography by M. Rendu, no official attempt was made to throw light upon the subject of vine-culture and to give it a progressive impulse. If lectures have been delivered, and works published, if the products of vineyards have been exhibited at agricultural shows, these efforts were the result of private enterprise, and consequently have little or no influence upon the question of vine-culture.

Means to procure vine plants.—Until the comparative value of the different kinds of vines be scientifically established I shall unhesitatingly say to the vignerons: Plant the new vineyards with the finest cepages that you know; you alone can distinguish each of them in your localities. Better than the proprietors or the scientific man, you know their qualities and defects. Take the best cepages, cultivate them carefully, adopt the pruning that fertilises them; give them the necessary supply of manure, and the returns from your vineyards will be double; then your vineyards will keep two families of vignerons instead of one; the salaries will increase, the district will be enriched, and you will have contributed to the wealth of France.

To proprietors.—Buy the cuttings from renowned vineyards, and save the finest cepages of your own; plant them in a nursery and you will then always have a stock of vines to fill up old or to plant new vineyards. Do not have recourse to provignage, replace the missing vines by two-year-old plants. Apply as much earth and manures as the soil will require; keep a stem and a fruit bearing branch. Do not spare hard labor, and your wines will double in value and equal in quantity the wines of the coarsest kinds of vines.

To the administration.—Procure during the pruning season, the cuttings of the finest cepages, &c, of the vineyards in France. It is easy and inexpensive to rear millions of vines in two years. These vines sold at low prices (5 francs per thousand) * would cover all expenses of collection. Create then in Algeria, in the Landes, in Sologne, as many nurseries and model vineyards as there will be of deserts to populate, and after ten years, the capital employed will give ten per cent.; the colonies will be established and the French wines will be bought in every part of the world. By adding to the above immediate means, the importation and the study of foreign cepages which have attained celebrity, the science of viticulture and anology will be definitively and firmly established.

BEST CEPAGES IN THE DIVERS PARTS OF FRANCE.

I recommend the following sorts:—

In the regions of the south and south-west of France.

For grapes to make raisins:—Mayorquin or bourmen; Panses.

For luscious wines:—Furmint, Grenache, Maccabeo, Malvoisie, Muscat blanc, Muscat noir.

For good wines:—Carignane, Clarette Marsanne, Petite-chiraz, Picpoule, Roussane, Rousselet, Roussette, Ugni, Vionnier.

In the Region of South West.

For the best wines:—Carbenet, Carbenet gris, Carmenere, Cruchinet, Muscadelle, Sauvignon, Semillon, Verdot.

For the best brandies:—Folle-blanche (Gouais).

In the East, Centre, and West.

For good wines:—Epinette and blancs-fumes,

* The lowest price I heard of in Burgundy was 30 francs. Nurseries such as the one mentioned by Dr. Guyot do not exist. A few kinds of vines may be had in the neighborhood of Paris or at Fontainebleau at from 50 cents to 2 francs a-piece.

Fromentes roses, blancs and gris, Gentils roses, blancs and gris, Mesliers, Pineaux blancs or chardenays, Pineaux gris or beurots, Pineaux de la Loire or de Vouvray, Pineaux noirs or noiriens, Plants dores, verts and gris, Rieslings Savagners.

Some of the names that I have cited are local names quite unknown beyond their own district. The same vines are known unde different names in the next department. This is one of the grievous consequences of the want of encouragement and instruction in vine-culture. There are not, in France, forty cepages which are worth cultivating for the quality of wines they produce; and those forty kinds are confounded under four hundred names enumerated in divers ampelographies. The distinctive and relative qualities of those cepages in richness of must, tannin, acids, salts, coloring matter, essential oil (ananthæ) and bouquet, have never been ascertained, and consequently their respective qualities and defects for wine making are still unknown. With regard to the vine and its products, we are yet in full alchemy; but this alchemy is so rich in local facts and in observations upon the best vineyards that it is ready to be drawn out into a clear nomenclature, and founded upon positive chemistry.

Summary examination of the relative value of the fine and the coarse cepages.—A few facts will suffice to prove the foregoing statements. One hectolitre (22½ gallons) of juice of chasselas contains from two to three per cent. of alcohol; one hectolitre of juice of gamai contains from five to seven per cent.; one hectolitre of juice of pineau contains from 10 to 14 per cent. Therefore one hectolitre of pineau is worth for alcohol alone two hectolitres of gamai and four of chasselas. An abundant crop of chasselas wine during three years is ruinous; for an empty cask containing three hectolitres costs often as much as nine hectolitres of wine. Abundance of gamais during the same period involves the vigneron in difficulties, because the casks are dear and the price of the wines low. An abundance of pineau, whatever may be the number of years, is always fortunate, for the consumption of that wine is unlimited, and the prices remain constantly and relatively very high. Three repeated failures in the crops of coarse wines cause misery for the vigneron and the proprietor, because the consumers of that sort of wines can easily replace it by beer, cider, or by artificial drinks, and refuse to pay for it beyond a certain price; besides, the keeping of those wines is difficult and costly, on account of the low price relatively to the large expenditure for casks and the management, whilst the scarcity of the fine wines raises the remaining stock to indefinite prices; first, because they can never be replaced by artificial drinks; second, because they can be kept for many years; and third, because the gradual increase of their value amply compensates for the cost of casks and maintenance. It is unquestionable that he who plants. now-a-days his vineyards with coarse kinds of vines, ignores his own interest.

Variation in the returns of a vineyard, according to the nature of the vine cultivated therein.—The wines have an intrinsic value in alcohol, and that value is always relative with the cepage producing the wine. Therefore, supposing an equal quantity of juice, the revenue of the vigneron is represented by 3 for the chasselas, 6 for the gamai, and 14 for the pineau. But, by the value of the taste and bouquet, by the hygienic and stimulating effects upon the physical and intellectual powers the difference between the fine and the coarse wines is more clearly indicated, and for that reason, even now, the fine wines are sold for upwards of 200 francs per cask, when the gamai realises only 25, and other inferiors 12 francs.

Relation of the value to the quantity of the produce of fine and coarse plants.—The mean produce of the vineyards planted with fine cepages, in the districts of Rheims and Epernay, is about 30 hectolitres per hectare* the produce of the vineyards planted with coarse cepages is 60 hectolitres; when the hectolitre of the latter is worth 25 francs, the hectolitre

* The hectare is 2 acres 1 rood, 37 perches. Nearly 2½ acres.

of the former is worth more than 50 francs. The gross return per hectare of both vineyards, is, therefore 1500 francs. The expenses of all kinds do not exceed 750 francs; the net profits are, therefore, 750 frs. per hectare, and represent an interest of 10 per cent. on the capital invested, 750 francs being the maximum of the cost of planting an hectare and keeping it unproductive for seven years. But, if, through abundance of crops the fine wines amount to 60 hectolitres and realise only 25 francs per hectolitre, the net profits remain the same, and the coarse wines, having fallen to 10 or 12 francs, cease to cover the expenses. When the crops have failed, the misery in the districts where coarse wines only are made is sometimes terrible, because the consumption of such wines is annual and local, and large crops occasion an unremunerative price. To be convinced of the superiority of the fine cepages it is sufficient to consider the prodigious wealth of the great vineyards and the relative mediocrity and poverty of those planted with coarse kinds of vines.

Chapter VI.

Different works to be done in the vineyards.

Weeding.—Hoeing.—Besides the dressing and tending of the shoots, the staking or trellissing, the cares and operations required to keep the vineyard in order may be stated as follows:—Do not allow any foreign vegetation around the vines; neither any useless vegetation upon it. An absolute and permanent cleanliness of the soil from the first movement of the sap until the gathering of the fruit is the foremost condition for the health, fecundation, fertility, and the ripeness of the grapes. Weeding a vineyard is clearing the soil in which it grows, to destroy, with hand or a hoe, the weeds that interfere with the growth of the vine. Hoeing a vineyard is to scrape lightly the surface of the ground, so as to refresh the foot of the plants and to facilitate the permeation of the air and sun, which accelerates the vegetation. The weeding and hoeing, which are generally repeated three times in a season, must be done oftener if necessary; the long grasses deprive the vine of respiration and heat, the smallest maintain upon the soil a pernicious moisture which prevents the airing and insolation of the ground. A vineyard planted upon a lawn, were it mown every day, would never be fertile. The vine delights in soils, the surface of which is rough and dry, even were it rocks or stones. Humidity and freshness are only favorable to the vine at a great depth where its roots seek for them; for that reason deep cultivation is unnecessary, especially in light soils. Lengthened experience has proved that fact.

Necessity of superficial cultivation.—Except to bury manures, or for the performance of provignage the digging of the vineyard has only for its object the azotising of a couple of inches of soil, otherwise, the digging of the soil has no importance whatever, for the vine thrives better in a firm and trampled than in a loose and light one. This fact can easily be verified on the rows bordering a footpath.

Necessity of preventing the soil from being shaded by useless shoots.

Those shoots have the same inconvenience as the weeds.—The vineyards of Tourraine would be twice as fertile and its products much better if the old and respectable stems were not overloaded with a luxurious foliage which folds itself into an impenetrable maze. The thinning out, clipping off, and tying, must be attended to as carefully as the weeding, and proportionately to the vigor of the vines.*

Proper time to work in vineyards

Weeding and hoeing.—The vigneron must carefully select the most opportune time to

* Longstakes.

work in his vineyard. Hoeing, for instance, must never be done when the soil sticks to the feet or the instrument used. Because, not only the weeds cannot be destroyed under such circumstances, but the soil gets so hard by its ulterior dessication. that it ceases to be pervious, and the following operation is very difficult of execution. No work should be done after heavy rains. The vineyards should never be dug or hoed after frost, however light it may be; for, after a white frost, the ground is in the same state as if it had rained. It is then necessary to wait for moving the soil, until the sun has restored it to its normal state; nay, it is better to wait till the white frosts have ceased, for it has been ascertained that one-half of a vineyard freshly hoed is more subject to the bad effects of frost than the other half which has not been hoed. I will incidentally mention that the same remark applies to a vineyard partly manured. The part manured remains intact, and the other is completely destroyed. With regard to vineyard works, the vigneron must be like the good gardener, who has his days for sowing, planting, weeding, hoeing, &c. The choice of the proper time for each operation is one of the most important conditions for the vine as well as for the garden. Thinning out, nipping off, clipping off, and tying, should not be done after heavy rains, on account of the bad state of the soil, nor during a very hot day. The excessive heat would be fatal to the flowers and fruits suddenly deprived of shade. Dull weather and slightly humid is very favorable for these operations.

Chapter VII.

TYING AND PRESERVATION OF THE VINE.

TYING, STAKING, USE OF IRON WIRE.

Pallisage, Tying.—Tying has for its object the fixing of the shoots to a stake, to a lath or batten, or to a wire, so as to keep them in the position required. In most of the French vineyards stakes are used; the length of those stakes varies from 18 in to 4 ft 6 in. Tying is a physiological condition of the cultivated vine; nature has provided it with tendrils, which enable it to effect that object, even in its wild state; it uses them to seek for air and sun, and to support its branches and fruits. These tendrils are important for its health and vigor. We must, therefore, replace by artificial means the natural supports that the pruning takes away from the vine. Good gardeners know well that the grapes of a vine well tied up are finer and of better quality than those grown on a loose vine The vigneron ties the branches and spurs after pruning and the shoots as they grow.

Trellis and stake.—Of the means of supporting the vine, one single stake is the worst, because when the shoots are tied around it most of the leaves and even the fruit are deprived of air and sun. Tying on trellis is the best. At Chablis, and in the neighborhood of Tonnarre, a stake is employed for each branch or spur of vine, which then takes the shape of a fan. It must be a very unfavorable season if the fruit under such conditions does not attain perfect maturity. But this intelligent mode is more costly than trellising with laths or wire. By the method I propose there would be 4000 vines per acre. That number would require 4000 short stakes, from 2 ft to 3 ft long, and which would be put into the ground from 5 to 8 in deep, according to the soil, and planted in lines three feet from the vine. The small stake is used for a double object:—1st. To tie up the fruit-bearing branch at a distance of 5 or 6 in from the soil. 2nd. To fasten a wire batten or lath at a distance of 20 or 24 in. from the soil. The shoots of the fruit-bearing branch are tied up to that lath, batten, or wire. The stakes of 4 or 5 ft long are fixed close to the stem. The shoots of the wood branch are tied up to them.

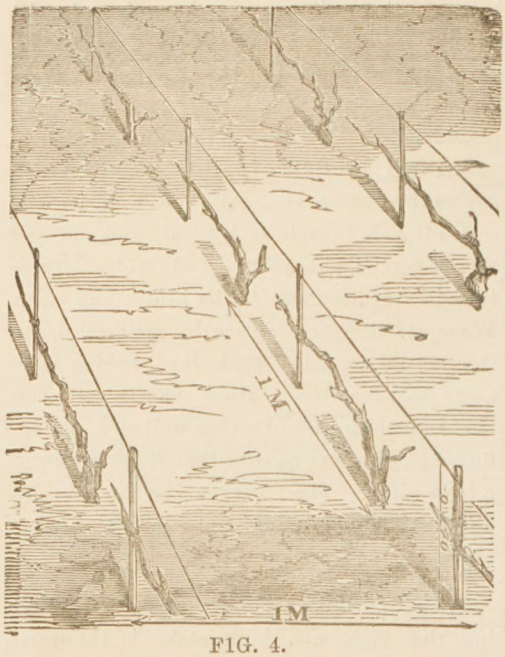

FIG. 4.

Figure 4 represents the small stakes with the wire fastened on the head of each one, and the vine pruned with its fruit-bearing branch and wood branch, or spur.

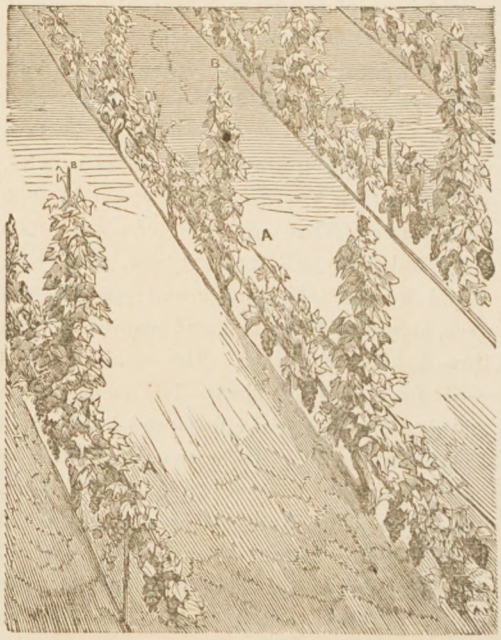

FIG. 5.

Figure 5 represents a trained vineyard in full vegetation; the vines have been thinned out, nipped off, and tied up in August and September (November and December in Victoria, Australia). The long stakes support the future wood for each stem. A A are the fruit-bearing branches trained on the wire and the short stakes. B B are the wood branches, trained on the long stakes.

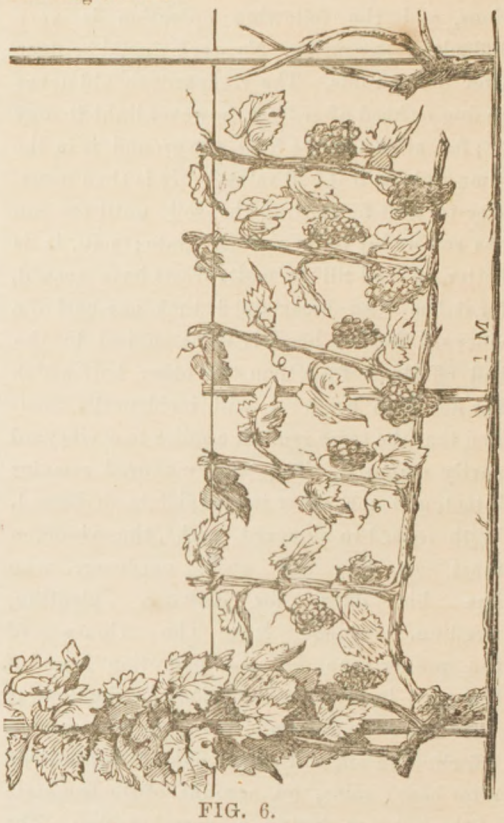

FIG. 6.

Figure 6 represents an isolated vine, in the same state of growth as represented in Figure 5.

This system of staking is more economical than the one used in Burgundy and Champagne. It necessitates less stakes and only about 5 cwt of No. 14 wire per acre.

NECESSITY OF PRESERVING THE VINE AGAINST SEVERE FROSTS, HEAVY RAINS, &C.

Preservative measures against frosts and rains are of great importance for the successful culture of the vine. Those means only whose efficiency cannot be contested are made use of by aspiring proprietors. A man of ordinary intelligence, if told that to preserve an acre of vines it would require upwards of three miles of straw mattings, would declare the project to be chimerical. But that chimera is like the

railways and the electric telegraph—in less than thirty years it will be classed among the realities.

The vine is subject to many drawbacks, amongst which may be noticed, especially in the centre and northern parts of France:—1st. The spring frosts, which destroy the fruitful buds. 2nd. The continuous and cold rains of June, which prevent the fecundation of the blossom, and cause the coulure. 3rd. The autumn frosts, which cause the falling of the leaves, and prevent the ulterior progress of the grapes. 4th. The rains of that season, which cause the grapes to rot.* I do not speak here of hail, diseases, insects, all of which have their share of the crops, because they are not of such a permanent character, and not so connected with the ordinary march of the season. Latterly the prevention of the vine against the scourges above mentioned has been much discussed, and, in particular, preservation against the spring frosts. But the means which do not provide against all the four will never solve the problem of obtaining crops with certainty and regularity. To preserve an acre it would require an extra annual expenditure of £8. The result would be a sure crop, double in quantity and superior in quality. I would not, however, recommend these preservative means in vineyards where the produce does not realise above one shilling per gallon.

PRESERVATION BY STRAW MATTINGS.

Vineculture, conducted as stated above, becomes an industry which gives sure products and calculable returns. Such is the cultivation of the peach trees at Montreuil, and the chasselas at Fontainebleau. It is precisely that mode of preservation, regular, permanent, and sanctioned by long experience, such as the walls and matting of Montreuil and Thomery, that ought to be applied economically to the vine cultivated in the open field. To carry out that method, straw matting of 20 in wide is necessary. Those mats are rolled up and unrolled in proper time. From the 15th of March to the 15th of November the position of the lines of matting is changed four times.

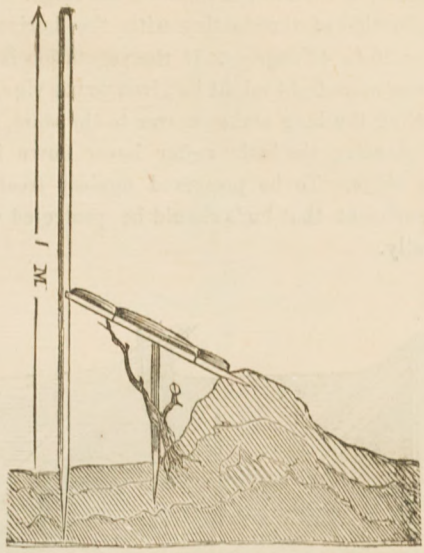

FIG. 7.

1st position.—From the 1st of April to the 25th or 30th of May the mats are fixed nearly horizontally above the pruned vines (Fig. 7). The mat is supported by a small rafter, one end of which is planted in the ridge, and the other fixed by a nail to the long stake.

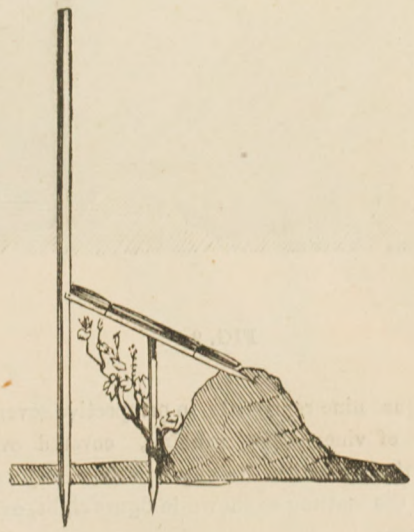

FIG . 8.

* In Australia, spring frosts and autumn rains are the only drawbacks. The latter are particularly to be dreaded in the neighborhood of Melbourne and in New South Wales.—TRANS.

Figure 8 indicates the same disposition as Figure 7, but the vegetation is more advanced. In both figures the long stake is to the east, south, or south-east of the ridge. The stem is against, or even in the slope of, the ridge. The inclination of the matting with the horizon is from 30 to 40 degrees. If the vegetation is too fierce, more light might be given to the vine, by putting the long stake nearer to the stem, and by planting the little rafter lower down into the ridge. To be preserved against frost, it is sufficient that buds should be protected vertically.

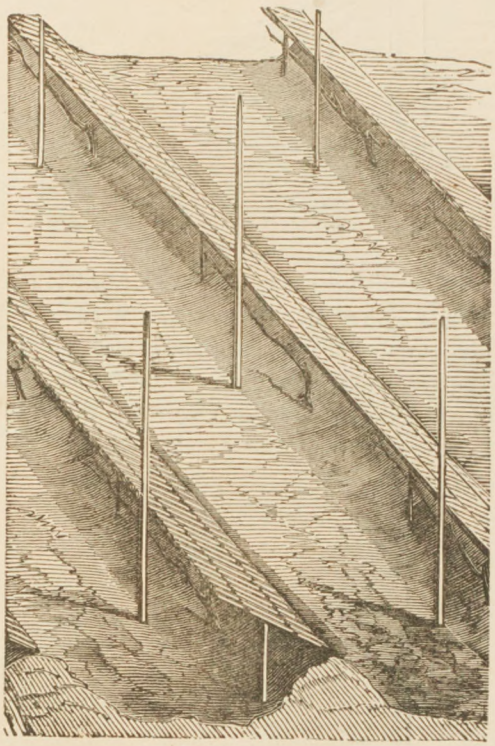

FIG. 9.

Figure nine represents in perspective several rows of vines after pruning, covered over with the mattings. In one day four men can place the matting as shown in figure eight, over one acre.

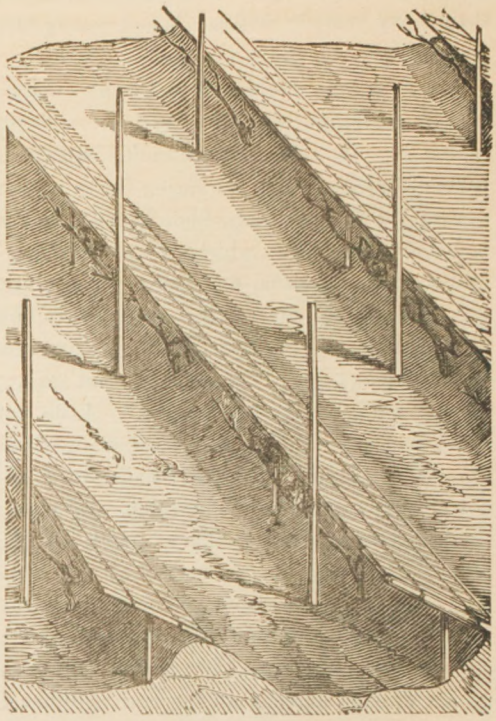

FIG. 10.

Figure ten represents, in perspective, the vines (with shoots) in vegetation, protected according to the dispositions shown by figure nine.

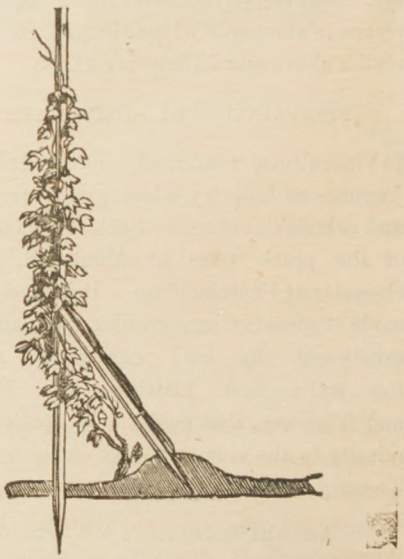

FIG. 11.

Second position.—From the 30th of May to the 5th or 10th July, the mats are raised to an angle of 60 degrees with the horizon; and the angle is opened to the east and south closed up to the west and north. Figure eleven shows the elevation of a vine after the above operation. The ridge is reduced, the shoots are reaching the upper part of the stake and their base where the grapes are remains alone sheltered against the cold of the north-west. According to the season and climate, the inclination of the matting may be increased or reduced. If the temperature is dry and hot, the matting should not be inclined so much. This is obtained by putting the stake nearer the stem.

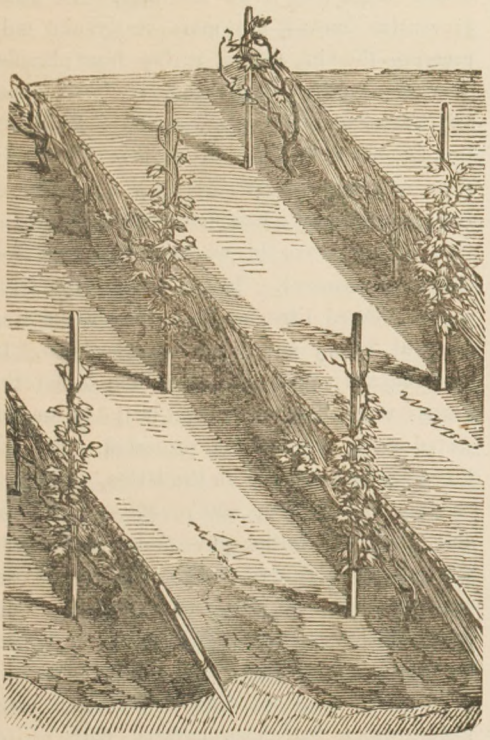

FIG. 12.

Figure twelve represents in perspective the relative position of the vines as shown in figure eleven. The shoots of the fruit-bearing branch are nipped off, but not those of the wood branch.

FIG. 13.

Third position.—From the 10th July to the 10th or 30th of September, according to the season, the mattings are fixed vertically to the north and west of the vines. Figure thirteen represents the elevation of the vine in full vegetation, supported by the long stake. The matting is fastened to the stake and the ridge has completely disappeared. The matting fixed vertically, two inches behind the vine, strengthens the grape, and increases its size as if it were grown on a trellis; it accelerates the maturity by one week at least, and perfects that maturity in a remarkable manner.

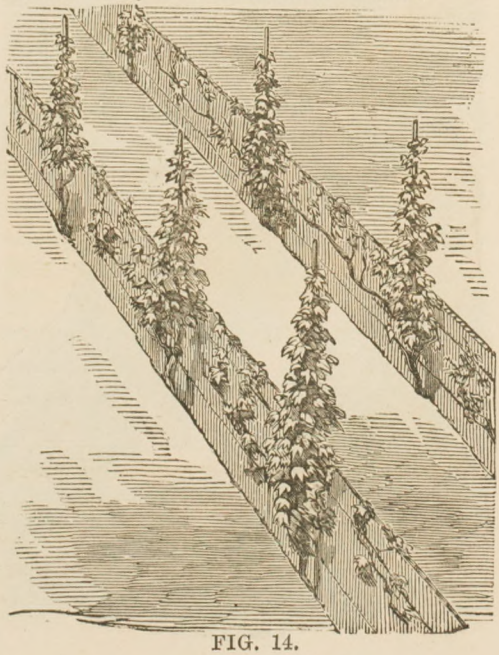

FIG. 14.

Figure fourteen represents, in perspective, that which figure thirteen shows in elevation. There is nothing so agreeable to the sight, as vines trained in that manner; the leaves are of a deep green, and the black bunches form a beautiful relief on the matting.

Fourth position.—In the latter part of the season, to guard against the autumn frosts and the rains, the mattings are brought back to the position they occupied in April and May.

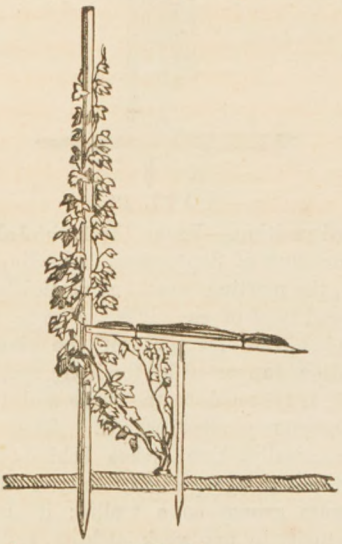

FIG. 15.

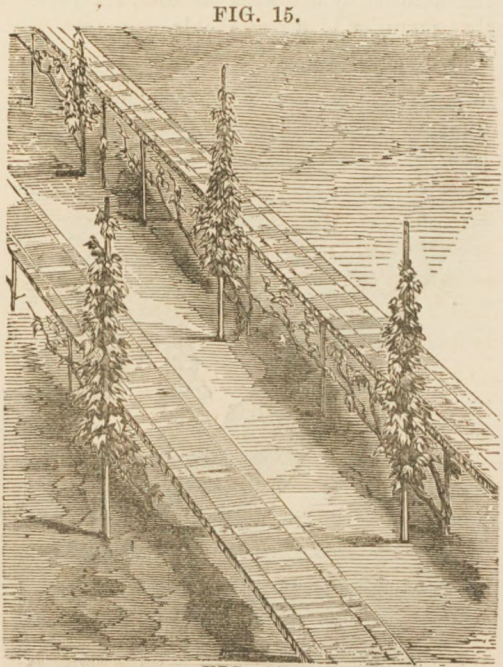

FIG. 16.

Figures fifteen and sixteen represent in elevation and perspective the state of the vine at that time. This process enables the growers to leave the grapes on the vine until perfect maturity * and prevents rottenness. For is there a vigneron who never found himself in great perplexity in the gathering season? Perhaps the grapes are not well ripe, and the frosts threaten to cut off the leaves, and, perhaps, the green grapes; or the rains will cause the grapes to rot. Will he gather? If he does, the wine will be bad, if he does not the grapes will be destroyed. The fourth position of the mattings relieves him from his hesitation.

Disadvantages and insufficiency of preventive means other than straw mattings.—All other preventive means, are more costly and only preserve the vine against spring frost; besides they deprive its young shoots of air and sun, and thereby induce the *coulure*. Preservation against spring frosts, without the conditions of airing and insolation is no preservation, it is almost a complete destruction of the crop. I can prove this assertion by a very conclusive experiment. In 1857, the unprotected vines suffered little or none from the spring frosts at Sillery and in the neighborhood. In the vineyard of 80 acres that I planted the grapes were showing as well in the 68 unprotected acres as in the 12 protected ones; but there was no *coulure* in the latter, and their produce varied from 600 to 800 gallons per acre, while the former gave only from 200 to 400 gallons per acre. The *coulure* had occasioned a loss of 50 or 60 per cent. of the grapes, although 15 acres had been protected by a quantity of pine branches and 15 others by long marsh grasses. The surrounding vineyards, which had been covered with calico, were also damaged by the *coulure* and did not give larger returns than the unprotected vineyards.

* This system of protection is scarcely applicable to Australia. Gardeners, however, may adopt the method with advantage, and vinegrowers in New Zealand and Tasmania will find it indispensable. —Trans.

Advantage of permanent mattings.—The agricultural societies of Rheims and Chalons, and most of the experienced vinegrowers have ascertained that the permanent use of mattings was perfectly consistent with the cultivation of the vine; that, under their horizontal shelter, the buds were guarded against frosts, and develop themselves with more vigor; that the grapes grew larger, and fecundation was effected with greater certainty; and lastly that maturity was more rapid and perfect. Remarkable and complete reports upon the subject were published in November, 1856, and March, 1858, in the Cultivateur de la Champagne by M. Dugue, Engineer-in-chief, and M. Bancalin, Engineer of roads and bridges. A vineyard protected with mattings is a beautiful sight, a picture. Elegance, propriety, cleanliness, neatness, richness of vegetation, everything is shown to advantage, and the colored wreaths peering through the verdure appear as reliefs upon the yellow mattings and form an admirable *tableau*. These results, I repeat, are not surprising. The benefits of sheltering trees are known by gardeners from time immemorial; I have simply sought to extend those benefits to the culture of the vine.

It is not the rising sun that destroys the chilled buds.—The general acredited idea that the first rays of the rising sun are the principal cause of the destruction of the frozen buds is erroneous. Repeated experiments have convinced me of it. The direction of the rows that I planted in 1850 at Sillery is north-south: my mattings therefore opened to the east and received the first action of the rising sun. In the nights of the 4th and 5th May, 1856, and the 6th and 7th, a double and severe frost struck all the vineyards, in Champagne, and, in particular those of Sillery. Justly alarmed by the coldness of the air and the clearness of the sky in the evening of the 4th, I had ordered some 300 yards of mattings to be fixed to the eastward of the protected vines in case of hoar frost during the night. The hoar frost having been very thick, my orders were executed from five to seven o'clock in the morning, before the rising of the sun. The sun rose, shining brilliantly. At ten o'clock the disaster was unmistakable and complete upon all the unprotected vines. Those placed under the mattings as indicated in the first position, (figure nine) and receiving directly the rays of the sun, were not injured in the least; while those that had been sheltered from the sun altogether were as completely destroyed as those which had no protection whatever. The same experiment was renewed on the following night upon a portion of the vineyard in a higher situation where the frost had not destroyed all the buds, although unprotected. Those buds were frozen the second night as well as those guarded against the rays of the morning sun. I invite the vinegrowers, for their own interest, to repeat those experiments.

The cold wind does not freeze the buds.—To oppose the action of hoar frosts upon the buds or young shoots of the vine, it is needless to protect them against any winds, for winds, however cold, diminish the danger instead of increasing it. The only thing required is to prevent the vertical light from falling upon the vine, and this may be effected by any opaque body suspended over it.

That body prevents the loss of the caloric of the plant by radiation. The caloric radiating into space is not returned by the sky, while the opaque body does reflect the greatest part of it. According as the bud cools itself, it condenses on its surface the vapor contained in the atmosphere, and is thus covered over with hoar frost; as long as a bud is not covered with hoar frost before the rising of the sun, there is no danger of its being frozen. It is by preventing the condensation of the vapors that the wind reduces the risks of destruction. If the vines are on low stems, as I advocate, the preservation is complete if the vineyard is cultivated in ridges.

The ridge is parallel to the row; and it must be from seven to twelve inches high, and close to the vines (Fig. 7 and 8.) The long stake is previously planted about seven inches in front of the vine, and the little rod or rafter is fixed

as shown in Fig. 7 and 8. This operation being repeated at every vine, the stakes and rods form a sort of frame ready to receive the matting, which is then fixed to the rafter, close to the stake, by a piece of annealed wire No. 14. After the 25th of May, or the first days of June, the vigneron, while hoeing, reduces the ridge to one-third of its height, replants the long stake close to the vine, and thereby puts the matting in the second position, which guards against the coulure (Fig. 11.) In the next hoeing the ridge disappears altogether, the stake is then planted behind the stem, and the matting is placed in the third position (Fig. 13 and 14), or espalier fashion. In the fourth position the stake is simply brought back to the front of the stem by bending the vine, which lends itself easily to that operation.

Mode of Preservation in Crimea.—There the vignerons bury the vines in the ground, as the arboriculturists of Argenteuil bury the fig trees. This operation, far from being injurious to the vine, renders it more vigorous. The precocity and the beauty of the figs of Argenteuil are due to the winter stratification.

Whatever may be the disposition of the vines in each locality, the vinegrowers are so ingenious and active that they will soon find out the best means of preservation for each mode of culture; it only needs that they be convinced of the advantages derived from the practice of protecting vines.

CHAPTER VIII.

GENERAL CONDITIONS FOR THE FORMATION OF VINEYARDS.

Sites for Vineyards.—Vineyards to produce wine can be profitably established everywhere, provided there be no stagnant water in the soil, and that the site be not subject to fogs. All land that can be easily cleared of water or vapor, either by its natural slope or by winds, be it plain or mountain, is suitable for vineyards, if the temperature of the place be high enough to bring the grapes to maturity. On the heaps of rocks, as at Fontainebleau, as well as on the poor sands of the downs, upon the most barren soils of Champagne, Sologne, Landes, &c., vineyards of good sorts of vines may be established, and will produce wealth by intelligent working and an outlay of £50 to £100 per acre in seven years.

Waste Lands.—Where the vine was never grown, the soil, however poor it may be, always contains sufficient nutriment for it. There are more of those nutritive principles if it is covered with grass, heath, fern, furze, or any resinous shrubs.

Inclination of the Land.—In undulating and mountainous countries the vineyards commence a few yards above the basin of the valley, and terminate far from the summits when the latter are too high. In low countries, the neighborhood of marshes and of clusters of large trees must be avoided; and the undulating low rises, well aired, must be selected in preference. A declivity in the lands from 10 to 30 degrees is better fitted for the vine than any other inclination.

Aspect.—The easterly, south-eastern and southern aspect are better than north-east or northern; but the worst, without doubt, are north-west, west and south-west.*

Soils Inaccessible to the Plough.—With regard to the mode of plantation and cultivation, the soils must be divided into two classes: soils inaccessible to the plough, and those that can be cultivated with that implement. The first contain two other divisions: the soils susceptible of regular hand culture, such as those on banks too steep to be cultivated with the plough, but of an homogeneous nature; and soils of decomposed granite, or in rocks naturally or artificially formed in terraces which contain vegetable soil only in certain places.

Cultivation of the Vine on Terraces.—The principles already enunciated, concerning the selection of cepages and manuring, are also applicable to the vine when cultivated on terraces or on rocky ground, but it should be

* To apply this observation to Australia, north must be written instead of south, and south instead of north.—Trans.

pruned, trained and trellised, more like the garden vine than like that of the open field. The number of vines per acre cannot be the same; the planting, the staking, and the development of the stem, depend upon special circumstances. One single vine can cover a rock twenty-five square yards in superficies as well as a tree. I will only say here that the vine must receive a quantity of vegetable soil proportionate to the development which is intended, and a quantity of manure, equally proportionate to the quantity of grapes that it is expected to produce. With regard to the cultivation of the vine on slopes of homogeneous soil, all the principles already enunciated are applicable; only the operations of trenching, earthing, manuring, &c., are more onerous than on soils accessible to the plough. But that excess of cost is well compensated by the hygienic advantages and the superior quality of the products of vines cultivated on hills. When the situation for the vineyard is fixed upon, the first thing to be done is to make every part of it accessible to drays so as to facilitate all the operations and economise labor.

Drainage.—This operation is of paramount importance. The drain must be as deep as possible to prevent the accumulation and stagnation of fogs and vapors on the surface. Fogs and vapors accumulate and sojourn in low situations on any depression of the soil, just as water does in pools and swamps. But a strange thing, and scarcely known, is that an open drain or channel in such situations, and where the declivity is greatest, will carry off the fogs or vapors as it would water. Trees and high hedges are the best harborers for the enemies of the vine; therefore, they should be carefully destroyed in its vicinity. The roads made through a vineyard are so many useful drains when made in an embankment. When numerous and deep they will help to prevent the effects of frost and coulure. In most cases the waste drainage of the roads will be sufficient, but in strong level lands, systematical drainage must be resorted to. In some instances wells will have to be sunk. Before planting a vineyard every future requirement must be anticipated, and everything which might disturb the vegetation of the vines must be removed. I have mentioned before, and I will repeat it again, the vine is a rich tree; the planting and cultivation are costly, and its products are a long time coming. Certainly, after seven years, it brings a fortune, if it does not stumble during that period of time, but if it is obliged to recommence its long voyage (and any displacement would put it in that condition), it always impoverishes or ruins the planter.

CHAPTER IX.

PRACTICAL CONDITIONS FOR PLANTING VINEYARDS.

Plants.

The three sorts of plants.—In the sixty five departments of France in which the vine is cultivated, and where it may be cultivated to advantage, the diversity of soil and sub-soils, sites and their declivities, temperature and character of weather, is such that it is impossible to lay down, in all the details, any rule that shall be applicable to every locality for planting nurseries and vineyards, or for their ultimate culture; but there are facts, precepts and laws, that the vinegrower must know, and which apply to all countries, and these I will enumerate succinctly. The vine is propagated by cuttings or slips, by layers, or by rooted plants grown from cuttings, The cutting or slip is simply a portion of a shoot of the year, put into the ground without roots. The layer is a shoot buried under ground, without being separated from the mother vine, and in which position it strikes root. The rooted plant is a cutting having struck root in a nursery. These three sorts of plants reproduce exactly the characteristics, qualities, and faults of the original vine. Vines raised from seeds can only give varieties, but it requires many years to prove their quali-

ties. This last mode of propagating the vine is, therefore, neither practised nor desirable.

Cuttings.—In planting a vineyard, cuttings, when practicable, are preferable to rooted vines, and more especially to layers. 1. Because if a cutting strikes root well, it produces fruit one year sooner at least. 2. Because it constitutes immediately a perfect tree, having its roots and stem unmutilated by transplantation; experience has proved that such a vine has more vigor and durability. 3. Because the cutting economises time and labor, and, therefore, the expenditure attached to the rooted plant or layer is saved. Unfortunately, the cutting does not always succeed well, and rarely in light and poor soils, so that in such cases it occasions delay and necessitates replanting, which results in irregularities of lines and irregularities of ages, both of which are extremely prejudicial and expensive. A vineyard well planted requires 5 or 6 years to give any returns; one or two years more involve a serious additional outlay, therefore the vineyard should be well planted at first at any cost.

Layers.—These are surer than cuttings, for generally all the layers succeed; but to obtain them, there must be an old vineyard close at hand, and containing the kinds of vines intended for the new vineyards. Besides, the layers are not obtained without damaging the mother vine; they are also costly and have too many rootlets under ground. A vineyard well cultivated and tended is not fit to produce layers, and layers do not produce healthy vines.

Rooted plants.—The rooted plant from a nursery does not present any of the disadvantages of the layer; it is cheaply reared, and offers the normal constitution of the isolated shrub; it is lifted with facility when required for transplanting, and it is as sure to grow as a layer. The cutting and the rooted plant are in effect the only good means for planting vineyards.

What is a cutting.—Any shoot of the year freshly cut from the vine after the maturition of the wood (from the latter part of autumn to the spring), and having at least two eyes, one under and one above the ground, is a cutting; two eyes under ground are better than one, and three are better than two; a greater number is unnecessary and even prejudicial, because the roots of the fourth, fifth, and sixth eye are too far from the head of the stem, and require to be too deeply buried; or in the event of the soil being shallow, the cutting has to be bent, A cutting having old wood at the lower extremity is not so good as one without. The radiation of the roots as well as the circulation of the nutritive fluids are interfered with. Such cuttings, too, are scarce and costly.

How to know good cuttings.—The cuttings should be made as quickly as possible after pruning. When everything is ready for planting, they should be carefully examined; if, when cut at the end, they do not show any verdure and humidity, they are of very little good, perhaps worthless. Their true state is easily ascertained by putting them for twelve hours in water and cutting them again, for then, if they present any verdure, all hope is not lost, but those cuttings should only be used for nurseries, their success is too uncertain to justify their use for permanent planting. The cuttings having been verified, they ought to be buried eighteen inches deep in good soil, neither too dry nor too damp, in regular beds from three to five inches thick, and the ground should then be trampled over. Cuttings thus stratified may remain eighteen months without losing their vegetative faculties; on the contrary, a few weeks, or the first six months, of this stratification predispose them for a vigorous vegetation. The stratification has a double advantage:—It prepares the cuttings, and gives the vigneron an opportunity of selecting the most favorable time for planting them out.

Time for planting cuttings.—April and May are the best months. It is the most favorable time for making a nursery and planting cuttings permanently. The rooted plants succeed best if planted at the end of autumn. The cuttings, when planted long before the advent of warm weather, and before the sap has begun to circulate, are liable to dry up or rot, for they suffer equally from the alternative of heat and cold, of

dryness and humidity. A complete plant, having roots and stem, can profit by all these circumstances, but a simple cutting has to create its own organs, and has only a fœtal existence, which disappears at the least disturbance in the conditions of its incubation. To succeed well, the cutting requires continuous warm weather. The month of May in the northern regions is therefore preferable.

NURSERIES.

Soil adapted for nurseries.—A fresh and generous soil, such as that of a meadow, is the best for a nursery. But poor soil may be rendered suitable for the same purpose by mixing in it four pounds of manure and eight pounds of vegetable earth to every lineal yard to be planted. However, low but not inundated land on the banks of creeks, or any humid place unsuited for a vineyard, ought to be preferred for nurseries.

Preparation of the land for a nursery.—If possible, the ground should be ploughed or dug to the depth of from twelve to fifteen inches in November, or, at the latest, in February *; and hoed or scarified in the spring, to destroy all the weeds. These preliminary operations may be dispensed with, and the nursery planted at the first digging of the ground, but it will then be more difficult to establish, although success may probably be attained; but under any circumstances the soil must be well dug and levelled.

Planting.—The cuttings being selected, cut to the proper length, and their healthy condition ascertained, the planting becomes a very simple operation. It must not be forgotten that the cuttings should not be more than nine inches deep in the ground, and that they must be well settled down in the trench which receives them. The settling or trampling down of the earth which covers the cuttings is the principal condition for the success of the nursery, because the cuttings require an immediate contact with the soil to draw from it by capillarity the humidity necessary for their vegetation. The nursery is divided into beds, which contain a limited number of rows of cuttings, and in such a manner that from each division path the beds can easily be kept clear of weeds. To facilitate this, a sufficient space must be left between each row, but along the rows the cuttings may be only one inch apart. However, where land is not scarce, more room ought to be allowed. After the nursery is planted the cuttings should be pruned with the secateur, leaving only one eye out of the ground, and, if there is any sandy or light soil available, the whole plantation should be covered over with it about half an inch thick. This last operation will insure the success of every plant and preserve the bud and the extremity of the cuttings against the effects of drought, cold nights or sun strokes. In the worst circumstances, that is to say where the only soil available is argillaceous, and therefore hardens under the influence of rain and aeration, one half of the cuttings will give plants of prime quality, about a fourth would be second rate and the remainder would be lost. But then, such a result ought to be considered very satisfactory.

Advantages of two-year old plants.—The plant should be taken out of the ground, and replanted after its second leaf; whatever may be the vigor of the shoots of the first year, its roots are too tender and too spongy to bear the severe wounds inflicted in digging out and replanting. After the second year, the roots are ligneous and hardy. Notwithstanding these favorable conditions, the proprietor should carefully watch the digging out, for the ignorance or the carelessness of the laborer might jeopardise the existence of the best plant. In the third year the roots are too strong and too deep to escape mutilation when the plants are being lifted; the two year old plant is therefore unquestionably the best. The nursery requires some care during the two years. The weeds must be well kept down, to prevent their intercepting the rays of the sun. If the shoots are too long and too numerous in August (December — January, in Australia) they must be cut off at

* May and July in Australia.

about one foot or 15 inches from the cutting and the small ones be pulled off. When pruning in the following spring one eye only is left on the spur. The nursery then receives a slight or superficial hoeing. From the 15th to the 30th June (November—December) the shoots are thinned out, leaving only the best, which are nipped off at one foot or 15 inches. Weeding as in the first year.

Cost of planting 40,000 cuttings in a nursery. —Forty thousand require an area of 13 perches.*

To plant 40,000, six men and six boys are employed. The cuttings are prepared by women.

Wages	48 francs.
Four cubic yards (or 5000 lb manure), 7 francs each ..	28 ,,
Cost of cuttings	10 ,,
Cartage and planting	10 ,,
First culture	12 ,,
Hoeing, first year	12 ,,
Pruning and thinning out, second year	15 ,,
Unrooting the plants and cartage to vineyard	13 ,,
Total	148 fr. (£6) †

That nursery will give 30,000 good plants, which will cover 7 acres. A nursery of two acres could be planted for £200, and would be sufficient to fill up 200 acres with two-year old vines. I have established in this manner nurseries containing two and three millions of cuttings, which have given me four fold the quantity required for my 80 acres. The circumstances under which I established these nurseries were so unfavorable that I anticipated that one fourth only of the cuttings would grow. The contrary was the result—three-fourths succeeded.

The planting of the vine.—The ground should be cultivated to the depth required. This depth must be determined by the nature of the soil. If the layer of vegetable soil is thin (5 to 7 inches) it must not be turned up so that it will occupy the bottom, and the subsoil the surface. It may, however, be mixed up with one-third of its own bulk of the subsoil. This result is obtained by using the Dombaste plough, which trenches the ground to a depth of 9 or 12 inches. This plough may be followed by a subsoil plough, so as to break up the ground 5 or 7 inches deeper than the first. A cross ploughing would perfect the preparation of the soil. This trenching costs from thirty shillings to two pounds per acre. Hand trenching costs not less than £4 and is no better.* The ground must be trenched for the planting of cuttings as well as for the planting of rooted plants, and it should be done as long as possible before the planting; in all cases the ground must be cleared of weeds, well harrowed and rolled either with the Crosskill or the ordinary roller.

Laying out the ground for planting.—The soil must be smooth and firm to enable the planter to make the squares and the lines, and to observe a perfect parallelism. One yard more or less in the length of a rectangle, an angle incorrectly set off, is sufficient to disturb the order of the whole plantation, and cause great inconvenience. I know it because I have been placed in that predicament by the neglect and inaptitude of a former vigneron.

Instruments required.—A certain number of T's, each side of which is about 10 feet, are extremely useful. The head of the T is laid parallel to the base of operation, the tail indicates the direction of the lines. Two surveying chains, marked at every yard, show the exact distances of the lines and vines, while

* This close planting is decidedly objectionable where land is no object.

† If the cost of the cuttings is left out these estimates of planting will apply to Australia. One man can plant 3000 per day, and his wages are not more than 4s per day. True, women and children are not to be had at the same price, but manuring is not required, and the weeding is not so costly.—Trans.

* £16 in Victoria.

several chains laid parallel at each of the marks showing the distances show equally the places for the vines.

Aspect.—Before laying out the roads, foot-paths, drains, and squares, the *orientation* must be decided. Theoretically, the best orientation is north and south because the rows of vines receive the insolation east and west, and at noon the sun strikes directly the ground between the rows. When the direction of the lines is E. or W., there is some portion of the ground and also fruits which are always in the shade. In certain sites, pre-existing roads or the natural formation may prevent choosing the direction. Therefore, it may be varied from N. to E., S., or W. But in any case it should never go from E. to S. to incline from W. to N., at least in France, where experience has proved from time immemorial that the western and northern aspects, particularly the first, were the worst for vineyards.

The planting.—When the roads and paths are laid out, and the places for the vines marked, the planting with cuttings or rooted plants may be let by contract or done by day labor, for the operation is simply mechanical, and the intelligence of the vigneron is not required. I have even found that intelligence is sometimes very objectional, so much so that I have been obliged to renounce employing vignerons for planting nurseries and vineyards, and for the work of the four or five first years. * French, Belgian, and German laborers have carried out, to my entire satisfaction, works that I was constrained to refuse to sixty of the most experienced vignerons in France because they would obstinately adhere to their routine of working. They were right to do so—to do as they had been in the habit of doing—and I was certainly wrong to employ intelligent and experienced men when I was reserving to myself all the intellectual part of the works, and when I wanted only willing arms.

* I met with the same difficulty when planting Tabilk and the Goulburn Valley vineyards.—TRANS.

Necessity of planting the vines level with the soil.—Should the vines be planted above or below the level of the surface of the soil—upon ridges or in holes? In healthy soils, the nature of which allows the water to penetrate to three feet deep, and retain, by capillarity, the moisture necessary to vegetation, the vines should be planted, as should also most other vegetables, level with the ground. However, the vines require sometimes to be planted upon ridges, as in soils too moist in themselves, or through the proximity of an impermeable subsoil. Under any circumstances the vines should not be planted in holes to be maintained there for any length of time. Provignage seems to establish a contrary principle founded upon long practice, but provignage is, properly speaking, nothing else than a means of filling in vacant places and manuring the old vines. Vignerons, in many vineyards, plant the vines in open trenches, and that with the sanction of long experience and an appearance of great success, but still it is a condition more proper for nurseries or for the first years of a vineyard; it is also a mode of trenching. But when the vine is full grown, and in full produce, the soil has been brought to a perfect level.

Of the roots of the vine.—Is deep planting necessary or advantageous? It is neither; it is injurious and contrary to the constitution of the vine, as it would be contrary to that of any other vegetable, the stem of which would be kept covered over with earth as fast as it grows, and so far as to separate its mesophyte, and consequently the natural origin of its strongest roots. It is fortunate for those who plant deeply that the vine has infinite vital resources, and that it shoots fresh rootlets from each knot buried; for the inferior roots could not rise up to the good soil, they would be wanting warmth, and would rot for the want of sap and through humidity. The best roots of the vine are those that spring from the stem at five or six inches below the surface of the ground. There they are stimulated by the exterior temperature at their summit, while their extremities, spreading and deepen-

ing, seek for moisture and nutriment in every direction, which they grasp with a thermo-electric force, resulting from the contrast of temperatures of the two extremities. Deep planting is nothing else but an error perpetuated by routine. If the vigneron would, every year, when filling up the hole made for the provignage, cut off all the rootlets formed above the primitive and deep roots, he would soon see his vines perish, and thus ascertain the weakness and inefficiency of the roots grown in the subsoil ; but he does not do that, and he is right ; his vineyard thrives, and that is sufficient ; only he attributes that prosperity to the inferior roots, while it is due to the new and superior ones. But its expensive work has always retarded and often compromised the success. How often a proprietor has been disappointed by a provignage too deep !

Vine planting compared to asparagus planting. —Twenty years ago asparagus were also erroneously planted deep, and a good crop was the exception. At present the asparagus are seen growing luxuriantly on the surface. If a two-year old root is sometimes planted in a shallow ditch, it is to give the asparagus the length of white stem desired, for the hole is filled up in the third year, whilst the head is growing ; and then, at the end of the season, the earth is speedily removed, to give the plant the benefit of the atmospheric influences. M. Gauthier, a skilful horticulturist of Paris, has just sent in a report to the Imperial and Central Horticultural Society upon the best method of cultivating the asparagus by seed or young plants, like all other vegetables, on a level soil. I have inspected his productions, which surprise for their precocity and beauty. Well, what I say of the asparagus, I say also of the vine ; it should be planted in such a manner that the first ring of roots be level with the surface of the soil, whence its roots will dart forth to any possible or desired depth, according to the special nature of the soil and the subsoil. The garden trellis has other exigencies. Sometimes it has for its object to obtain a vigorous and long stem, sometimes to grow large bunches of grapes, well filled up with a liquid, rich in water and light in sugar. The addition of roots by layering concur singularly to those results, but a vineyard is not a trellis, the table grape is not the wine grape ; and, besides, if layering has many disadvantages for vineyards, it has not the disadvantages of a deep planting, for the layers remain within reach of atmospheric influences.

Care to be bestowed on the vineyard.—When the planting is done, each vine should be pruned to one bud only, the ground cleared and stirred, so as to present a perfectly clean appearance. A vineyard must be coquettishly and neatly brought up, and maintained in that condition. At all times, its toilette must be a special object of care, for the vigneron and proprietor should take a pride in the state of its appearance. The gross annual returns will be £8000 for every 247 acres, the expenditure £4000, leaving, therefore, a net income of £4000 per annum. The vine cultivated on such a large scale makes a lordly property ; it creates mansions and pays numerous servants ; it is a great and rich lady, who cannot live in disorder, filth, or abandonment. It must be kept in a stately style, since it can afford to pay the expenses.

Vineyard let by contract or worked by day laborers.—All, or most of the operations required in a vineyard should be executed by contract. It is often difficult to decide between daily work (by which good but little work is obtained), and contract work (which gives plenty, but generally bad, work). The solution of that problem consists in the practical knowledge of what an ordinary laborer or vigneron can do of the special work in ten hours. When contracts are let out, the time required to carry out the work should be always specified ; for if under any ordinary circumstances " time is money," in cultivation it is more than money, it is life. The contractor who thinks he has a right to defer his work causes sometimes an irretrievable injury.

CHAPTER X.

HUSBANDRY OF THE VINEYARD FROM ITS PLANTING TO THE TIME OF ITS FULL PRODUCTION.

First year.—After the planting, three or four hoeings or scarifyings are all that the young vineyard requires; nipping off or disbudding would be hurtful. If the foliage is well developed, the roots expand more, and the vine is more firmly established. The filling up of the missing plants takes place during the second year.

Second year.—The second year is less expensive. The vine requires no staking yet*, and no manure, for its small roots could not benefit by it. From the 1st of November to the 15th of December †, the plants which failed must be replaced by new rooted ones. If the first planting be carefully done, the failures will not exceed five per cent. When stable manure is used for planting, it must not be put on the roots of the vines, for it would cause death. There must be always one or two inches of soil between. When the vineyard has been planted with cuttings, and there are many failures, it is best not to fill up in the second year, for many of the apparently dead cuttings may grow vigorous shoots yet. This fact, which I have often observed, proves how a vine branch stratified may retain its force of vegetation. In all cases where there is no intention of resorting to provignage, or any other system of layering, to replace the missing plants, a number of vines equal to the anticipated failures must be reared in nurseries. After filling up the blanks, the young vineyard requires no care for the winter. However, if the land is poor, and if also there is some good vegetable soil in the vicinity, the second year is the time to effect e thorough earthing. Forty, eighty, or as much as four hundred cubic yards per acre, deposited in ridges to the north-west * of the rows of vines, is always an excellent operation, especially if the soil does not cost more than 5d or 7½d per yard. If such a large quantity is not available, twenty yards are not to be disdained. It will always have a favorable influence on the vines.

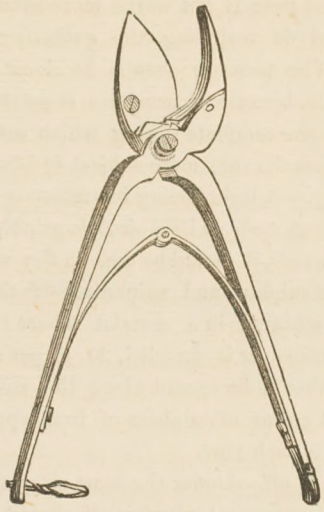

FIG. 17.

Pruning.—Pruning is done in March, April and May (in France), the latter being the best. Pruning can be reduced to such a simple precept that everybody can practice it. To cut off close to the stem with the secateur (Fig. 17) all the branches but one the most vigorous and the nearest to the ground, and to cut off this last one, leaving only one eye, that is all the pruning for the second year. The secateur is preferable to the pruning knife, notwithstanding the contrary opinion of eminent vignerons and arboriculturists. Such skilful men certainly do more and better work with the knife, but when the proprietor is obliged to employ any ordinary vigneron or laborer to prune his vineyard, the secateur is preferable. It requires long practice to use the knife well and quickly. With regard to the crushing of the shoots by the secateur, the vine is too robust to suffer from it. When one

* In Australia the vine requires staking in the second year, for it is then as forward and strong as in France in the third year.—TRANS.

† May and June in Australia.

* South-west in Australia.

or more shoots spring from the ground, and one of them has absorbed sap enough to cause its development, to the detriment of the shoots above ground, it should be kept to form the stem, and in that case the earth should be removed from the plant till the origin of the shoot is reached ; the shoot should then be pruned to one eye as the other has been. The pruning of the second year is not worth more than 4s per acre, and 6s including the gathering of the wood. The pruning should be done as late as possible, because it promotes vegetation and because the complete hoeing which would follow renders the vine more subject to hoar frosts.

Hoeing.—A light hoeing immediately follows the pruning, and, as its object is principally to destroy weeds, it should be done in dry weather.

Use of sulphur and sulphate.—If the vineyard is situated in a district where the vine disease exists or is dreaded, 20 lb per acre of sulphur should be spread along the rows, and about 30 grains of sulphate of iron applied to the root of each vine.

Nipping off.—Under the same circumstances as above, a general nipping off should be resorted to in the latter part of May and the beginning of June. This operation should cause no inconvenience, because the second year is not the one in which two or three whole shoots are needed. Nipping is unnecessary if blight is not expected.

Other hoeings.—The second hoeing, superficial as the first, is done in June ; the third in August, a fourth is sometimes required in September. In fact, the hoeings must be so frequent that the ground will remain bare during the vegetation of the vine.

EXPENDITURE DURING THE SECOND YEAR PER ACRE.

Four hoeings	£1	5	6
Thinning and Nipping off ..	0	5	0
Sulphur and Sulphate	0	7	0
Pruning	0	7	0
Replacing dead Vines	0	6	6
Vegetable Soil..	6	0	0
Total..	£8	10	0

Third year.—The third year is much more expensive than the second, on account of the stakes. For it is time to take care of the fine shoots to form the vine and to carry fruits.

Manuring.—In the third year poor soils will require 24 cubic yards of stable manure per acre, in November and December. This manure is put in a trench, made with the spade or plough, and covered over with the soil. After that operation the vineyard is left for the winter.

Pruning.—The pruning is still simple. Cutting off all the shoots but the best one, which is pruned to two eyes, such is the pruning for the third year.

Hoeing and staking.—The pruning is followed by a light superficial hoeing. Sulphur and sulphate are used if needed, and then the stakes are planted to the north or west of each vine. Great care must be taken to prevent the destruction of any of the already swelled buds ; for, if one be pulled off, the disposition of the vine would be compromised for the following year. However, the collar of the branch, that is to say, its junction with the stem or old wood, is generally very rich in under shoots, which grow vigorously, and repair the accident, since the production of the fruit is not yet the object to be obtained in that year. The long stakes must be fixed strong enough to resist all winds. Nothing is more dangerous to the vine than the falling down of the stakes. Nothing shows more the carelessness of the vigneron, or the slovenliness of the overseer or proprietor, than crooked rows and stakes in every direction.

Nipping off.—The two or three best shoots must not be nipped off, but this operation must be practised upon the inferior shoots with great care especially if the former are not very promising.

Tying.—After the thinning, and the nipping off, the two or three principal shoots are tied on to the long stake, to guard them against the winds and to draw more energetically the sap by their vertical position. The fastening should not be too tight, else it would crush the leaves and prevent the circulation of the sap.

Other hoeings and works.—The second hoeing is done after the tying. In the latter part of July, a second nipping off and clipping take

place; then follows a third and fourth hoeing, so as to destroy any vestige of weed which might have grown round the vine. The fourth hoeing is not effected in the same manner as the others. The surface of the soil is scraped up, and the scrapings are drawn into a ridge, which forms the nucleus of the one made in the following spring along the vines on the opposite side of their best aspect. The stakes are then taken out of the ground.*

EXPENDITURE PER ACRE FOR THE THIRD YEAR.

Manure	£6	5	0
Stakes	5	0	0
Pruning	0	6	0
Hoeings	1	5	6
Nipping off	0	4	0
Tying	0	4	0
Staking and unstaking ..	0	8	0
	£13	12	6

Fourth year.—In the fourth year there are two very important operations: the palissage and the pruning.

Palissage and short stakes.—Palissage is simple and economical. Short stakes are planted in line with, and in the middle of the space between the vines; they are of such length that fifteen inches will remain out of the ground when they are firmly driven in. When all the stakes are levelled, a small staple is fixed on the head of each of them. A wire No. 10 passes through those staples, and is fastened, at convenient distances, to pegs well driven into the ground, so that it will easily be kept quite tight. About 150 lb of wire is sufficient for the palissade of 4000 vines. The whole cost of the palissade, including short and long stakes, would amount to about £12 per acre. The wire could be a smaller one, and the price reduced to one-half; but, when it is too weak, it is often broken by cattle, or by the hunters. I have known a general who could not hunt in a vineyard without falling down, so the proprietor took the wire away. Clever wine merchant, but poor vigneron.†

* This last operation, which has for its object the preservation of the stakes, is not practised everywhere and is certainly unnecessary for Australia.

† This will appear ludicrous. Any man who chooses to pay for a permit for shooting (£1) can almost go with impunity about everybody's property.

Pruning.—The pruning in the fourth year is the normal one, for the whole existence of the vineyard; that is to say, a fruit bearing branch and a spur for wood are left on the stem.

FIG. 2.

Figure 2 will give an exact idea of the pruning to be practised from the fourth year, the fruit bearing branch A B fastened to the short stake at B, and wood branch or spur C D intended to produce two or three shoots which will require to be fastened to the long stake, spring from a stem represented as ten or twelve years old and better shown by

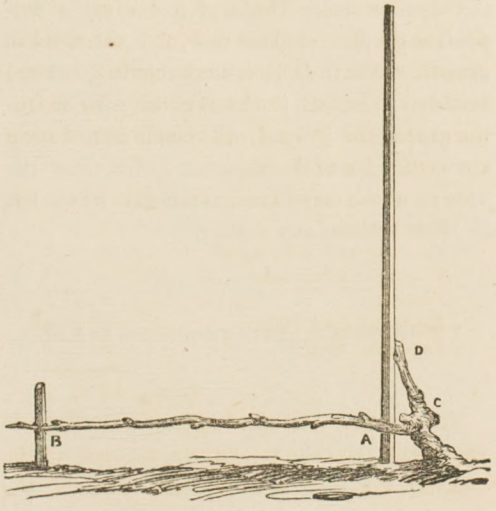

FIG. 1.

but the age of the vine does not alter the principle nor the effect of the pruning which must always be executed in the same manner. However, if the vine is not to be protected by any means after pruning, it would be advisable to effect the pruning at two different periods in such a manner that I will try to explain by figure 1. In the course of February or March, the old fruit bearing branch AB, as well as the gourmand *, ADF, are to be removed; the three shoots, D, E and C, are allowed to remain on the stake till the 25th or 30th May; the small offshoots and the laterals, however, may be cut off. Then, after the 25th or 30th of May, one of the branches, D and E, the one that shows most fruit, is brought down horizontally to form the fruit bearing branch, while the other is cut off at E and forms the spur or wood branch, CE.

This mode of pruning offers a double advantage: 1st, the upper buds, being in a drier current of air, are not so subjected to hoar frosts; 2nd, it keeps back the vegetation of the inferior buds and renders them less liable to frost. Everybody knows that the upper buds draw the sap, and grow the first and vigorously at the expense of the inferior ones, which seem to wait till their turn arrives; if then the upper buds are destroyed by frost, the inferior ones will become a precious resource, and, if both are frozen, the superior counter-buds of fine cepages will produce grapes. In that case, to accelerate the growth of the fruit, it is advisable to allow the branches to remain in the vertical position till the grapes are well out, and have gained some strength. I would recommend to treat the vine as above explained, especially when left to itself without any shelter.

* This glutton or sponging shoot bears no fruit.

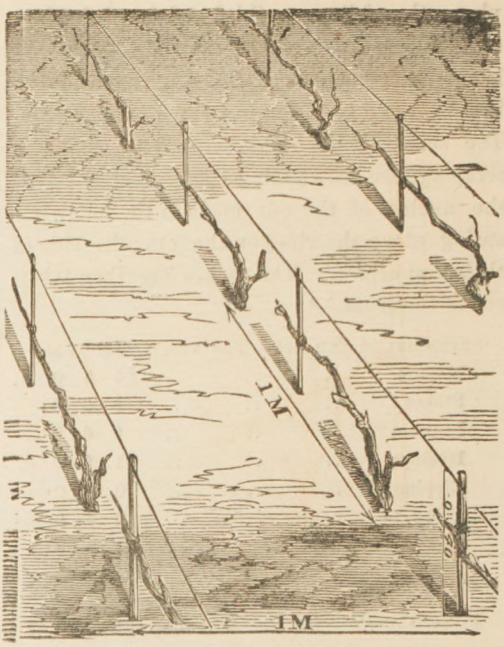

FIG. 4.

Figure 4 represents the vineyard after pruning, before it has been hoed, the ridge made, or the mattings fixed.

If the system of protection by straw matting is adopted, the fourth year is the time to apply it. In that case the pruning must be done earlier. To illustrate this operation I will refer the reader to figures 7, 8, 9, and 10. I do not think it unnecessary to insist upon the efficiency of that system of protection, proved by repeated experiments upon a large scale, by calling the attention of the vigneron to the state of vegetation as shown by figure 8. Everyone will instinctively see the power and merit of such a shelter, the truth is that a vine so protected will defy frosts 4° or 5° degrees below zero, and that as much because it is protected against humidity, as because it does not lose any caloric by radiation.

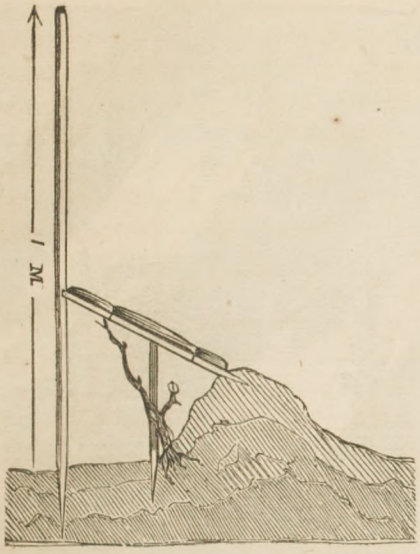

FIG. 7.

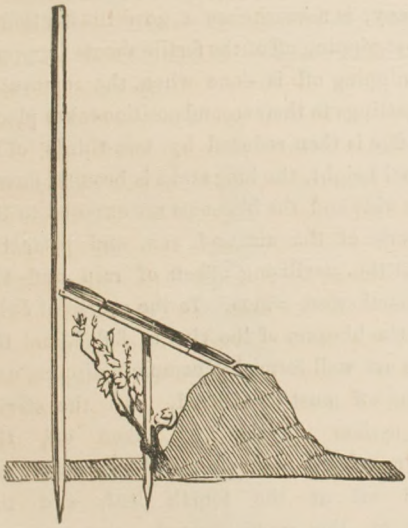

FIG. 8.

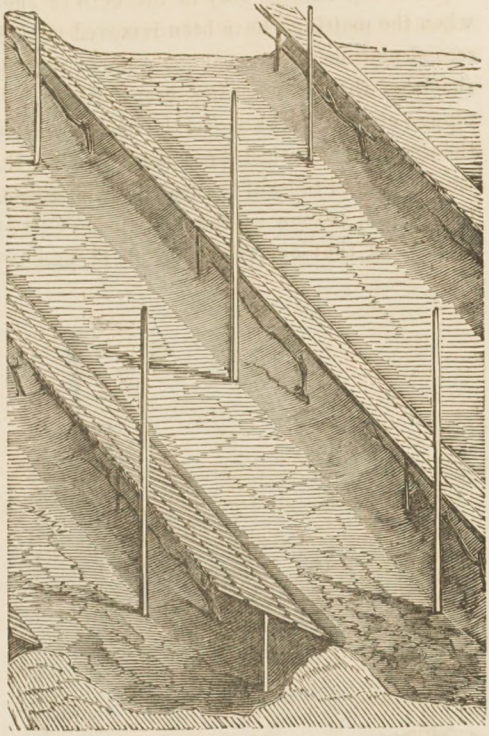

FIG. 9.

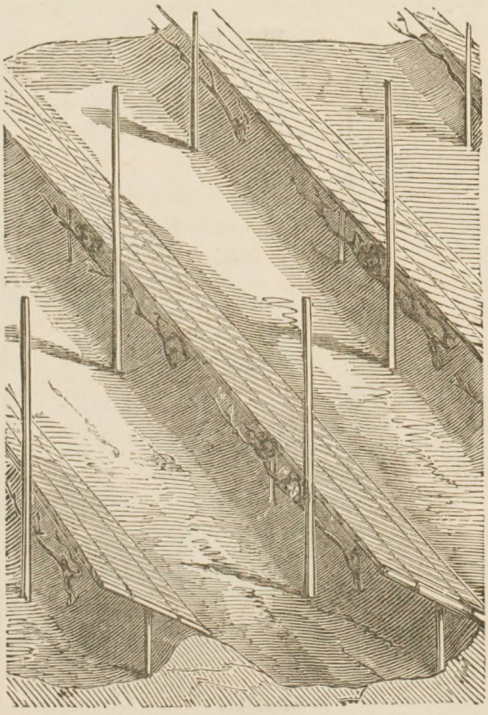

FIG. 10.

From the 30th of May to the 30th of June, when the mattings have been removed to their second position to prevent the *coulure*, and the shoots of the fruit-bearing branch have been nipped off two leaves above the higher cluster, the shoots of the wood branch are tied to the long stake and those of the fruit-bearing branch to the wire, as soon as they are strong enough to allow of that operation (figs 3, 11, and 12).

FIG. 3.

FIG. 11.

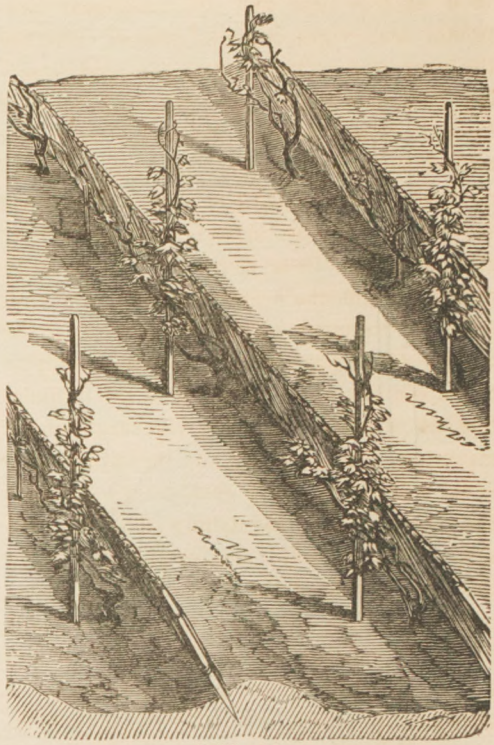

FIG. 12.

Figure 3, although inexact, in that it shows as many clusters as leaves on the shoots of the wood branch or spur, shoots which often do not bear any, is nevertheless a good illustration of the first nipping off of the fertile shoots (pppppp) This nipping off is done when the removal of the mattings to their second position takes place; the ridge is then reduced by two-thirds of its original height, the long stake is brought nearer to the vine and the blossoms are exposed to the influence of the air and sun, and protected against the sterilising effects of rain and the west north-west winds. In the course of July, when the blossom of the vine is faded, and the grapes are well formed, a complete nipping and clipping off must be effected. All the sterile and useless shoots are taken off, the counter shoots which have grown are nipped off at the fourth leaf, and the shoots of the wood branch are cut off level with, or a few inches higher, than the summit of the long stake—after having been tied up a second time. Then, a third hoeing is done, and the last trace of the ridge disappears,

It is at this time that the intelligent proprietor and vigneron will observe whether their expectations, founded upon a good flowering, are now realised. The principal causes of the *coulure* are, without doubt, the cold rains and winds in June, and certain meteorological circumstances that the gardeners call weather without sap. The mattings are a perfect remedy against these causes, but the poverty of the soil and the over-loading the vine with fruit are so many causes of *coulure*. If the *coulure* takes place when the vines are protected and the season favorable to the fecundation, it is a sign that the vineyard requires manuring. The withering and the imperfection in the maturity of the grapes are a warning to the vigneron. Till the falling off of the blossom (flower) the soil is always rich enough for the development of the herbaceous vegetation of the vine; its poverty is revealed only at the time of the formation of the fruit. Before summer pruning, thinning out and tying, the mattings are raised vertically to the north, west, or N.W. of the rows, from the 1st to 15th of July.

Figures 13 and 14 illustrate the 3rd position of the mattings. They act like walls. At the end of August another thinning is applied, and some clusters are buried in leaves; the latter should be removed.

FIG. 13.

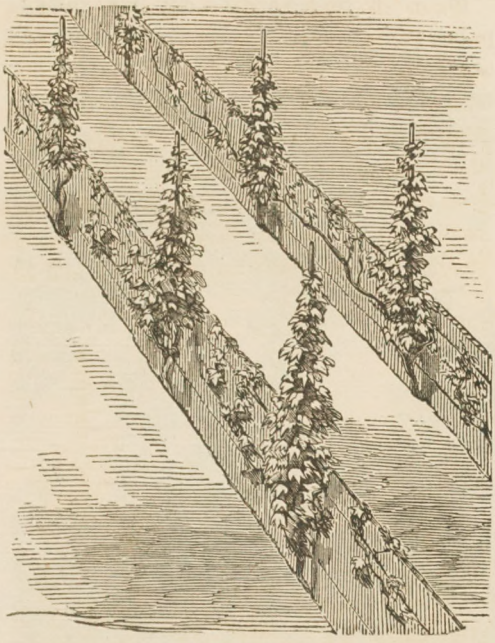

FIG. 14.

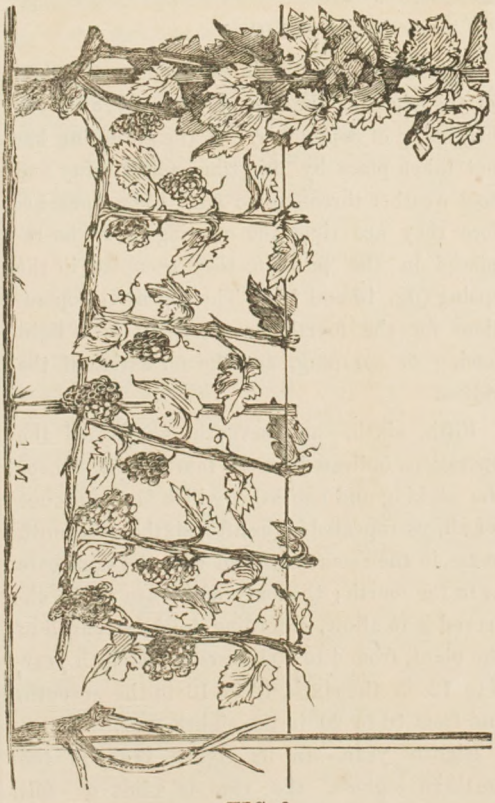

FIG 6.

Figure 6 represents exactly the summer pruning of the fruit bearing branch at the end of August.

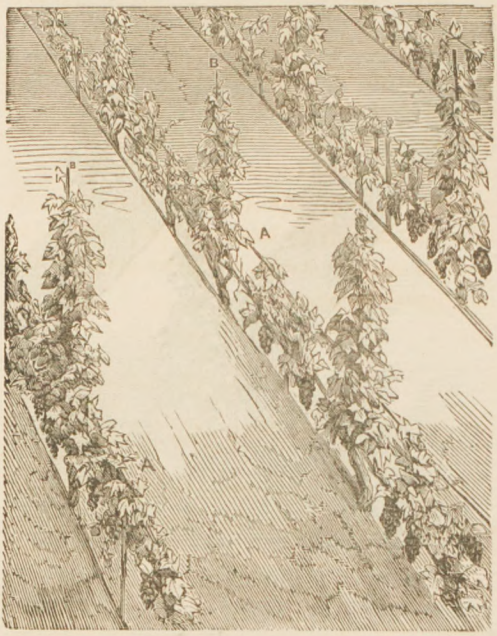

FIG. 5.

Figure 5 represents in perspective the state of the vines at the end of August and the beginning of September. If the gathering has not taken place by this time and a rainy and cold weather threatens to spoil the grapes before they are ripe, the mattings must be replaced in the position they occupied in the spring (fig. 15 and 16.) The last of the operations for the fourth year consists in a light hoeing or scraping, and the formation of the ridges.

Fifth, sixth, and seventh year.—All the operations indicated for the fourth year, except the staking and palissage, which is fixed once for all, are repeated in the fifth, sixth and seventh years, in the same order and with the same care as in the fourth; the only difference to be observed is to allow, according to the strength of the plant, from 4 to 8 clusters in the fifth year, 8 to 12 in the sixth, 12 to 16 in the seventh, and from 16 to 20 in the eighth year.

Eighth year.—In its eighth year, in the northern regions, the vine is adult or full grown, is in a state of full production, and for 20 years longer it will maintain its vigor and fertility if on land where it was not cultivated before, and if the proper nourishment is given to it. After 30 years the fecundity may decline and even be destroyed in certain soils, but a productive period of 20 years creates so much wealth that one needs not be pre-occupied by such a contingency, which, after all, seldom happens, and which I believe impossible if care and adequate nourishment are accorded with regularity and perseverance. In the central and southern regions, where the soil is good, and the vine intelligently trained, it is in full product when six years old, and gives a regular crop even at five.

Annual expenses for one acre of adult vineyard.—When the vineyard is planted with fine *cepages*, and the soil of a medium quality, the expenses of culture will be as follows, namely:—

Manure	£3	16	0
Pruning	0	14	0
First hoeing, forming ridges and staking	1	12	0
Wear and tear of stake and wire	1	2	0
Disbudding, tying, and clipping off	1	0	0
Three hoeings	1	4	0
Gathering, carriage, fermenting, pressing, casks and keeping, at 4½d per gallon 352 gallons	6	2	5
Unstaking, hoeing, and filling up blanks		13	4
Total ..	£16	3	6

Annual product of one acre of an adult vineyard without preserving mattings.—The mean produce will always be above 350 gallons, and, if the vineyard is planted with the finest species, the average price per gallon will never be below 2s, or £35 4s per acre. Deducting the £16 3s 6d expenditure, it would leave an annual net profit of £19 0s 6d, representing 5 per cent. interest on a capital of £320.

Annual product of one acre of adult vineyard, protected with mattings. If the system of mattings is applied, the average produce will be double, or above 700 gallons, and the

gross return £70 8s. But the expenditure will be larger, namely :—

Expenditure of unprotected vineyard, as above stated ..	£16	3	6
Mattings and fixing same ..	8	0	0
Gathering and winemaking, casks, &c.	6	2	4
Total ..	£30	5	10

Deducting that amount from the gross returns, £70 8s, it leaves a net profit of £40 2s 2d, showing a great advantage over the ordinary culture of the vine.

Cost of one acre of vineyard after the seventh year :—

One acre of land* ...	...	£16	0	0
Expenditures	1st year ..	16	0	0
,,	2nd ,, ..	8	0	0
	3rd ,, ..	14	0	0
,,	4th ,, ..	18	0	0
	5th ,, ..	9	12	0
,,	6th ,, ..	8	0	0
,,	7th ,, ..	2	8	0
Total	...	£92	0	0

Add to the expenditure of the fifth year the amount realised on the produce of the fourth year, £3 4s; to the 6th year, the produce of the 5th, £6 8s; to the 7th year the produce of the 6th, £12 16s. Add also the interest on all the outlay, about £20, which, however, is quite reimbursed by the produce of the seventh year. In the above calculation, the wine is only valued at one shilling per gallon, because, the vineyard, being imperfectly grown, or under the age of maturity, the quality of its produce is inferior, and only worth one-half of what it is when adult. The above statements show that a vineyard unprotected will give 17 per cent. upon the capital invested, and if protected, will give from 35 to 40 per cent. If it is the vigneron himself, assisted by his family, who plants and cultivates the vineyard, the result is still more advantageous, for, during the seven years, the capital disbursed for labor amounts nearly to £50 per acre. Therefore, a vigneron who can dispose of £30 or £50, can plant an acre of vineyard which will give him at the end of eight years from £24 to £40 annually. But, under any circumstances, the absolute condition of success, for the vigneron as well as for the proprietor, lies in the cultivation of fine species, fit to produce wines of a real and mean value of 2s per gallon. All fine cepages in dry situations, where the vine can mature its fruit, will produce wine of high value and of certain sale, especially since the English market has been thrown open by the new treaty of commerce.

* This price is for land below the medium quality.

CHAPTER XI.

Creation of a large estate, founded upon viticulture.—According to the statements of the foregoing chapter, from the eighth year an acre of vineyard will pay annually the vigneron, in labor alone, upwards of £8, and give the proprietor a revenue of £16. It will have cost the latter £96, and given £48 to the vigneron who has brought it into its normal state. If the vineyard, created and finished, contains 250 acres, the salaries paid to vignerons during its period of infancy will amount to £12,000, and will have cost to the proprietor £24,000, including all interest and expenses. After the eighth year the vineyard will pay the vignerons annually £2000, and £4000 to the proprietor. Two thousand pounds represent a good budget for fifty families of vignerons necessary for the cultivation of vineyards containing 250 acres. £4000 represents an interest of 10 per cent. on a capital of £40,000 and there is no land planted with fine cepages which is not worth £160 per acre; therefore the landed property is well worth the capital invested. But, of the capital there is only £24,000 expended; the £16,000 remaining is to be spent in the following manner; £4016 for cellars, presses, vats, and implements: £2024 for the residences of the master, overseer, and vignerons, for gardens, orchards, fences, etc. and also for the establishment of a small farm,

which must be annexed to the vineyard. The produce of the vineyard will then enable the proprietor to have a lordly vendangeoir * with a village, mansion, gardens, orchards and farm. And that is not all, the 250 acres will insure comfort to 50 families. Such would be the magnificent result for the capitalist who requires 10 per cent. upon his capital advanced; but for the settler, who would be contented with 5 per cent., a return of £4000 represents a capital of £80,000, out of which £24,000 only have been devoted to the formation of the vineyard. There would remain £56,000 for mansion, park, hothouses, garden, and farms of 1200 or 1500 acres, which would support themselves. A farm of 1500 acres of poor soil necessitates a minimum outlay of £24,000 before it can give an annual net profit of £240, or 2½ per cent., after paying the wages of fifteen families at £40 each per annum. The revenue of such a farm will never afford the expenses of a mansion, parks, hothouses, etc., etc., and those who expect it to do so will be deceived; the vine alone, in France and in the regions where it brings its fruit to maturity, has the power of creating wealth in poor and abandoned soils; alone it can give 10 per cent. on the capital invested, and alone it will be found capable of maintaining great and rich estates.

* A vendangeoir is the whole of the vineyard establishment.

VINIFICATION.

CHAPTER I.

GENERAL PRINCIPLES.

The great art of making wine is of primitive simplicity. Its best precepts are in the traditional practice; modern science is of service only in demonstrating the elements of vinification, in measuring their proportions and in describing the conditions under which it is effected. Chemistry is to the making of wine what physic is to musical composition. The genius of the wine is in the vine, and its character is stamped in each species of vine. The soil, climate, season and aspect may modify the character, but the wine always will possess peculiar characteristics by which the vine that has produced it can be recognised. To make soup for your laborers, plant pumpkins. To refresh the vulgar, plant water melons. For the service of your table plant cantaloup melons; but never expect chemistry to transform your pumpkins into cantaloup nor even into water melons; do not expect it from the soil, climate, aspect, or season; do not expect it even from God who leaves to your intelligence the choice of his gifts, but who does not change his laws to suit the wish of folly or avidity. Therefore to make good wine, plant good *cepages*. Gather the fruit when well ripe. Gather them promptly, cleanly, and judiciously. Separate the good grapes from the mediocre, and especially from the bad. To make white wine carry the grapes speedily to the press, previously well cleaned. Distribute all the juices from each press in casks well prepared, without any bad taste or bad color. Let the wine ferment in covered temperate place till it is calmed. After one or two weeks put it down in a cellar

which has a uniform temperature of 51 to 53 degrees. Fill up your casks every eight days, rack off once or twice at the most each winter, and in dry and cold weather, and you will always have the best possible white wines that such cepages, soil, climate and season can produce. To make your red wines, crush and press, either with a wooden shovel or the bare feet well washed. Then fill up the vats, previously carefully prepared, to four-fifths of their depth, level the surface of the grapes with a rake and beat them down with the back of the wooden shovel; close the doors of the fermenting house and take care that the temperature does not go below 59 degrees. Listen two or three times a day to the sound of the fermentation by applying your ear to the vat; as soon as silence has succeeded the tumult of the boiling, draw off your wine by the tap previously fixed at the bottom of the vat, for the wine is made and its fermentation accomplished, and anything beyond that is detrimental maceration. Fill your casks with the so drawn wine, but by successive portions, up to three-fourths of their capacity; send directly the murk to the press, and complete the filling up of the casks in equal quantities with the wine pressed out of the murk. A few days after put your casks in cellars below ground, or in those at the surface. Fill them up carefully every eight days, rack off in January or February, and you will thus have the best possible red wines that the kind of vine, soil, climate and season can produce. To make rosy wines, partridge-eye colored, or, in other words, wines of intermediate colors between red and white, the wine must be drawn off from the vat when the fermentation has reached two-thirds of its completion, or twenty-four hours at least and forty-eight at the most after the first sound or bubbling caused by fermentation has been perceived. The murk is pressed immediately after the drawing off, and the subsequent treatment is the same as that of other wines. Under any ordinary circumstances the foregoing recommendation would suffice to enable any vine-grower to make good wines, the best wines of France; but in order further to elucidate the subject it is necessary to reconsider the principal indications in their practical and technical point of view. I have included the sparkling and liquor wines in the general observations, because they belong, in some degree, to a special industrial preparation.

CHAPTER II.

VINTAGE.

The vendange, or gathering, of the grapes is the first act of the vinification, and the last and sole purpose of vine culture. The gathering is the supreme fact which resumes and sanctions all the labor of the vigneron, and all the expenses of the proprietor. An abundant crop of well ripened grapes is a true conquest, the result of a six months' campaign, during which spring frosts, cold June rains, hail, insects, diseases, autumn frost and rain had to be overcome and subdued. There is nothing more dramatical, more exciting, than the struggle of the vine-grower against the enemies that attack his work without intermission and to the last. In vine districts a good vintage is a general triumph, which cheers up the laborer in his toils, and heightens the animation and joyfulness of the whole population. But this unanimous satisfaction is seldom given by capricious autumn, to the hazards of which the vigneron abandons himself with the quiescence and fatalism worthy of a Turk. Fine and good vintages are now getting more scarce, and that is not because of the inclemency of the seasons, but because of the stupid ardor of covetousness and desire of obtaining a crop of any description to make a wine, whatever may be the quality. Sixty years ago one used to grow grapes to make wine; since, and especially for the last twenty years, wine is made solely for the money that it realises. Wine is made with grapes grown from coarse *cepages*, crammed on a small space of neglected soil; it is made with green grapes, and specula-

tion, trafficking audaciously in names, destroys the former reputation of the wines of France. Oh, manufacturers and merchants of pretended French wines, how long will your impudent traveller persuade foreigners that your wines from gamais, chasselas, gouais, verdillon and verjuice, qualified by the addition of glucoses, molasses and raw sugars, are the true and good French wines ? The answer is ready : English industry offers similar wines, made with preserved grapes, sugar and acids. To re-establish the trade of genuine French wines, vineyards must be planted with fine *cepages*, and the fruit be allowed to come to perfect maturity. The French wines are light and generous, inimitable in their agreeableness, and incomparable for their hygienic influence on the body and mind.

Ban de vendange *—Advantages of late gatherings—Disadvantage of the ban de vendange.—In old times an assembly of notables, assisted by experienced vignerons, fixed for everybody a day before which gathering grapes was not allowed, and that day never preceded the complete maturity of the fruit ; the quality of the wine was the pride of the man and of the country, and it was very properly thought that no single individual had a right to compromise a reputation the maintenance of which was a matter of general concern.† The desire to realise the crop as early as possible is permitted to influence the fixing of the ban de vendange where it exists. The crop must be turned into money as soon as possible, and the September rains and October frosts are dreaded like irresistible scourges, from the grasp of which the grapes must be taken, be they only half ripe ; what matters the quality, as long as there is a sale for produce, and it will always sell, the wine having become so scarce. This anticipated fixing of the ban de vendange is, therefore, exercised without a regard to the quality of the wine, and for that reason the complete suppression of the custom is desirable.

Danger of early gatherings.—The inclemency of the weather in autumn is generally less injurious and less fatal than people believe. For forty years I have observed with interest most of the vintages, and their episodes relatively to meteorological effects. I have often seen the proprietors in Burgundy, Champagne and Tourraine regretting their early gatherings, and I have always ascertained that the temporisers of the same localities obtained better crops and better wines. To make the good wines, the true wines of France, except, perhaps, in some Southern localities, the grapes must be gathered when in their highest state of maturity. A perfect maturity is of as great importance as the choice of fine *cepages*. For, in truth, the juice of Chasselas may measure four or five degrees with the gleucometer, and of well ripened gamai six or eight degrees, when the juice of the best black Pineau, if unripe, may mark zero ; when the Pineau is slightly red, it marks two degrees, then four, six and eight, and it is only by longer and complete ripening that its juice reaches ten, twelve and even fourteen degrees. It is evident, therefore, that the perfect maturity of the grapes is the necessary complement of the fineness of the vine which produces it. So the vigneron who gathers his Pineau as soon as it is black outside and green inside, obtains wine worth one shilling per gallon, and the vigneron who gathers it a fortnight or a month later, when it is thoroughly black, gets a wine worth from three to four shillings a gallon. The choice of the time for the vintage is of great moment. For several years I have seen the finest black grapes of the great vineyards in Champagne sold at from 24s to 32s the cwt. Well, a vineyard well tended will always produce one ton of grapes per acre, which would give a return of £24 or £32.

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* Vendange is used for gathering and also for all the operations of wine making.

† Cyrus Redding thinks wrongly that the ban de vendange is an infringement upon the personal rights secured by the Revolution to every Frenchman. The ban de vendange is no law of the code, it exists only in a few localities, and even there it is not strictly carried out ; in fact, it is a kind of understanding among the inhabitants of a commune, and any of them who chose to override it can do so with impunity.—TRANS.

Advantages of late vintages.—I have no hesitation in laying down the principle that the vintage should be late in the season, as late as possible, and that all the efforts of the distinguished vinegrowers should not be directed towards the saving of the fruit from the inclemencies of the weather, but to protect it against those inclemencies till its perfect maturity. An instance of that practice and the proof of its results are to be found at Thomery; it is in that locality one may learn in what the true maturity of the grape consists. When, in September, one visits the trelliss and espaliers of Messrs Rose and Charmery, the golden color and the apparent perfect maturity of the grapes draws the most emphatic expressions of admiration from the visitor, who is astonished when told that they will require two or three weeks more to attain perfection. The admirer is inclined to think that those skilful vinegrowers are taking advantage of his credulity; it is not so, however, for in two or three weeks those grapes will be double in value; and for that reason care and trouble are not spared to preserve them against rain and frost. In many vineyards, such as Vouvray, Sauterne, and several others, without the use of any protective means, the vintage is commenced as late as possible. In some localities the proprietors wait till the pellicle of the grape has reached the state of fermentation and is covered with mouldiness; to make the best and most highly esteemed wines I have ascertained myself the excellence of this practice; in 1846 I made a cask of white wine from meslier grapes, the surface of which was all covered with mould, and so much so that when taken off the vine a cloud of dust would arise and the grapes fall from the stalk. That wine had neither a rotten or mouldy, taste and kept admirably all its fine qualities. Successive gatherings of the grapes as they reach maturity would appear at first sight an excellent practice to make good wine—we shall see farther what to think of it; but, in any case the unripe or imperfectly matured grapes must be strictly thrown out. To sum up, when the vintage has for its object the making of wine of repute, and of high value, it must be as late as possible; an early vintage can only produce wines of middling quality or of no value.

MUSTS, AND MEANS TO APPRECIATE THEM BY THE GLEUCOMETER.—TRANSFORMATION OF THE MUSTS BY THE ADDITION OF WATER OR SUGAR.

Must.—The must is the juice which results from the pressing of the grapes before fermentation. The grapes are pressed with the hand or with the end of a small hand-press.

Hand-press.—To avoid the direct bruising, and more especially to obtain with more facility all the juice of the grapes from their state of verjuice till the time has come when their state of perfect maturity permits their being pressed without great effort, I have caused four small hand-presses to be made.

Fig. 18. Fig. 19.

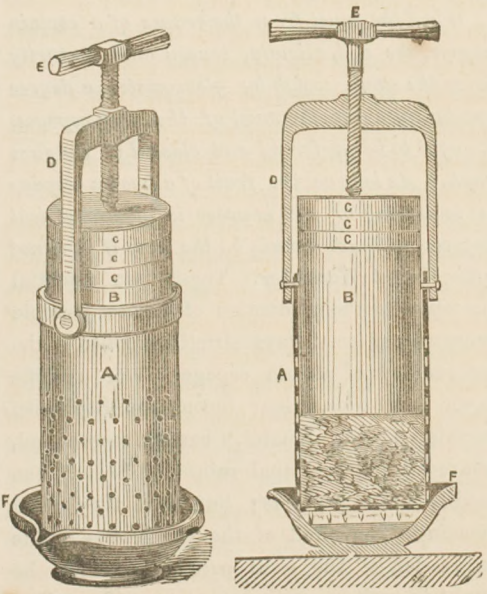

FIG. 18—EXTERIOR VIEW OF THE HAND-PRESS. FIG. 19—SECTION OF THE HAND-PRESS.

A is a cylinder made of strong plate perforated to two thirds of its height and at the

bottom, and corrugated and strengthened at the top so as to receive the screw frame D which supports the screw E. When the cylinder has been filled up with grapes and the screw-press folded down on one side (this frame moves on the side hinges) a wooden cylindrical piston, B, is lowered and pressed down on the grapes with the hands, and afterwards with the screw brought back to its vertical position; if all the juice is not extracted when the piston is completely down, the screw is brought up again and the piston is loaded with the wooden discs CCC. During the operation the press is placed in a tub or any other recipient large enough to hold the produce.

Gleucometer.—The wine-maker must have recourse to numerous gleucometrical experiments to ascertain, 1st. The relative value of the grapes of the different vines. 2nd. The precise time of their perfect maturity. The must-weighing instrument, gleucometer or densimeter, ought to be the indispensable guide of the vine-grower to select the cepages and determine the time for the vintage.

When the must from the grapes of a certain cepage, the soil, climate, season and maturity being the same, weigh by gleucometer, a degree constantly above the must of the other cepages, it ought to be preferred and classed in the first rank. As long as the fruit of a known cepage is improving or will improve in gleucometrical degrees, it must remain on the vine if it is not after the 1st November. These two essential precepts for the production of the best possible wine cannot be always strictly applied; the infecundity of certain cepages, their specific savor and odor, their incompatability with certain soils and climates, a baneful season, and, above all, the autumnal rains and frosts, often modify those precepts; but, still they must remain in the mind of the vinegrower as the expression of the ideal perfection which he ought to seek to realise at any sacrifice. The gleucometer is a simple and inexpensive instrument resembling all the areometers and thermometer used by everybody.

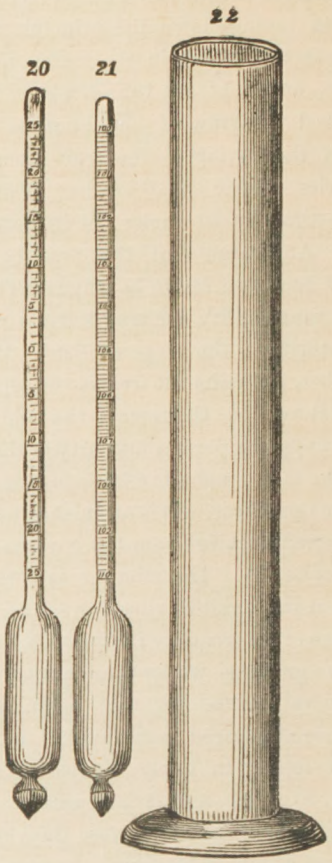

FIG. 20.—Gleuco-œnometer. FIG. 21.—Gleucometer. FIG. 22.—Gauge in which to immerse the instruments 20 and 21.

The gleucometer indicates in an absolute manner the density of the must, and in a relative manner only, the quantity of sugar which concurs to increase that density; the polarimeter gives precise results upon the richness in sugar of the must, but the optical instrument is not yet within reach of everybody, and the gleucometer gives approximative results, quite sufficient for wine-making, especially if its scale, having for zero the density of water at the temperature of 53° Farenheit is made large enough to show the hundredth parts of the density. One degree of the gleucometer represents about two ounces of sugar per gallon of wine, or one part of pure alcohol for every 12 gallons of wine. Therefore, if at any time it is desirable to in-

crease by one degree the proportion of spirit in the wine, two ounces of cane sugar must be added for every gallon of wine. It would require four ounces of any other sugar to produce the same effect. But the must of the grapes contains also non-saccharine and non-reducible matters in alcohol, which form also its density. However, those matters have only an influence of one-tenth or a fifteenth upon the number of degrees shown by the gleucometer. By substracting one-twelfth from that number, the mean quantity of sugar contained in the must will be known. This approximation is quite sufficient for practical purposes.

How to ascertain the quantity of sugar with the gleucometer.—When the juice is pressed from the grapes and filtered, it is put into the gauging glass (fig. 22) and the gleucometer is immersed in it. The gleucometer will sink in inversed ratio to the density of the liquid, or its richness in sugar, and the degree marked on the gleucometer level with the surface of the liquid indicates approximately the saccharine matter that it contains. It is only necessary to substract one from every twelve degrees, and that will represent nearly the other foreign matters. The temperature of the juice must have been previously brought down to 53° by immersing the gauging glass in water recently drawn from a good well. This operation is extremely easy in execution and repetition. It should be applied to all cepages which are grown in the vineyard, and renewed at the different degrees of their maturity. The gleucometer is the scale which weighs the richness of the musts like the alcometer of wines, and although this ponderable richness does not constitute the fineness nor the quality of the juice (properties belonging to the cepages only), it represents, nevertheless, the most important element of the wine, the sugar, which will eventually constitute its strength in spirit. Each vineyard ought to have a register for gleucometrical observations. Such a register would assist considerably the study and progress of viticulture and œnalogy.

Relations of the degrees of the musts to the richness of the wines they produce.—It is necessary to know the relations existing between the degrees of the different musts, and the correspondent richness of the wines they produce. 1st. Those relations may be approximately established in the following manner :—The musts which do not work above 5 or 6 degrees by the gleucometer, are poor wines and cannot pretend to any reputation in France, and still less in foreign countries ; they might produce very fine and delicate wines if made from good cepages, but they are not strong enough for the great commerce of the interior or for exportation. 2nd. The musts of fine cepages which work from 8 to 15 degrees, produce the good wines, the great wines which characterise more especially our splendid viticole production ; it is those wines that have founded our legitimate fame throughout the world. 3rd. The musts which rise from 15 to 24 degrees produce wines very rich in alcohol, in tannin and coloring matter, and are only fit to blend with other weak wines; or they produce liquor wines analagous or superior to some of Spain, Portugal, Italy, or Madeira, and other meridional countries; but those wines cannot be consumed as an habitual and abundant beverage. They constitute generous and precious stimulants, when drunk in small quantity, and they have nothing which can connect them with the wines of Bordeaux, Burgundy, Tourraine, and Champagne, which are the true types of the wines special to France.

Process by which over rich musts may be transformed into wines suited for habitual consumption.—The musts, too rich in saccharine matter, and produced generally in the southernmost parts of France, have raised a question relative to the vintage time, and to gleucometrical measures. The proprietors who desired to transform their rich musts into dry and fluent wines, like those of Burgundy, &c., gathered the grapes as soon as the must would work 12, 14, or 15 degrees by gleucometer, and they were successful. Other proprietors have allowed the grapes to come to perfect maturity, and lowered afterwards the must to 15, 14, or 12

degrees by adding before fermentation the necessary quantity of water to obtain that result. The second process complies with the general principle of gathering when maturity is complete, and is the best, the most rational and advantageous. It is better, in effect, to allow the development of all saccharine matters which are the fundamental basis of vinosity, and extend that richness to a larger quantity of wine, than to suppress it, as well as incur the loss of the proportion of wine which results from it. Pure water constitutes generally 75 per cent. of the wine, and, when it is added before the fermentation, it absorbs sugar, coloring matter, tannin, salts and acid, which it requires to form wine, especially if the skins and stalks are not cast off before the fermentation.

Increase of the richness of the must by the addition of sugars.—This grave and dangerous question has been agitated for a long time, not with regard to excessive richness, but the poverty of the musts. Is it possible to increase the proportion of saccharine matter in musts by the addition of other divers saccharine matters? Such is the second question, the solution of which, affirmatively and absolutely given without sufficient examination, has contributed as much and more than the planting of gamais, chasselas, and other coarse *cepages*, to tarnish and trifle away the reputation of the good French wines. There is no doubt that, by means of saccharine matters, such as glucoses, molasses, honey, beetroot, and other sugar, the must may be raised from 2, 4, 6 and 8 degrees to 10, 12, 14 and 16 degrees; and undoubtedly, also, if those additions are made before the fermentation, they mix well with the wine, but the results of these mixtures are worthy of the components. The mixture of chasselas and glucose produces a detestable drink; the mixture of gamai with the same glucose produces a heavy wine, which contains all the qualities of fecule spirits and the juice of coarse and vapid grapes. Sugar from grain or fecula, fermented with the pineau, would not be so bad; but the must of pineau itself, however weak it may be, would produce a wine infinitely preferable for taste and health, only it would not be so strong and intoxicating. Fermentation draws from the grapes, or rather the must, only the elements and qualities which are contained in it. It will never draw from the gamai what belongs to the pineau alone; and, notwithstanding the contrary assertions of several chemists, the different saccharine matters contain always the principles of their origin. With the must from grain, fermentation will give spirits of grain; by fermentation, glucose will give spirit of fecula sugar; and with molasses and divers other sugars it will give corresponding spirits. If you distil separately fermented glucose and fecula sugar you will obtain a spirit undoubtedly vapid and of disagreeable taste; if you distil separately pineau and gamai wine, the spirit from the former will be far superior to that from the latter. Every plant, every saccharine fruit, has its special sugar, which has in its turn its special alcohol. The characteristics of that alcohol might be unnoticed or confounded by chemistry, but neither the palate nor the stomach will mistake or ignore them.

Vintage in operation.—I will now say a few words upon the material execution of the vintage. The processes vary in each locality, but they rest upon a principle common to all. The grape gatherers, women, men, children and old men, are each provided with a basket, a pruning knife or scissors, and are divided into proper gangs conducted by one man, who takes away the baskets when full, and empties them into a water-proof recipient, which contains about 22 gallons, and is, therefore, easily lifted by one man or carried by two. Two of them form a load for a beast of burthen when carried on its back. There are different kinds of recipients, some are made of osier, others of wood. Some are made to fit on a man's back; others have a handle on each side, but the best are unquestionably tubs made for that purpose or from casks containing 45 gallons, cut in two and fitted with an iron handle on each side. These gathering tubs must be well cleaned before the vintage. When they are filled up with grapes

they are carried away on drays to the fermenting house, or emptied at the vineyard into oblong vintage vats fixed on drays stationed at convenient places. This last mode of operation requires less tubs. In gathering fine grapes the direct transport in recipients is preferable: 1st, because it saves numerous decartings, causing often loss of juice and grapes, and more labor. 2nd, because the grapes do not undergo any trituration or immersion, which would render difficult the examination and sorting at the fermenting house. 3rd, because these same grapes being neither bruised nor heaped in large masses do not undergo any incipient fermentation before the suitable time for a good vinification.

Gathering baskets.—These baskets are made of osier (fig. 23). They ought to measure about 3 or 4 inches in depth at the most, and have a wide opening, over which a handle is fitted. They are easily carried; the grapes can be deposited with speed and facility, and the overseer is enabled to detect at a glance any bad ones when he empties them into the recipients. This latter advantage is the most important of the gathering, because the gatherers are always anxious to fill up their baskets with any grapes that come under their hands.

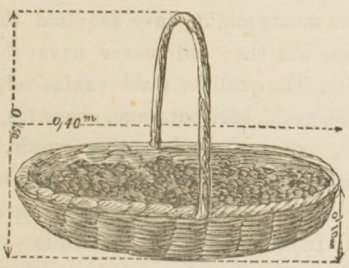

FIG. 23—GATHERING BASKET.

Cutting off, sorting and cleansing the grapes.—If the sorting is not done immediately after the cluster is cut off the vine, the gatherer is only provided with a pruning knife, but, if it is done, then scissors are required instead of a knife, because with them any parts that are green or imperfectly ripe, shrivelled up, frozen, or rotten, can be taken off. A supplementary basket between each two gatherers receives the refuse. If the sorting is effected when the basket is emptied into the tub, a double service of baskets is required, and the most intelligent of the gatherers are selected for that operation. But when the weather does not permit the sorting at the vineyard, it is done at the fermenting house, and there it is generally done more effectually. When the grapes are carried to the fermenting house in large vats, sorting is nearly impracticable.

Use of the refuse grapes.—The refuse grapes which result from the sorting are not entirely lost; they are put aside, and inferior wines are made from them. Those wines are generally used for local consumption. Any proprietor careful of his own interest will not allow those wines to be thrown into the great market of the interior, or for exportation.

Duration of the gathering.—When it lasts ten days it is a long gathering; an intelligent proprietor will always organise a staff to enable him to do that important operation in less time, if possible.

Simultaneous gatherings—Successive gatherings.—If the vineyards have been planted with the same *cepages* in the same locality, if they have been naturally or artificially protected against frosts, if they have not suffered from hail, and the gathering takes place as late as possible, it is advantageous to gather the whole at the same time. But it sometimes happens that, either on account of frosts, of coulure, hail, or a mixture of early and late varieties, the grapes ripen successively, and at an interval of several weeks. It is only under such exceptional circumstances that it is advisable to get in the crop at successive periods; but when that practice has only for its object the gathering of the grapes as they appear to come to a sufficient degree of maturity, it must be strictly prohibited, for, whether the grapes be really or apparently ripe, they may remain advantageously on the vine till there is no doubt of the maturity of all. It is very difficult to select the grapes that are perfectly ripe from those apparently ripe. Gathering as late as possible in the season, and at one time, such is the rule; any other mode of proceeding is a lamentable exception.

Disadvantages of pressing the grapes at the vineyard.—In some localities the presses are taken to the vineyard, and the grapes are pressed on the spot. This practice has for its object to prevent the coloring of the wine, which is supposed to be caused by the carriage of the grapes in the tubs, and the bruising occasioned thereby. The disadvantages of such a practice are more serious than those intended to be avoided. The cold and rain, the bad roads, the necessity of bringing casks to receive the must, and all the necessary implements to work the press, occasion a loss of time, juice and grapes. When the service of transport is well organised, grapes (even the most colored), may be brought a distance of fifteen miles, and make a wine of an unexceptionable whiteness. This is an operation repeated yearly in Champagne, where the merchants of sparkling wines buy the red and white grapes at a distance of twenty and thirty miles, and know how to bring them to their own presses by hundreds of tons without causing the juice of those grapes to be colored in the least. All the operations of the vinification ought to be performed in the fermenting and press houses.

Chapter III.

Operations at the Vendangeoir.*

I will now speak of the operation above mentioned.

Notes to be Taken on the Arrival of the Grapes at the Vendangeoir.

Duties of the chief of the vendangeoir.—However simple and primitive be the making of wines, it comprises a series of ideas, and is composed of a succession of operations, with which the proprietor, the overseer, or the chief vigneron, must be perfectly acquainted. The chief of the vendangeoir, whoever he may be, must receive the grapes personally when they arrive, ascertain their production, verify their state of maturity, their quantity, quality and richness, and write down all those circumstances.

Difference in the richness and quality of the musts.—We know that the must is the juice resulting from the pressing of the grapes before any fermentation has taken place. It is essential to understand what is meant by the richness. The richness is an element necessary to the quality of the must, but it is not in the least the quality itself. For, let us compare some of the musts best known, and of different origin, as :—

The must of fecula of potatoes (transformed into glucose).
The must of farinaceous substances, do do.
The must of beetroot.
The must of cane sugar.
The must of chasselas.
The must of gamai.
The must of muscat.
The must of pineau.

Those musts might have acquired the same richness, but they will never have the same qualities. The qualities reside exclusively in the potatoes, grain, beetroot, cane, chasselas, gamai, muscat, pineau, or, in other words, in the specific nature of the fruits, of the roots or stalks which produce indirectly saccharine juices. In each species the richness may be freed from the qualities and faults it contains, as well as the odor and flavor which deteriorate or improve it ; but it always remains peculiar to its origin. If it were otherwise, if the richness of all the musts were alike, an excellent beverage could be made out of the grain alone, the potatoes, or the beetroot ; good wines could be made with chasselas, gamai, gouais, &c., which is materially impossible. But, if this transformation is absolutely impossible, it is also relatively impossible ; and the fact proves it sufficiently, since the must of

* The word vendangeoir, or vineyard establishment, represents the vineyard and the whole of the houses which are required for the cultivation of the vine, and the making of wine ; it is also applied to a country box, to a house or mansion which has a vineyard for its principal dependency. The vendangeoir is to the vineyard what the farm-honse is to the farm lands. One has a vendangeoir in Burgundy, Champagne, Medoc, Touraine, like one has a farm in Brie, Normandy and Picardie. The buildings especially devoted to the making of the wine are generally called the vendangeoir. Vendangeoir is pronounced *vendanjoir*.

grapes is the indispensable basis which gives to the produce of those adulterated mixtures some apparent resemblance to wine; good sense as well as experience indicates, therefore, that the mixture would be an average produce between the qualities of the sugar of potatoes, beetroot, grain, cane, and the qualities of the chasselas, gamai, muscat, and pineau. The richness of the must is not, therefore, its quality; however, in the grape as well as in all saccharifierous plants, the richness of the must is generally and naturally in direct relation to the quality, especially when the cepage is the same and grown under the same climate. I have said, generally, because the famed wines offer in that respect numerous exceptions, of which the taste, smell and stomach are the best and even the only judges. Thus the musts of the Upper Medoc may be stated at 9 for an average; those of the Rhine, 9; those of Champagne, 10; those of Burgundy, 12; and those of Roussillon at 14. The superiority universally accorded to the four first-named wines over the fifth, shows sufficiently that the richness of the musts does not correspond always to their quality. The richness of the must is simply the quantity of fermentive sugar, or sugar convertible into alcohol that it contains. The quality is the fineness or the coarseness of the sugar, the fineness or the coarseness of the juice that it contains, as well as the acids, salts, essential oils, and azoted matters, the whole of which forms the must, which may be poor and yet of good quality; or it may be rich without quality. Chemically speaking, 100 parts of an average grape must are constituted as follow, namely:—

Pure water	78
Glucose, or grape-sugar ..	20
Free acids (tartaric, tannic, &c.)..	00.25
Organic acids or salt (citrarte)..	1.50
Mineral acids	0.20
Azoted matters (yeast or ferment) Essential oils .. .. Mucilaginous and amilaceous (starch) substances.. ..	0.05
	100.00

Those divers elements of the must from grapes varies according to the cepages, their maturity, the soil, climate and season; and those variations might double, or be reduced to one fourth of their average qualities, for the sugars, free acids, salts, azoted matters, and mucilages; but each of these divers elements retains its peculiar and original character; the water of the pineau is not even the same as of the gamai, and still less does it resemble ordinary water, or the chemical water. The bodies have properties in vegetable and animal functions that science still ignores, and which daily reveal themselves by incontrovertible facts. It is thus that certain special affinities of bodies in chemical motion, when in a state of formation, have been admitted; thus, azone must have expressed a particular state of the oxygene, a state that the instinct of gardeners and agriculturists had felt in the atmosphere long before and designated by the term *etat de seve*. The juice of pineaus, muscat, semillon, cannot be chemically composed any more than the milch from the cow, and she goat, or the blood of divers animals. I have stated, at the beginning of the treatise on vinification, that chemistry was to winemaking what physical science was to musical composition. By that comparison I have had no intention of depreciating the eminent services that chemistry has rendered and is daily rendering to vinegrowers and to vinification: far from it, I accord the most loyal homage to œnalogical chemists. But all the services rendered by them consist more particularly in the analysis, in the measure and intelligence of the constant elements and phenomenons of vinification, than in the discovery of facts, of rules and processes arising to modify, to replace, and especially to perfect in every respect the wines of first quality. It is thus that the discovery of sonorous vibrations, the relations of their number with the notes of the gamut, and the ciphered laws of their accords in virtue of those numbers were precious conquests for sciences and for the arts, but long before that discovery the ear had guessed the relations and the laws of sounds; the rules of melody and harmony were established, and even now inspiration and musical genius are still the unique source from whence spring master-pieces. Science might

have helped and perfected the creations of composers, but it is completely foreign to inspiration and to the special qualities of their productions. The composer of the wine is the vine; its spirit belongs to it and not to chemistry. It is not by a metrical appreciation that the relations existing between the vegetable and animal kingdoms should be judged; chemistry, that magnificent science, which I love, and have studied and practised with passion, has not yet found the key of those relations. Experience, sometimes baneful to humanity, has ascertained that in proportion as vegetable or animal products were reduced into a formula, and analysed with precision at the laboratories, they became more and more unfit for animal alimentation; we are now spared the chemical gelatin. Heaven will that chemical wine be spared to humanity! Chemistry tells us: All sugars from fruits are chemically represented by C^{12} H^{12} O^{12}. Thus, grapes of all kinds, apples, pears, plums, raspberries, figs, melons, C^{12} H^{12} O^{12}. Chemistry goes no further. The sugar from grain and the sugar from potatoes are also quoted by C^{12} H^{12} O^{12}. And the meaning is this: In this theory those sugars do not differ in anything from any other sugars from fruits. That is true with regard to the quantity of carbon, hydrogen and oxygen which composed those divers substances, but the sense of it is absurd, and it is false as to the physiological effects, as well as it is false that the beetroot sugar, represented by the formula C^{12} H^{12} O^{12}, is physiologically identical to cane-sugar, equally represented by C^{12} H^{12} O^{12}. If chemistry had to represent the flesh of a partridge, a wild boar, or an ox, it would only do it with the formula C·H·O·A·, and the same numbers for exponents and for co efficients, yet the sensual and digestive effects of those fleshes differ essentially. If the relations of alimentary substances cannot be yet chemically analysed and measured on account of certain known quantities unexplained to this day, neither can they be strictly judged by a simple tasting; gelatin, for instance, chemically extracted, purified and properly seasoned, gives soup very good to the taste, and a very acceptable jelly, which however, will starve a dog in three weeks, and give diarrhœa to a sick person after using it for six days. Salts of lead give a sweet and seductive savor to acid wines, but they render them extremely poisonous. In the same manner, sugar of grain, potatoes, beetroot, mixed with wines, increase their absolute strength, and might render them agreeable at the first tasting, but the use of those wines will produce the same physiological effects as the alcohol of grain, potatoes and beetroot; that is to say, material and deplorable moral effects.

I must repeat that I do not impugn the chemical science, which, indeed, I place in the first rank of modern sciences for its enlightment and discoveries, and for the services that it has rendered; neither do I question its laws or its œnological analysis which instructs and guides surely the vinegrower in his pursuit. But I will assail with all my power an error (which the chemists will soon discover themselves)—the absolute assimilation of the sugars from fruits among themselves or with those of grains, potatoes, beetroots, &c. I will contend against the substitution of those sugars in vinifications as being equally advantageous, 1st, because that assimilation and that substitution are a double error, which has already cost Burgundy, and other vine districts, one half of their reputation. 2nd, because that error threatens the future of vine culture in France by making away with the *crus* and the cepages at the same time. 3rd, because it would ruin ten millions of vinegrowers, if, against all common sense, it is upheld by a science greatly esteemed and naturally expected to enlighten and to serve as a guide to vine culture and wine making. What matter? will it be said; if the similitude is a truth, the science must make it known. Perish a country sooner than a truth! Be it so, but I, a chemist, a physiologist; I who, like you all, have made experiments to supply the deficiency of wines and to provide good wines of all kinds for consumption; I who, for some fifteen years, have studied the wines of sugars,

without any personal interest; who have seen thrown upon the public streets the wines made with water saturated with sugar and murk of pineau; I tell you that you are propagating an error, unconsciously; and, as often happens to *savants*, you have been the dupes of your good faith, in accepting as true, deceptive experiments, and facts incorrectly observed, carelessly studied and explained. I will not end this long but important digression, without indicating the means for testing the correctness of the foregoing assertions. Take equal quantities of glucose of fecula, syrup of sugar of beetroot, and syrup of sugar of cane. Dilute separately each of the above products with sufficient water to bring them down to 6 degrees of the gleucometer. Take an equal quantity of must of pineau quite ripe, and of must of gamai, well ripe also, then bring them down to 6 degrees. Place each of those liquors in separate glass vessels, add the necessary quantity of yeast to the musts which are naturally deprived of fermenting principle, then let them ferment in the same place at 68 degrees. After eight or ten days of fermentation, distil successively the five liquors in water-baths (bain-marie). The tinned alambic as well as the warm are to be thoroughly cleaned after each operation, and the spirits received in separate vessels. Bring down to 48 centissimal degrees each of the spirits obtained, and put them in bottles hermetically closed. After three months get tasters not prejudiced by the origin of the spirits to judge them comparatively; they will find

Spirit of	fecula	... very bad.
,,	,, beetroot	... bad.
,,	,, cane sugar	... good.
,,	,, gamai	.. middling.
,,	,, pineau	... very good.

Not one of the above five could be mistaken. If they are tasted twelve months after the same differences will be even more distinctly observed. I have made those experiments conscientiously, carefully and unprejudiced. I treated it as a question of commercial economy, and the results obtained were as above stated. The differences are not so sensible if the products of distillation are raised to 90 degrees to be lowered afterwards to a potable standard of 48 or 50 degrees; because for spirits as well as other substances, the more they are concentrated to the absolute state of their immediate principle, the more they lose their original character either vegetable or animal; the more also they advance to a state of mineralisation and lose all special odor and savor, and therefore all quality of nutritive assimilation. It is for that reason that concentrated and rectified spirits diluted with water, or mixed with wines, do not resume the alimentary qualities which they primitively had in the fermented juices. I shall now return to the vintage operations. The production, state, quantity, quality, and the richness of the grapes brought into the fermenting and press house, being ascertained and registered, the *vendange** is discharged, and immediately placed in the press, if for white, and in the vats if for rosy or red wines.

Egrapages.—Whether the vendange is sent directly to the press or to the vat; whether white, rosy, or red wines are to be made, there is a previous operation common to all wines: it is the egrapage, or the separation of the berries from the stalks. This operation is effected by the fullage, or the pressing, during fermentation.

Influence of the stalk upon the quality of the vine.—When the grapes are well ripe, the stalk is lignified, and, if imperfectly ripe, it remains green. If the stalk is preserved during the pressing, or participates in the fermentation, it can only impart an astringent principle to the wine, the principal basis of which is the tannin; that principle is useful in white wine containing a large quantity of albumen, and is advantageously employed as a preventive of the disease in white wines, called the grease; it is neither hurtful to the stomach nor disagreeable to the taste if it is in small proportion in white

* Vendange has a double meaning. As a general term, it means the grape harvest; but it is also used to express the quantity of grapes gathered by one proprietor. One will say: The vendange is fine this year (the whole product of vineyards) and also, my vendange, is good, or my vendange is pressed, &c.

or red wine; indeed, it gives it some body, and is not foreign to the firmness of its taste; but, if it contains an excess of tannin, the wine is hard, astringent, disagreeable to the taste, and heavy on the stomach. In almost every vineyard observation and experiment have ascertained the advantages and the inconveniences of using the stalk in the operations of wine making; and for that reason, in one-half of the vineyards in France, the egrapage is rejected, and in the other half it is practised with great care. This diversity of opinion and action is not only manifested in opposite regions essentially differing in their wines, but it exists also in the same districts, in the same commune, and each vigneron seems to have reason to congratulate himself upon his own process. I will give, as an instance of that confusion, the upper Champagne, the department of the Marne, where the most uniform of all sparkling wines are produced. This proves that egrapage is not essentially related to the fundamental basis of vinification, and, for my own part, I am deeply convinced of the fact.

Influence of the pips and skins upon the quality of the wine.—The stalk is not so hurtful to the quality of wines as the pips and skins, which contain in excess fat oils and albuminous matters; the pips especially contain the most injurious elements to the delicacy and the health of the wines in which they have been allowed to macerate a long time. Taking out the pips is far more important than the egrapage.

Case in which egrapage is useful.—In vineyards which produce hard, astringent, strong in alcohol and long keeping wines, egrapage is advantageous, and even necessary. It is injurious for light wines of a known laxness and weakness, which do not keep long; for white wines that undergo the pressing process at once, and of which the juice is not allowed to macerate with the stalks, skins, nor pips, egrapage is almost indifferent, since the stalk which resists the action of the press has not sufficient time to communicate its tannin to the must, as is the case when maceration takes place. It is for delicate light white wines a cause of weakness and sickness, which might be avoided by putting the stalks in a bag and hanging it in the must while under fermentation after pressing. By that process the necessity of using tannin extracted from gall-nut, as is sometimes done, would be avoided. The tannin precipitates the albumen that certain wines contain in excess. Whatever it might be, egrapage is a very simple operation and easy of execution; it is generally followed by mashing and crushing the berries. It is easily conceived that for the production of white wines the egrapage and crushing of the berries reduce considerably the volume and resistance of the residues to be pressed. The stalks which occupy a considerable space have disappeared, and two thirds of the must contained in the berries has naturally run out; the residue to be pressed is scarcely one fourth of the primitive volume of the *vendange*. Thus a press which could only hold seven hogsheads or two cubic yards of vendange not subjected to egrapage and mashing, can receive and press 25 hogsheads of grapes which have been so treated. Egrapages and mashing are processes of primary importance for making white wines of superior character.

Egrapage with the trident.—Egrapage is practised in different manners. The simplest is the one shown by figure 24.

FIG 24.—EGRAPAGE WITH THE TRIDENT AND TUB.

The tub, B, is half filled up, and a man or woman, armed with the three pronged fork, A, dips it into the grapes and turns it rapidly; by these movements the berries are rubbed off from

the stalks and fall to the bottom of the tub, while the stalks, being lighter, rise to the surface when they are picked up and thrown into a separate tub.

Egrapage by the mill-hopper.—A quieter process is indicated by figure 25. A hopper, D, 3 feet long at least, and opening at the lower part into a half rundle cylinder, wherein the flier, B B, is fixed.

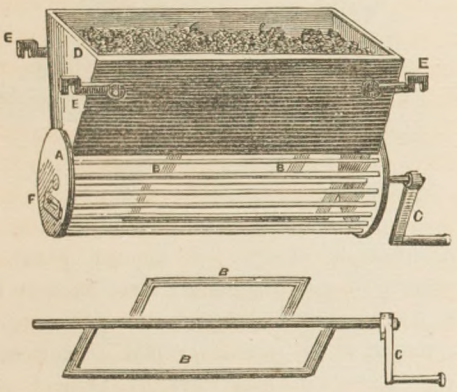

FIG 25.—MILL-HOPPER FOR EGRAPAGE.

The grapes thrown in the hopper are grappled by the flies and rubbed against the rundles of the half cylinder; by these movements and rubbing, the berries are detached and fall through the half cylinder whilst the stalks stopped by the rundles remain and accumulate; when they are in large quantities so as to impede the operation, they are taken out by a small door, E, fixed at the end of the cylinder opposite to the handle, C. This apparatus is placed either on the press, vat, or a movable recipient, which is emptied into the press or the vat.

Wooden grating.—The best and most economical method of egrapage is better and more economically effected by the use of the wooden grating as shown in fig. 26. It consists of a horizontal frame, on the top of which there is a wooden grating, B, made with transverse bars of about one inch square; they are fixed at right angles and shouldered so as to present a level surface and square holes of about an inch. The grating is moveable to facilitate its clearing, and it rests upon four legs, AA. The frame, D, projects 8 or 10 inches

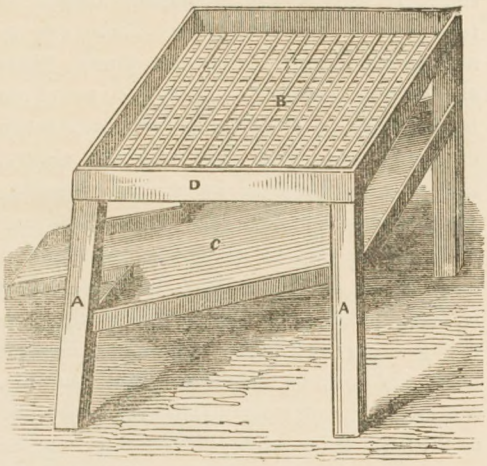

FIG. 26.—WOODEN GRATING FOR EGRAPAGE.

over it. The grapes are strewn over the grating and agitated till the whole of the berries have passed through, which fall on the inclined plane, C, that directs them, as well as the juice, either into the vat, press, or hopper of a crushing mill. The stalks are gathered and thrown aside in a cask placed alongside the grating. The stalks are distilled for brandy.

Mushing and crushing.—If the egrapage is not indispensable for the making of good wines, the crushing of the grapes, either with or without the stalks, is necessary, and must be executed before the pressing for white, or before vatting for red wines. The direct mashing effected by machinery differs greatly in its object from the one effected by men with bare feet, when the mash is in ebullition in the vats. The preliminary crushing, either by instruments, hands, or feet, is of absolute necessity, and it is its good execution which renders the mashing in the vat less indispensable.

Crushing the grapes with the naked feet.—The preliminary crushing of the grapes with the naked feet, is the best process; it is practised in the upper Medoc, and may be practised everywhere. The weight of a man is sufficient to overcome the resistance of all the berries, and the suppleness and elasticity of the flesh of the soles of the feet permit the pips to escape being crushed. In my opinion, it is very important to leave the pips quite intact, and not to allow

their oily, feculous and albuminous kernels, to take part in the maceration. There can be nothing objectionable in the feet of men, where cleanliness is observed. If so, the use of our hands should be forbidden in the preparation of our aliments, and that would be absurd, since it would be about impossible. Treading the grapes is best done upon an inclined platform, where two or three men can stand at ease. If the stalks are not to be taken out, it is sufficient to crush the grapes in the tubs used to bring them to the fermenting or press house, and to throw them directly into the vats, if they are intended for making red wine, and on the press if for white. There they may be trodden before being pressed. The essential result to be obtained, for white wines, is to draw from the berries of the grapes as much juice as possible, and to burst them all so as to reduce the volume to be pressed, and its resistance to the pressure. For red wines, the object is to disintegrate the component parts of the grapes, to mix the juices, ferment, coloring matter, and to facilitate contact with the air, so as to insure a rapid and uniformly progressive fermentation, and also to effect the best possible dissolution of certain elements of the wine, and the best combination of others. If the preliminary crushing is well done, whatever may be the means, the mashing in the vats is rendered easier.

Rollers for crushing. The best and most used instrument to crush the grapes is the one invented by M. Lomeni, and improved by several practical men. It consists of two wooden cylinders, (BB fig. 27), grooved and revolving parallel to each other; the hopper D is fixed on the top.

As the grapes, deprived or not of their stalks, fall into the hopper, D, fixed to the frame, C, by two iron brackets, E, they are seized by the grooves, dragged and crushed in their passage between the two cylinders, put in motion by the handle, A, fixed at the extremity of one of them. The cylinders are placed at a sufficient distance apart to allow the pips to pass intact. One such machine will crush a great quantity of grapes, and can be worked by a boy

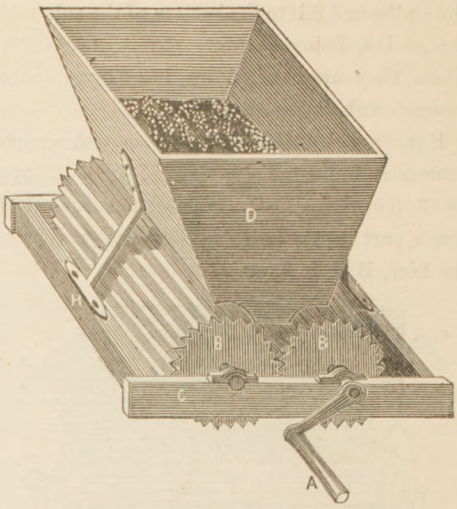

FIG. 27.—LOMENI'S CRUSHER.

Whether the egrapage is applied or not, I recommend the preliminary mashing as an indispensable operation for speed and for the perfecting of white wines. It matters not with what utensils or machinery it is effected, the simplest and the most economical are always the best.

Presses and pressing.—I shall speak of each special pressing when treating of the different kinds of wines. But in the meantime I will treat the general question of presses and pressing.

Dezaunay's Press, and operations on open presses.—I have seen most of the old and modern presses in operation; I have myself used a great number, and I have caused one to be made in such a form as I thought most perfect. Yet it is not better than the others, and certainly not so good as Dezaunay's press, and still less so than the one invented by M. Benoit, called the Troyan press. Although I have not had an opportunity of giving Dezaunay's press a trial, I judge it excellent, because of its cleverly simple mechanism, and its rational disposition, which suit so well the majority of localities. My opinion is supported also by the approbation of a most competent man in agricultural affairs, M. Barral. To explain the mechanism of that press, I borrow the design and description given by M. Barral, in his excellent work

the "Bon Fermier," (the Good Farmer) :— "A screw is solidly fixed in the centre of Dezaunay's press, (fig. 28,) and it is maintained immoveable by a strong fastening underneath the beam which supports, transversely, one of the wooden basins of the apparatus. Each one of these wooden basins rests besides upon a stone pillar. A screw nut, fixed in the wheel A, rises and comes down along the screw, and presses the support B, and the block C, which are both in wood. The block C rests upon a system of joists and boards, under which the grapes are placed. To exercise the pressure two men turn the fly-wheels, E,E, by the handles they are provided with. The conical cog-wheels, DD, fixed upon the same axis, move the wheel, A, which comes down along the screw with the support, B, and the block, C. Towards the end of the operation, the men standing upon the joists to work the fly-wheels, EE, go down into the wooden basin, to act upon the levers, GG, to which they give a vertical and alternative motion, so as to operate by percussion."

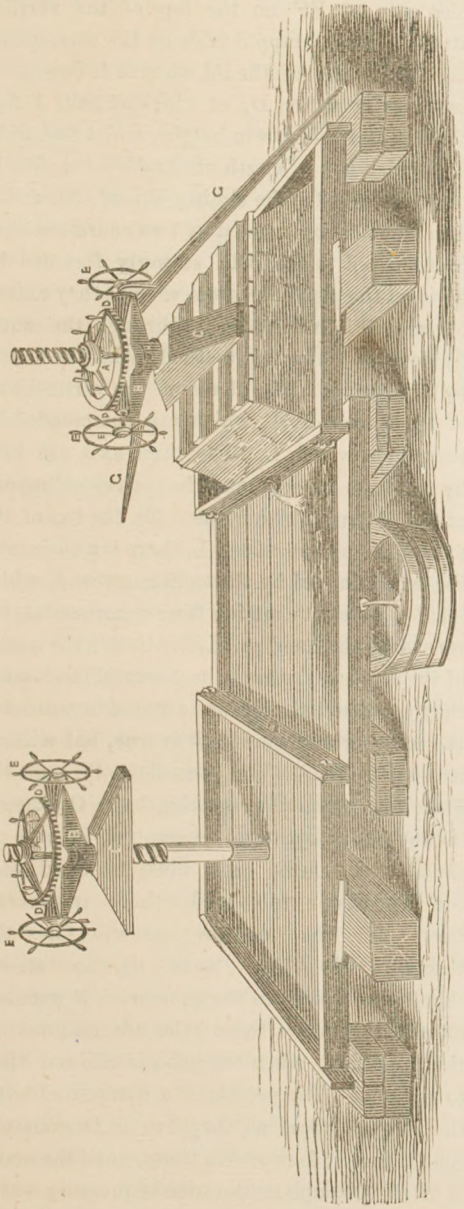

FIG. 28.—DEZAUNAY'S PRESS.

Dezaunay's press is conveniently disposed : three different speeds can be given to it, according to the number of hands employed—but always in such manner that the pressure will be the same, and the results obtained identical with the produce of must.

In operating with this press, as well as with any other open presses, the grapes, with or without stalks, mashed or not mashed, fermented or not fermented, are placed in the centre of the large platform or wooden basin then dressed in the shape of a large round or square cheese, of about seven feet diameter or side, and two, or two feet six inches thick. Sometimes the sides are supported by boards; they are moreusually left open. When the work is so dressed, two planks, or joists, nine feet long, are placed upon it parallel, and at two feet from the centre. Upon those a certain number of joists are fixed so as to form a floor. Other joists are placed upon the former cross-wise, and then the block, C, is brought down to bear upon them and causes the pressure. This pressure, which crushes and extends the work, must be executed slowly to give time for the juice to run out. When it has ceased running, the joists are lifted, the work cut up with a spade, and replaced as before, to be repressed till all the juice is out of it. A complete pressing requires generally four repetitions of the above operations.

Troyan Press and its working.—The Troyan press invented by M. Benoit has a more

complicated construction and mechanism than Dezaunay's, and its price is higher. But it is fixed with greater facility, and can be adapted to the *egrapage*, the preliminary crushing, and other operations of wine making. Fig. 29 will suggest the idea of a movable piece of furniture, like a piano or a side board, that may be placed anywhere. That press is as powerful as a locomotive.

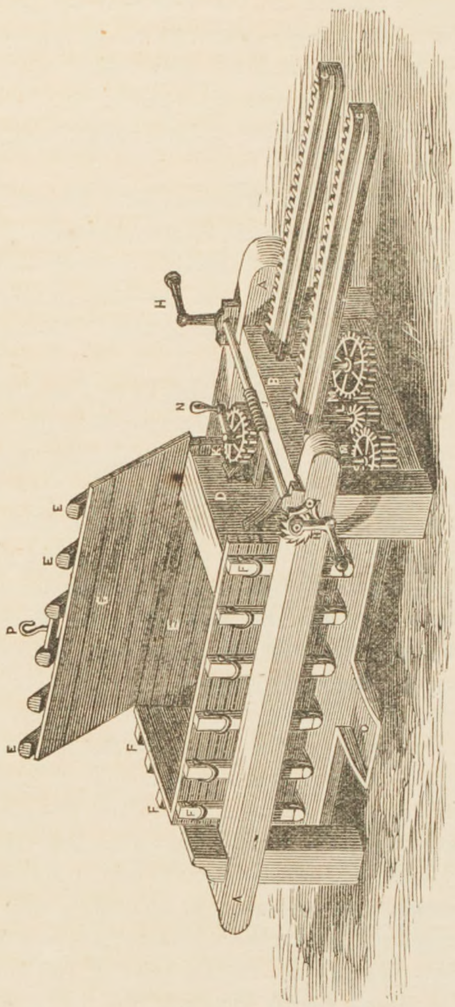

FIG. 29.—TROYAN PRESS.

A rectangular frame, AAKO, formed of four oak pieces, one foot four inches in height, by one foot thick, and fastened by strong cast iron squares, bolted at each angle, both inside and outside, is placed upon four legs as stout as the frame itself. The sides, AABA, of the frame and its back-cross beam, hidden in figure 29 by the side, FF, form a support and a fulcrum to a box or coffer, the sides of which, as well as the bottom, are made of grate-frames, maintained against the pressure by struts, eight inches by six inches, placed one foot apart, and bound together by iron bridles. A lid, G, made of oak boards, supported by struts, EEE, folds upon the coffer, and closes it by the iron grapples seen at FF on the top of the vertical struts. Each grapple folds on the corresponding struts, EE, of the lid when it is down. A rectangular piston, D, or block of oak, 1 foot thick, 2 feet 8 inches in height, and 4 feet wide, and which has a length of stroke of 4 feet 10 inches, completes the closing up of the coffer. The piston is commanded by two enormous cast iron-toothed racks, CC, strongly fastened by bolts on the piston, D, from whence they extend horizontally, in CC, and go through the outer frame at B. The two-toothed racks are moved by two roving-frames, fixed on the vertical axis of the wheels, MM, which are commanded by the pinion-wheel, L. The three axis are held by the cross-beam B, and the corresponding one at the bottom of the frame. On the top of the axis of the pinion-wheel, L, there is a horizontal cog-wheel moved by the endless screw J, which itself receives its motion from a horizontal bar turned by the handles HH. Under the action of the two handles, and the powerful mechanism they command, the piston is moved forward into the coffer or box, slowly, it is true, but with an irresistible force. The juice flows through the grate-frame into the receiving basin O, whence it runs into a bucket to be emptied in vats or casks. A double pale must be fixed near the handles to hold the transversal bars of the endless screw, for the reaction of the work is so strong that it would slacken the pressure if it were left unsecured. Besides, those pales are used during the stoppages, when the juice is allowed time to run out. The pressures are repeated with the Troyan press as they are in Dezaunay's, that is to say, four or five times, until the mark is dried. A complete operation of pressing white wines lasts five or six hours for twenty pieces

of forty-five gallons each; by working two shifts of men night and day, eighty pieces can be made in twenty-four hours, that is to say, 3600 gallons, or the produce of ten acres of vineyards. For red wines such a press would do the work of twenty acres. I have observed the working of the Troyan presses during six years, and I can affirm that their services are excellent. The grating for taking the stalks off the grapes is placed on the floor above the press, and the berries fall into a Lomeni crusher. This crusher is placed on the top of the open coffer of the press, which receives the crushed berries and juice till it is full. No press has appeared to me so well suited for a large vineyard establishment as the Troyan press; the Dezaunay press appears better suited for ordinary vineyards. It is needless for me to say that, before commencing pressing, the press must be well cleaned, as well as the house in which it is placed. Cleanliness must be observed during the whole time the press is at work.

VATS, MUSTS, AND WINES—FERMENTING HOUSE.

Fermenting vats and musts.—Fermenting vats are large receivers open at the top; they are sometimes made of stone, but generally of wood. Contrary to what is observed with regard to presses, the vats play a more important function in the making of red wines, than in the making of white wines; it is only necessary that the latter remain a short time in the vats, to deposit the gross lees and to clear them a little.

Glass tube to indicate the level of the must in the vat.—The vat must be of good oak, bound with iron hoops, and provided with a glass tube three quarters of an inch in diameter, communicating at the top and bottom with the interior of the vat, to indicate the level of the must. Opposite the tube a graduated scale is placed; each division of the scale marks $22\frac{1}{2}$ or any other quantity taken for unit. The tube shows the quantity of the must contained in the vat, and also the time when the lees are deposited; for the must which it holds clears up by depositing its lees and raising the scum like the must in the vat. When the must is clear enough it is drawn off and put into wine vats or casks.

Pumps and pipes.—The must is carried off from the press, either by buckets or other vessels, or a force pump, to which a leather hose is attached; but, if it is possible, the fermenting vats are placed on a lower floor than the press, and the musts are conducted directly from the press into the wine-vats by tin pipes or tinned copper pipes. I will add here that the quality of the wines does not depend upon their good or bad execution, or even the omission of the above operations; they are good without being essential. Put the wine of good cepages, in the best possible manner into new or recently emptied casks, and, provided that those casks have only contained white wines, brandy or alcohol of good taste, be you rich or poor, well or badly supplied with implements, and living in a hut or mansion, you will make good white wines. I insist upon this fact of absolute truth because a great number of people, of good and bad faith, extol a mass of unimportant processes of details, and, while they affect to be extremely careful without any regard to expense, in the making of the wines, they plant their vineyards with coarse cepages; resort to layering, manure to excess, and even add water and syrups of glucose to their juices. Those vinegrowers are persuaded or attempt to persuade that by the egrapage, the depositing of the gross lees in vats, the use of pumps and pipes, they make marvellous wines; it is simply knavery or absurdity. If, then, I have indicated, and if I indicate further, the most convenient and rational means to secure the best vinification possible or probable, I do not think that between the most expensive and complicated processes, and the simplest and cheapest ones there could be a difference of 1 degree in 12 in the definitive quality of the wines. Tell me the names of your cepages, the state of maturity of your grapes when gathered, assure me that you have not resorted to any

mixtures and that you put your wines into clean casks, and I will class them according to their true quality without any information as to their making.

Vats for red wines.—Those vats must be made of oak and be as much as possible of the same capacity. The capacity of the vat should be 900 gallons, if required to hold mark for 720 gallons of wine, and 1125 gallons for 900 gallons of wine. A vat of half and one of a fourth of the above capacity would be useful. The 1125 gallon vat is the most suitable. The dimensions are: Diameter at top and bottom 6 feet 4 inches; 7 feet 6 inches at the exterior of the bulge; 7 feet 6 inches high exteriorly; 6 feet 2 inches interiorly. The vats must be made in the shape of a cask and not of a truncated cone. That shape offers advantages for symmetrical solidity which gives it a superiority over any other form. Vats made of good oak, without sap, will last more than a century; they require no painting, which, in fact, would be injurious.

Vat-house, or Fermenting-house.—In a large vineyard establishment the vats must be so arranged in the vat house that a dray may pass easily between the rows. A vat house of 26 feet wide should have only one row of vats, although each vat might be only 7 feet in diameter. 1st, because there must be a passage between the vats and the wall of 20 inches at least. 2nd, because the cartage of the grapes, the placing of buckets for drawing off, the placing of the casks, and all the movements incident to the making of the wines, necessitate a space of about 18 feet. Two rows of vats require a house of 40 feet wide. The floor should be slightly inclined. The height between the two floors cannot be less than 14 feet, although the vats be only 7 feet high, because the vats must be raised 20 or 22 inches from the floor, and the four remaining feet are required for cleaning and taking the mark out of the vats. The vat-house is provided with windows, so that it may be aired or kept warm at will. The vats should be placed upon strong beams, and in such manner that they can be inclined when washing them with water and when drawing off the wine. It is needless to add that the bottom of every vat must be made perfectly secure against the enormous pressure when full. This is done by adjusting two small cross beams on it, and causing those beams to rest upon the supporting frame.

Heating and airing the *cuvees* or fermenting houses.—All fermenting houses where valuable wines are made should be provided with a furnace to raise the temperature if needed, and to maintain that temperature at 68 degrees. It is a very small expense, and the furnace is useful for other purposes, such as boiling water to clean the vats. A fermenting house must be constructed in such a manner that the temperature may be regulated either by warming the air inside or establishing draughts to refresh it. When master of the temperature, the winemaker can direct the fermentation as he pleases; but, if the dispositions of the vat-house do not afford him that advantage, he must supply it in the best manner he can, or dispense with it altogether, as it is not an absolute necessity. If the crop of grapes is good, the wine will make itself in the vat, whatever the temperature may be.

Casks and stands to support them.—The casks destined to receive the white wines must be new, or have contained white wines, or spirits of good taste, because bad casks or coloring matters, especially those of red wines, dissolve themselves during the fermentation of the musts, and alter for ever the color, savor, and odor of the wines. With regard to the absence of bad tastes, the casks intended for red wines require to be in the same condition as the casks for white wines; but they might without any inconvenience have been previously used for red wines. When the casks are selected, a few days before the gathering commences, they must be overhauled, repaired, and well rinsed with hot water, then bunged up and put in a fresh place, and kept there till they are wanted. When they are to be used they must be rinsed again with hot and afterwards cold water, and then placed upon stands one foot from the floor of the cellar. The

object of the stands is to keep the casks at a certain height to facilitate their inspection, to discover the leakage, and especially for racking off. Their object is also to prevent the contact of the casks and their hoops with the soil, which would cause them to decay rapidly.

Racking off.—The object of racking off is to separate the wine from its lees, and to put it into a fresh clean cask. This operation is generally effected by a large cock put in at one end of the cask; the wine is then drawn off and carried by buckets or large wooden pitchers into the cask prepared to receive it. At the last moment, when the wine is coming out slowly, care must be taken that no lees are drawn off; this mishap is avoided by allowing wine to fall into a shallow silver cup, the shining of which reflects the least cloudiness caused by a mixture of lees, which a practised eye would soon detect. The lees are kept for distillation. A syphon is sometimes used for racking off, and one which draws the wine by the bunghole is often preferable, because it avoids boring the casks at the end, and also any loss of liquid, often occasioned by the fixing of the tap. But the use of the syphon is difficult, it requires great care and practice to prevent the mixing of the lees; besides, the cask into which the wine is run, must be lower than the one whence it comes; very few cellars offer that advantage.

Fining or Clarification.—Fining has for object the clarification of the wines. It is effected with gelatine, albumine, or some other glutinous animal matter, such as blood, milk, isinglass, white of eggs, etc., diluted with a certain quantity of wine, to which water is sometimes added. The solution is put into the cask and well stirred up with a stake. Then the wine is left for six or eight days. The fining substance forms a glutinous cloud which falls slowly upon the lee and carries down all the matters that would affect the limpidity of the wine. The best fining for delicate wines is the white of eggs. Two diluted in a quart of wine, in which six or ten pennyweights of common salt has been dissolved, suffice for fining 45 gallons of wine. When the quantity of wine to be fined is large, the whole of the fining is prepared in one mass and distributed in the above ratio.

Chapter IV.

CLASSIFICATION OF THE WINES.

Elements of the classifying of wines.—So far the juice of the grape has remained mixed mostly, if not with the stalks, which were taken out by egrapage, at least with the skins and pips of the berries. When making white wines, the separation of the must from these matters should be effected as quickly as possible.

Composition of the stalks.—The stalk is composed of a ligneous substance of tannin and chlorophylle whilst it is green; it contains organic and inorganic salts, especially bitartrate of potash.

Composition of the skin.—The skin or pellicle contains the same salts as the stalk, cellulose tannin, essential oil, and especially a coloring matter, blue, red, or yellow.

Composition of the pips.—The pips contain amylaceous substances, a fatty oil, gluten, albumine, tannin, and organic and mineral salts.

Action of the stalk, skin, and pips upon the fermentation.—These three constituents of the grape contain no element that can be directly converted into alcohol, that is to say they do not ferment. But, without actually constituting the vinous fermentation, they accelerate and precipitate its periods. One may compare their action to that of burning wood accelerating the boiling of the contents of the kettle; only in this case the wood in combustion would be placed in the kettle, and would give consequently many of its elements or the products of its combustion. Would the contents of the kettle be improved or not?

The influence of the mode of fermentation upon the wine.—Is the wine improved or deteriorated by its tumultuous fermentation with the stalks, skins, and pips? Without assuming to solve positively those questions, I will affirm only that the wine fermented in contact with stalks, skins, and pips is very different from the wine fermented without; this last wine is *white*, the other is *red*; and the antithesis, expressed here only by opposition of its color, does not reside in the least degree in that color, which is only an accident. The difference lies in the hygienic and special properties, and those of red wine differ from those of white. At present some white wines are made that possess all the properties of red wines, and *vice versa*; to obtain the last result it is sufficient to ferment the must of white grapes with their stalks, skins, and pips; by that process all the effect of a rapid decomposition and dissolution by maceration of the principles and products foreign to the juice of the grapes are obtained.

Wines of low fermentation.—Wines of low fermentation are those that are produced from musts fermented without stalks, skins, or pips.

Wines of high fermentation.—Wines of high fermentation are those which have fermented with all the constitutional parts of the grapes.

Macerated wines.—Macerated wines are those of high fermentation, which are allowed to remain in contact with the musk a long time after the tumultuous fermentation has subsided.

The color has no influence upon the quality of the wines. Nothing is more foreign and indifferent to the quality of the wines than the color. It may be a sign, an indication, but it is never a quality by itself. For the greatest number of consumers the color is a guarantee of nature, purity and strength in the wine.* This error favors the fraudulent commerce in wines.

* A member of my family, a wine merchant of Riceys, when in Paris, drank only red wines, even at the best restaurateurs'. He was persuaded that water and alcohol were more frequently used in adulterating white than red wines, and he pretended that he could recognise the purity of the wine by its color. He ignored that wines of an admirable color are made at the second and third washing of the murk of black grapes, and that certain departments sell their wines of one, two, or three colors at prices regulated by their capabilities of coloring one, two, or three quantities of white wines, or wines without color.

Hygienic property of white wines.—The white wines are in general diffusible stimulants for the nervous system; if they are light, they act rapidly upon the organisation, of which they exalt all the functions. It seems that they escape as rapidly through the excretive organs of the skin as through the mucous, and especially through the urinary organs; their action is, therefore, of short duration.

Hygienic property of red wines.—Contrary to white wines, the red are stimulants, tonic and persistent for the nerves, muscles and digestive functions; their organic action is more silent and lasts longer; they do not augment perspiration, nor the excretions, and their general action is astringent, persistent and concentrated.

Public opinion, founded upon daily experience, leaves no doubt upon the dissimilitude between the sensual and organic effects of white and red wines.

WINES OF LOW FERMENTATION (WHITE WINES.)

Causes giving priority to white wines.—I place the white wines in the first rank among all wines—1st, Because they are the result of the fermentation of the juice of the grapes free from all substances foreign to the vinification. 2. Because they possess in the highest degree all vinous qualities, bouquet, flavor, stimulation, nervous, active, cordial and spiritual; in one word, because they are to other wines what youth is to mature age. 3. Because their making is the simplest, and because also they are more directly constituted.

Any grape can produce white wines.—*Cepages*, the grapes of which are black, violet,

rosy, gray, yellow, or white, can produce white wines. That result is obtained by separating the juice of the grapes from the skins before any fermentation or maceration and also by separating the juice from the stalks and the pips which sometimes contain a small proportion of coloring matter. In fine, it suffices to press the grapes immediately after the gathering. A colored grape which produces a bad red wine often gives a white wine more agreeable and healthy; that is easily conceived when one bears in mind that the foreign substances of its juice (to its sugar and alcohol) which color it, cause the formation of astringent and tart matters, of odoriferous oil and azoted principles in excess; but there is no colored grape, producing a good red wine, that cannot produce a good white wine; in other terms any colored grape that cannot produce a good white wine, will never produce a good red wine.

White wine is the best standard by which to appreciate a *cepage*.—White wine is the true sample and criterion of any *cepage*, soil, climate and season. When the white wine of each *cepage* is well known, well appreciated and classified, the œnologic science will have a basis, a rational starting point to judge logically the qualities and faults communicated to the wine of that *cepage* by one, two, fifteen or thirty days of fermentation and maceration with the stalks, skins, and pips. Œnalogy will then lay down rules for the vinification, and give reliable advice to vinegrowers; but till then it loses itself in the alchemy of the most diversified and whimsical costumes, or it throws itself into a labyrinth of mathematical systems, totally foreign to the real facts. In the midst of that anarchy opinion is misled, the taste is depraved or lost, and the taster himself does not know what he wants or what is good. The taste as well as the eye or the ear, is subject to error and perversion of opinion. One believes a thing to be good, and imagines it to be excellent, upon the simple word of a professed judge, as one believes in the beauty of an indifferent picture, or an abominable musical composition, upon the word of the adepts of the fashionable school of the day; but painting and music have their scientific and artistic principles, while gastronomic tasting has none yet to defend itself against errors, or preserve it from a false course. Everything is still empirical in the tasting of drinks and all other aliments; tasters, eminent cooks, and individual sensation, are the despotic arbitrators of taste, and there are no laws that can be opposed to their decision, or permit a reasonable discussion. And what makes the case worse, and adds to that deplorable situation, is that the taste gets accustomed to the most detestable savors, and gradually finds them delicious. This unquestionable fact is especially to be remarked in the use and appreciation of drinks. I have heard of some vignerons, filling up a cask with murk, green or half-ripened grapes and water, to manufacture a sort of cheap drink called *rappe*, proclaiming such beverage excellent, and even more particularly after a daily use of six months, when, for a stranger, it had actually acquired the color, odor and savor of the juice of manure. The cask of *rappe* is for the family, the cask of the Danaides. Every day a pitcher full of water is poured into it by the bunghole, and an equal quantity of the juice drawn from the tap. It is easily imagined what that juice must be after six months. The different sorts of beer and cider are at first very repulsive to the neophyte, who is about making use of them, and that to the great surprise of the people who are in the habit of drinking them, and who take long draughts with great relish. I will also speak of the modification or perversions introduced in the use and preparation of a drink which possesses nothing alcoholic nor vinous, but which offers an interesting comparison with the white or red wines if prepared with or without a prolonged maceration. Professors of hygiene used to say that tea furnished a beverage, light, stimulating, aromatic, and very agreeable to the eye, smell and taste; that the green teas possessed those qualities in highest degree; and that to retain those qualities as pure and complete as possible in the infusion, it was necessary to pour the water in full ebulli-

tion on the tea, and not to allow the contact to last more than four or five minutes before drinking the beverage. They told us then that a prolonged maceration caused the solution of the coloring matter, and of the resinous astringent, tart and bitter elements, and caused the evaporation of the aromatic stimulating principles, or their destruction by their mixture with the coarse principle common to the leaves of most plants. They told us also that the black teas were burnt refuse of the torrefaction of the black teas, and that they possessed but few of the stimulating and aromatic, qualities of the green teas. We had faith in our masters, and conformed ourselves to their dictates in the choice and preparation of our tea, which indeed gave us a very agreeable and very stimulating drink, of which the happy effects upon the strength of our bodies and mind were fully appreciated. But commerce, habits and domestic economy have so thoroughly upset the teaching of the *savants* and sages, that now the long macerations of one third of green and two third of black teas, and the second and third washings of the same teas furnish a beverage drunk by all England, Holland, and the North of Europe, and by imitation, the Frenchmen who use tea. Under that form tea is only a macerated water, brown or black, having nothing to please the eye, odorless, tart and bitter to the taste and little or not at all stimulat ing but such as it is, the consumers are so fond of it that they would reject as a worthless infusion the tea prepared according to the scientific and rational formula. Is there any digestive, tonic, vivifying, or salutary qualities to the health in the coloring resinous, acid and bitter matters taken away from the teas by maceration, as there are in red wines? and are those qualities preferable to the vivacity of the nervous stimulation produced by simple infusions, as it would be produced by white wines? That is possible and even probable; but everybody will admit that it is necessary to characterise the action of each preparation to judge their comparative and absolute value. It is essential to determine what belongs to the essence itself of the tea, and what belongs to the resin, tannin and coloring matter contained in it. The same remark applies to the wine, the specific constitution of which is the fermented must, pure and simple, and not the stalk, skin and pips worked by the fermentation or maceration. The conclusion to be drawn from the foregoing observations is that white wine is the pure wine; and I earnestly invite all vinegrowers of localities where red wines are mostly made, to make every year one or two hundred gallons of white wine; whatever may be the fineness or the coarseness of the *cepage*. They will derive great benefit by studying what wine will be the most suitable for the amelioration of the red wines in future; besides, they would have a wine that will give them satisfaction, whether they drink it or sell it. In the making of white wines, the press has no influence whatever; all are good, the best are the most powerful, those that do the work with the greatest speed, and necessitate least labor.

Disposition of the casks for white wines.—The casks selected to receive the white wines should be put on stands temporarily disposed as close as possible to the press. But in any case they should be kept in shaded places, rather warm than cold, and allowed to remain there several days before being put in cellars. When the musts are put in vats to deposit their lees previous to being put in casks, all the different products from the pressings are mixed up. This is, in my opinion, the best practice. In many vineyard establishments where white wines are made, the fourth or fifth pressing is put away and is not even used for filling up. I think it is wrong, because the greatest proportion of tannin and free acids contained in these last products is often necessary to the health and even the savour of the wines. This rejection is only profitable when the maturity is incomplete, or when the must is extracted from middling or worse kinds of grapes. Whatever may be the means of putting the wine in the casks, well fixed upon their stands, we have now to consider the transformation of the must into wine by fermentation.

Fermentation of white wines.—The fermen-

tation of wine is a phenomenon known from time immemorial, at least it was known for centuries that the juice of the grapes, or the whole grapes, put together in a vessel and in a certain quantity would become heated and permit the escape of some air or vapor by raising at the surface a boiling scum, and causing an ebullition of greater or less intensity; it was known that by the effect of the working that the sweet juice, or must of the grape, was gradually losing its sweetness and that it was not sweet at all when the working was terminated. It was also known that alcohol or spirit did not exist in the must before fermentation, but was, on the contrary, in smaller or larger quantity in the fermented wine. Chemical science has been enabled, since Lavoisier, for this last three quarters of a century, to state precisely the conditions of the phenomena of fermentation, and to discover the basis, the effects, and the determinative causes. The *basis* of the vinous fermentation is the sugar of the grape; its *effects* are the transformation of that sugar into alcohol which remains in solution in the liquid, and in carbonic acid which escapes, or has a tendency to escape, under the form of gas; its determinative *causes* are the action of the ferment animated by the oxygen of the air which it absorbs actively at a temperature of from 59 to 95 degrees. Without heat, air, yeast, or sugar, neither fermentation nor its effects can exist, that is to say, the production of alcohol and carbonic acid. Science teaches us also that fermentation decomposes completely, and without any loss, 100 parts of grape sugar into 51.11 parts of alcohol, and in 48.89 parts of carbonic acid. It teaches us that a certain portion of the ferment works and decomposes in that manner 60 parts of sugar at least; that the most favorable temperature is comprised between 68 and 86 degrees; that at 59 degrees the action of the ferment or yeast upon the sugar diminishes; and that it ceases below 49 degrees; that the quantity of sugar decomposed at 106° to 140° or 175° is less than at 68° and 86°; that the temperature of boiling water, 212°, paralyses entirely the action of the ferment in closed vessels, and that, if that ferment, which is nothing else but an azoted albumenised matter, is brought into contact with the air it will recover its activity and power upon the decomposition of the sugar; while, under the influence of cold, below freezing point, the action of the ferment is also paralysed, and the fermentation in closed vessels is also suspended, but the phenomena of fermentation are reproduced, without any contact with the air of the interior, if the temperature becomes again favorable. Finally experience has proved that, if fermentation could not commence without oxygen or contact with the air, it could continue, and does continue, afterwards in must secured against the effect of the oxygen and the air. One of the circumstances which has the greatest influence upon the development and progress of fermentation, and upon the good or bad making of the wine, is the volume of the must, it is the mass of liquid in simultaneous action in the same vessel. Between the fermentation in a quart vessel and the fermentation in a vat holding ten thousand quarts, there are infinite shades in the character and the qualities of the wine produced or preserved. The larger the vessels that contain the must the more rapidly the phenomena of their vegetable existence are accomplished. The vine, from its birth to its death, by sickness or old age, is not a chemical being, finite, and containing principles immediate and fixed; it is a living liquid, which has its youth, virility, old age and decrepitude. Large vessels are for wine what large cities are for men; there, life is tumultuous, rapid, full of vices, of diseases, and other elements of destruction. The wines, like men, live more steadily and longer in a small circle and in isolation; the bottle is the hermitage of the wine, the cell of the cenobite. Remaining a time in large vats does not suit the majority of wines; the light and white especially go through the different phases of their life with a rapidity fatal to their qualities; however it is the duty of the intelligent vigneron to adopt such rational means as may hasten the progress of the wines towards a fit state for use or for sale. When the object is to produce

dry wines, to vinify the over sweet and to give age to the very coarse ones the employment of large vessels offers to the intelligent wine maker several very great advantages; the proprietors who use enormous vats, simply to save the purchase of casks, commit a sad mistake in their speculation. If they do not lose their wines altogether, they reduce at least their value to a great extent. Experience and theory have confirmed the general practice of using casks of a capacity varying from 22 to 60 gallons for fermenting the musts of white wines or to keep those wines for several years before they are bottled. Undoubtedly the advantages afforded by casks of similar size for handling and moving them has been taken into consideration; but their fitness for the qualities of the wines was the principal cause of their adoption. When the wines of Champagne are kept for twelve months in casks holding more than 45 or 50 gallons, they lose their sparkling quality unless a large quantity of sugar be added to them. The greatest portion of the French white wines acquire and retain their fine qualities in casks holding 120 to 45 or even 22 gallons. The fermentation, in any vessels, of must freed from stalks, skins, and pips, is slower and more temperate than of musts with their murks. I have verified the temperature of both, and remarked that the heat developed by the pure musts never rose over the ambient temperature, while the heat developed by the murks of red wines often went up from 7° to 15° above the atmospheric temperature. In years of good maturity, all the periods of fermentation of red wines are accomplished in the space of three or five days, while the fermentation of the pure musts of white wines does not reach the same degree of completion in less than fifteen days or three weeks. By looking through the bung-hole of a cask, twenty-four or forty-eight hours after the must has been put in, bubbles will be seen rising up and bursting successively, producing thereby a more or less abundant scum of a dirty grey color; at the same time the mass of the liquid swells up, and forces that scum, which renews itself ceaselessly during several days, to run out over the outside of the cask. If the ear is brought close to the cask, a crepitation and a continual effervescence will be heard; and, if the finger is dipped in the liquid, it will be observed that the temperature will rise gradually and proportionally with the intensity of the hissing noise, and to the abundance of the scum thrown out. This phenomenon is called the working, which causes the overflowing of the scum. The bubbling of one hundred casks, stowed in a close and warm place, is sufficiently intense to be heard as soon as the door is opened, and a strong vinous odor is perceived at the same time. Here follows what takes place: —The azoted matters contained in the must have been converted into globules of ferment, which, animated by the presence of the oxygen of the air absorbed, multiply five or six times their number, and their primitive volume attacks the sugar and separates it into alcohol and carbonic acid; this last, while escaping from the liquid under the form of gas, produces the bubbles and the ebullition which is heard and seen on the surface; but the carbonic acid does not escape alone, it carries away an excess of ferment and albuminous matters, which form the scum and leaven which is thrown out by the working, while another quantity of ferment falls to the bottom of the cask, and mixes up, in the shape of small black grains, with the other precipitates which constitute the lees. In escaping from the cask, and spreading through the lower parts of the atmosphere, the carbonic acid has the odor of alcohol, although it retains only such a small quantity of it that the waste is of no importance. The execution of those chemical and mechanical operations occasions heat which raises the temperature of the fermenting house. According to the theory that fermentation should continue as long as there is any sugar in the must to be converted into alcohol and carbonic acid, and its complete stoppage should be an indication that the wine is made and perfected, and especially that it contains no more sugar. But, practically, such is not the case. After its first vinous fermentation the wine becomes calm, and, if I can express it so, retires within itself, retaining at

the same time some sugar, ferment, acids and salts, for another fermentation, slower and more direct, the mysteries of which have not yet been penetrated by our means of observation, analysis and induction. Science is on the track, it presses and guesses at them, and will disclose them, I am convinced ; but at present the greatest part of the secrets of the inmost vitality of the wine belongs still to alchemy, aud the rules for conducting them are those derived from good tradition. Thus, tradition teaches us that the first fermentation of white wines must commence in a warm place, 59° at least, and 86° at the most ; that, after the fermentation has lasted for one or two weeks and more (for the must, containing no foreign matters, fears not the inconveniences of their maceration), they can be put in a cooler place, which retards or suspends altogether that first fermentation, indispensable for the vinous constitution. To decide upon the ulterior course of action with regard to the impulse to be given to the following phases of the fermentation, it must be ascertained whether the wine under treatment can be ameliorated by retaining its sugar and working it slowly, or whether that wine is better when dry and retains as little sugar as possible. Both of those opposite results may be obtained by favoring and protracting the first fermentation, or moderating it by lowering the temperature, or stopping it suddenly by cold. Thus the size of the fermenting and keeping vessels and the temperature, high, medium, or low, are powerful to modify infinitely the qualities of the wines in general, and especially the white wines. To arrive at that conclusion I have neglected several questions of secondary importance. I now return.

Filling up the cask during the fermentation. —Is it preferable to fill up the casks with must, and to keep them always full, in order that the working overflowing of the froth, or scum at the bunghole may proceed from the beginning to the end of the fermentation ; or is it preferable to fill them to such an extent only that no barmy matters will run out ? The answer will be short and peremptory ; the albuminous scum that runs out at the bung hole has no other nature or injurious qualities than the ferment and defecations which subside in the cask ; as soon as the first fermentation of the must is accomplished, the scum will fall of itself to the bottom to mix up with the lees. It is therefore quite unnecessary to allow it to run out in disgusting streams, which may cause acetation and carry off besides a large quantity of good wine. In Champagne, where the wines are the finest and the most delicate in the world, clear in taste and odor, limpid as distilled water, working over is not allowed, and filling up is never practised during the first fermentation.

Closing the bung hole.—Is it necessary to apply the hydraulic bung to the cask's hole, or simply to put upon it a vine leaf or a piece of paper, or linen kept down by a small brick, or a bag of sand ? Do whatever you like ; it is equally indifferent, the carbonic acid fills up exactly the void in the cask, and that is the best protection against the oxygen of the air. With regard to the ideas of preventing the evaporation of the wine and collecting the alcohol in the hydraulic bung, it is a delusion. Vine culture and ænalogy do not depend upon those infinitesimal qualities to realise profits ; the hydraulic bung, which is in itself a good thing, a very ingenious kind of valve, does not give one pound of grapes more per acre, and does not change the gamai wine into pineau. When the first fermentation of the white wine is completed or suspended by the depression of temperature, the casks must be carefully filled up, and the bung closed, but not too tight, because fermentation may set in again and cause the loss of wine, and even the bursting of the casks ; in that case the hydraulic bung would be advantageously used, as it prevents the access of air, and allows the carbonic acid to escape. It is then the time to decide whether the casks should be in the cellar or not.

Influence of cold upon the clarification of wines.—If the weather becomes cold, the storing of the white wines in the cellars may be deferred, especially if the proprietor wishes to

make them potable, or, as it is called, marketable, speedily. A cold temperature of several degrees below freezing-point, but not sufficiently low to congeal wine, is very favorable to all kinds of wines, and particularly to white ones, the salts and superadded matters of which they precipitate in such a manner that it whitens them, and gives them a limpidity that they could not acquire in less than one or two years of cellaring in a constant temperature of 49° to 53°.

Filling up the casks during the latent fermentation (secondary fermentation).—If the filling up is indifferent or useless during the initial or primary fermentation, it becomes necessary when that fermentation is accomplished or suspended, and that the latent fermentation replaces it to exist alone henceforward. The filling up must be done at least twice a week till the next racking off, and with wine of the same age and quality as in the cask. Afterwards filling up is done once a month till the next racking off, and then once every three months till the sale or the bottling off.

Racking off.—The first racking off must be done upon the lees without fining, because it would be very injurious to bring all the deposited matters (such as agitation caused by the fining would do), such as the ferment, the azoted and coloring matters and salts, in contact with the wine, the first racking off having for its object the avoiding of such contact. If the second racking off is done in March it should be preceded by fining, as well as all ulterior racking off, which may be repeated once or twice a year according as the wines are more or less impregnated with foreign matters. One racking off in the year is sufficient for all fine wines free from mixtures. The racking off should be done as much as possible during dry and cold weather.

WINES OF HIGH FERMENTATION (ROSY AND RED WINES).

Relative qualities of the red and white wines.—I have placed the white wines before all other kinds, because in all teachings one must proceed from the simple to the compound, and white wines are the produce of the pure juice of the grapes. In adopting that course of classification I did not presume to assert that they were superior or inferior to the red wines for ordinary use, and the pleasure and health of man; the facts of consumption in France and foreign countries will easily prove that I should have been wrong to establish a precedence between those two wines. Besides it is an idea that I have never entertained. I have stated already that the wines which have fermented or macerated with all or part of their accessories are more weighty than the pure or white wines; they are less diffusible and less stimulating, but, more tonic and nutritive, their use is more readily adapted to the habitual alimentary regimen than white wines, and when they are the produce of fine *cepages* and old stems, the red wines are not inferior to any other, for the pleasure of the senses and hygienic influence. But, as the red wines admit in their preparation the association of substances essentially foreign to the progress of the vinification, by the presence of those substances the fermentation is so stimulated that it passes through all its periods in less time and at a temperature higher than in the making of white wines, it is therefore evident that the study of the red should be logically placed the last. The methodical order will enable vinegrowers to judge and understand better their differences, qualities and properties. The rosy, blue, dark or black wines are a variety of red wines; their preparation is the same in its elements; it differs only in the duration of the contact with the murk and by the solution of their soluble principles.

WINES OF HIGH FERMENTATION (ROSY AND RED WINES.)

Depriving the grapes of the stalks to make high fermented wines is unnecessary.—To make rosy, red wines of maceration which may be called blue or black, the abstraction of the stalks is not indispensable; if the grapes are, fine and delicate, like those of High Medoc, in the Bordeaux district, Clos Vougeot, in

Burgundy or Bouzy, in Champagne, the *egrapage* deprives them of a certain tonic action upon the mucus of the mouth, which action renders the vinosity and *bouquet* of those more sensible to the taste and smell, by fixing them to the organs so to speak, as alum fixes the colors to textures. If, on the contrary, the grapes have a poor juice and deep color, like the gamai, orleans, &c., the tannin of the husk is indispensable to conceal the vinous poverty. Finally, if the grapes contain in excess all the vinous, coloring and astringent principles, like those that give the red wines of Roussillon, Cher, Rhone, and the South of France in general, the suppression of the stalks in the fermentation or maceration would add absolutely nothing to their qualities, and I am even convinced that the qualities of the stalks would be wanting. The stalk is the most wholesome and the most inoffensive accessory contained in the juice of the grapes, and if the fermentation and maceration have for their object to extract from the accessories of the grapes certain substances favorable to the taste, digestion, and to the muscular and nervous strengths of the human organisation, it is from the stalks they will obtain them sooner than from the fatty oils, starch, and albumen of the pips and skins; the pip especially is dangerous ; it is the egg of the vine, containing all the putrid elements. I am persuaded that, if the delicate red wines were made in the same manner as currant jams of Bar, by taking the pips out before fermentation commences, fine and more durable wines would be obtained. I regret that I have not yet been able to test that process. I recommend proprietors of fine vineyards producing red wines to make experiments, and to compare the results with those of the other two processes, observing, of course, a perfect identity in all the other conditions of the vinification. The longer the mash is allowed to remain in the vat, the more marked will be the differential effects of the three modes of operation

A preliminary crushing of the grapes is necessary for the making of red wines.—In any case that operation is indispensable before putting the grapes in the vats. I have already indicated the means of executing it in the article on white wines. Only, instead of fixing the implements on the press, they are placed near or above the vats. Before filling the vat, a sieve, a wicker basket, or a bundle of vine branches, loosely tied, must be fixed on the bottom opposite the tap hole, to prevent the mark being carried away with the must when drawn off.

A vat should be filled up in one day.—Whatever be the process adopted for the fermentation of the grapes, the vat must be filled up as quickly as possible, and in any case during the day, in order that the fermentation of its contents be simultaneous, and as it sometimes starts in the interval of one night, the subsequent addition of grapes would cause an untoward interruption.

A vat should not be entirely filled up.—The vats must only be filled up to five-sixths of their capacity, because, during fermentation, the juice swells up, the mark is raised by the carbonic acid, the scum, ascending between the vat and the mark, springs out at the top and accumulates in abundance ; if, therefore, the mark rises above the sides of the vat, the scum will run over and waste a large quantity of wine. The wine so wasted is always filthy and subject to degenerate into acetic acid, The consequences would then be most disastrous. The partial filling of the casks does not only prevent the wasting of wine, but its principal object is to leave room for a thick layer of carbonic acid which always accumulates there, and which forms a sort of lid on the mark. This cover intercepts the access of the air and prevents acetification.

Head of the mark.—The head or cap is the superior portion of the mark, 2 or 3 inches thick, which dries up and hardens according as the mark rises and the juice retires, not only by finding its level, but also by the weakness of the capillary force which cannot maintain humidity beyond a certain height above the main level of the liquid. Through the subsidence of the capillary humidity, the mark forms a veritable resisting crust, which breaks in the same manner as substances partly solidified. If the cap rises above the vat, the

carbonic acid, being heavier than the air, will escape and cease to protect it from the contact of air, ceaselessly renewed by an inverse current to that of the carbonic acid; the alcohol contained in the cap disseminates itself over the stalks and skins, absorbs the oxygen, and passes into the state of acetic acid. This danger is avoided by filling the vats as recommended before. However, for more security, the vats may be covered over with mats or tarpaulins. This cover must only be fixed either for the purpose of intercepting the currents of air, or to keep the temperature favorable to the matters in fermentation. In the last case the cover should be made of non-conducting substances.

Vats hermetically closed.—These sort of vats, with their safety valves, tubes, and hydraulic recipients, do not offer any advantages during the first fermentation, and have an infinity of inconveniences, the expense and difficult working of which are the least. It is, nevertheless, necessary to have such vats, because they can be turned into wine reservoirs, like pipes or hogsheads. The vats are also useful for the maceration of wines. The lid prevents the acetic acid from mixing with the tannin coloring matter and tartrates of potash, the accumulation of which in wines is the object of maceration, either to render them saleable for their coloring properties or to make them last 100 years; or, in other words, to make them impotable for 99 years, and allow them to become problematically potable at a price which, if calculated with compound interest, should be 64 times their primitive value. I despise a wine that can only be drinkable when 100 years old, especially if its proprietor makes it so through stupidity, as much as I prize a wine that will keep 100 years always good, and always superior. Make a wine that will be excellent to drink at from two to five years old, or sooner if it is in its nature; make it so that, like Champagne and Burgundy wines, it will keep good for 10 or 20 years, and you will have done for yourself and for others what is reasonable and best; if that wine becomes good at five and still remains good at 50 years, like Bordeaux, so much the better. Those wines bought at two francs the bottle will please everybody and will enrich you sooner than the Tokay and Johannisberg which at 100 will be worth 50 francs (£2) per bottle, and which, to indemnify the family who would have made it, would require to fetch 64 times the value of the first year of its making. Wine is like money: when it does not circulate, it does not exist; one million kept in a hole for a thousand years is only valuable in the thousandth year, and in that thousandth year it has lost a deal of its relative value.

Conditions to be sought for in a good red wine.—To produce a good wine, "that cheereth gods and men," that is salutary to body and mind, in other words a French wine; one that keeps well for 10 or 20 years, and bears the voyages and action of divers climates, such are in France the three conditions of the problem to be solved by viniculture and vinification, from the Rhine to Bayonne, from the Loire to Nice. The hermetically closed vats go for nothing in those three essential points.

Condition of the fermentation of red wines.—The fermentation of red wines is stimulated, retarded or accelerated, like those of the white wines, by three principal circumstances: the temperature of the air, the maturity of the grapes, and the more or less extended surface of the vat brought into contact with the air. The fermentation of red wines is also like that of white wines, proportionate in intensity and the rapidity with which it goes through all its phases, to the mass of the must contained in the vessel.

Commencement of the fermentation in the vat.—It follows, from all I have said, that if the temperature is at 68° in the atmosphere, and at 62° or 64° in the vat, if all the elements of the well ripened grapes, which are in suitable proportion in the must offer a mass of from 400 to 800 gallons, and if the vat is open, fermentation will commence within the first twelve hours. Simple and slow at first, it will no be long before it be double, that is to say it will have two seats and two intensities very different from each other.

Separation of the liquids and solids in the

vats.—The liquid separates itself from the solid matters, which rise to the surface, while the must by a gradual filtration remains pure, lowest, and underneath the mark; the complete separation is effected during the first 48 hours, often after 24, but rarely later than 48. Its rapidity is in proportion to the more or less complete preliminary crushing of the grapes. When the stalks have not been taken off the solid mass or mark rises higher and goes lower into the liquid than when *egrapage* has been resorted to. The must occupies two thirds or one-half of the inferior part of the vat, a portion of the mark is immersed in the liquid, another retains a great deal of juice the capillarity, and the superior portion of it condenses itself by the draining of the juice and soon forms a crust or cap by desiccation. When the stalks have been removed the same distribution is observed, the mark occupying only the fourth or third or the superior portion of the mass and it does not rise so high in the vat.

Phenomena perceptible to the ear and feeling; noise and heat.—When the separation of the solids and liquids is accomplished under the first effects of the fermentation, a crepitation similar to the one observed in the fermentation of white wines, will be heard by applying the ear to the vat; and on the top of the vat there is an ebullition forming large bubbles, very different and more powerful than the noise produced by the disengagement of the gas in the liquid portion. If the hand is applied to the inferior or middle part of the vat a sensation of relative freshness will be felt; if it is applied in the middle of the superior third, opposite the middle portion of the mark, a noticeable heat will be felt. If the thermometer is employed, it will show from 86° to 95° in the middle of the thickness of the mark, and from 68° to 77° in the centre of the liquid.

The fermentation of red wines is double.—If the mark is warmer than the liquid, it is not because the heated molecules at the bottom of the vat rise and accumulate at the top, as is the law for all heated liquid, it is because the fermentation of the mark is more active and more intense than the fermentation of the juice; what proves that difference of fermentation is that the mark of white wine put separately rises to 105° in its isolated fermentation, while the fermentation of the juice never rises over 68° in an atmosphere the temperature of which is 60°. That is the reason why I have said that white wines are wines *of low fermentation*, and the red wines of *high fermentation*. That phenomenon of the different temperature in the liquids and the solids during fermentation of red wines is extremely remarkable and sensible. No vigneron ignores it. There are therefore two different fermentations in the vats, that of the mark and that of the liquid; the one low and slow, the other high and rapid, reacting upon each other to heat and stimulate themselves, and to lower their temperature retards their progress. In reality, the object of treading in the vat is to refresh the mark that gets too much heated, and to warm up the must that would remain too cold. There is no vigneron who ignores that the treading in the vat reduces and extinguishes the fermentation and the heat; treading frequently therefore retards the definitive operation of the fermentation.

Details of treading in the vat.—Within the first twenty-four hours the winemaker gives to the vat a first *coup de pied*, that is to say, he treads upon the mush barefooted, with his trousers folded up only above the knees. In that first operation he takes care not to let his feet go through the whole crust of the mark; his only object being to crush it and stimulate its fermentation. When that fermentation is attained and kept for a while at its highest degree (about the third or fourth day) the winemaker goes bodily into the vat, and mixes up the solids and liquids to stimulate by the heat the fermentation of the latter, and to cause them to dissolve the produce of the fermentation by a complete working of the mark. When the operation is performed, the tumultuous fermentation has disappeared, the mean temperature is lowered, and both reappear only in pro-

portion as the mark rises again above the liquid there to reproduce a new heat and fermentation, which will again become extinct. However, the vigneron, attentive, and desirous of making his red wines completely, reanimates once more the fermentation by a last *coup de pied* only, because he is aware that, as the fermentation draws to its end, the mark would not come up again to the surface if it was entirely pressed down as in the second treading. The wine, then, that must be drawn off, twelve hours at least and twenty-four at the most after this last operation, would be muddy, and the *goutte** would not gladden by its bright and limpid color. When the grapes are well crushed before being put in the vat, the first and last treading may be dispensed with; but the second cannot under any circumstances, if the winemaker wishes to obtain the maximum of color, tannin and salts that can be dissolved during the sensible fermentation of the red wines. Instead of treading the mash as described above, the stake, as shown by Fig. 30, should be used.

Fig. 30. Treading Stake.

The stake AB is of 6 feet long, and made of light wood; there are six swellings from 4 to 5 inch in diameter at CCCCCC which are reduced to 2 inches at DDDDDD. The crushing stake finishes admirably, the operation commenced by the first stamping of the feet.

Time for drawing off from the vat.—The red wines are perfectly made when the very sensible heat and ebullition cease. When in applying the ear to the vat there is no noise, no ebullition heard, and when on dipping the hand into the mark there is no heat felt, the red wine, or wine of high fermentation, is made and perfect, whatever be its color; it must, therefore, be promptly drawn off from the vat to prevent the red wines becoming wine of *maceration*, blue or black wines. It has been repeatedly stated that the best indication of the proper time to draw off the wine from the vat, is when it is ascertained by the gleucometer or distillation that all the sugars are transformed into alcohol. Such, however, is not the case, for sugar remains in the must, and in most red wines, one, two, and six months, and even longer after fermentation. Whether there be much or little sugar to be converted, that sugar belongs henceforward to the latest fermentation. As soon as the sensible fermentation has ceased the drawing off must take place, even if one half of the alcohol be not yet provided, because, in the absence of heat and abundant disengagement of carbonic acid the pips, skin, and stalks, give to the wines only the produce of the maceration.

Rosy wines.—To avoid dividing the attention of the reader by the description of incomplete phenomena, I have been obliged to explain without interruption all the phases of the high fermentation, characterising more especially the preparation of red wines, carried out in all its details, but the time has come to say that, before producing red wines, the fermentation produces wines which have ceased to possess the stimulating and diffusable character of white wines, and have not yet acquired the harshness and firmness of red wines. Those wines are at the same time agreeable and wholesome. I will designate them "rosy wines" and this appellation will include all the wines of other colors between white and red, which have been baptised under the bizarre names of grey, partridge eye, onion-film, straw, &c., &c.

What are the rosy wines?—The rosy wines are those drawn off from the vats after 24 or 48 hours, according as the fermentation is more or less active.

Cause of the scarcity of rosy wines.—The rosy

* The wine drawn from the vats after fermentation is called *goutte*, or *vin de goutte*; and the wine obtained from the pressing of the mark is called wine of first, second, third, &c., *presse*, according to the successive pressings.

wines, (exclusive of white wines colored after being made) are scarcely known in commerce; the rich and hospitable proprieters of vineyards are about the only persons who make rosy wines for their own use. They prefer them to the white and red, and especially to the wines of maceration, for their agreeable and wholesome properties. My experience has convinced me that they were right, but commerce and consumers, especially when strangers to vineyards, declare only for the extremes. They admit only of two distinct shades, white or red. It is to be regretted, because they deprive themselves of the best of wines.

Qualities and duration of rosy wines.—Rosy wines are generally excellent to drink in the second year, and if they are kept they improve as well and as long as the white or red wines. The preserving principles of wines are exclusively in the alcohol and sugar; the coloring matter, the tannin acids and vegetable salts, the albumen, gluten, &c., are the dangerous and perishable elements. The rosy wines possess less of those matters than the white and macerated wines. Those wines are drawn off from the vat before any treading or crushing.

Making and drawing off.—Ordinary process.—In general, to make rosy wines, the proprietors follow, by listening at the vat, the development of the fermentation, and choose for the drawing off the moment it manifests itself in the whole mash by a general ebullition and heat. Sometimes they are guided by tasting. Twelve or even twenty-four hours after the commencement of the fermentation the wine is too sweet to be drawn off; often also after twenty-four hours it is too hard. Excessive sweetness signifiies that the must contains too much sugar and not enough alcohol, tannin and coloring matter; too hard means that the must contains too much alcohol, tannin and coloring matter and not a sufficient quantity of sugar. The right moment for drawing off, as indicated by tasting, is when the wine gives the same sensations as a strong or light punch, that is to say when the saccharine and spirituous principles exist in such proportions as to render the whole pleasing to the palate. Everybody understands that shade of savor; it is easily appreciated, for it always manifests itself in the course of a good and regular fermentation, but it only lasts for a moment, and it is that moment that must be seized upon. To make certain of it the proprietor must renew his tasting every hour, when the fermentation is very active, and every other hour when it is slower. To effect that object a gimlet hole is made, at or about the middle of the vat. As long as the savor of the wine improves, the drawing off may be delayed. As soon as a doubt presents itself the drawing off must take place, and the murk be pressed. The distribution of the wine drawn off from the vat and the wines obtained from the pressing must be effected in the same manner as indicated for the white and red wines. If before putting the grapes in the vat the gleucometric degrees of the must have been carefully recorded, it will be remarked that the most favorable tasting of the wine corresponds always or nearly so to the apparent reduction of one-half of the saccharine matter, or, in other words, that the gleucometer marks then one-half the degrees of the must if the wine is weighed at 53°.

Sampayo's process.—I must here enter into some details of another method of making rosy wines, which was once more practised in Champagne than it is now. It was known under the name of Sampayo's process, and its object was to increase artificially the maturity and the sugar of the grapes; it is a theory which has not been studied enough, and which deserves the greatest attention. The grapes are gathered with care, and put directly into vessels containing about 22 gallons, without being trodden, crushed or bruised in any way, and which are afterwards covered over with a piece of calico. Casks of 45 gallons are sometimes used. The grapes remain in that state during 8 or 12 days without fermenting in a noticeable way, but completing their maturity, and preparing to furnish a must richer and more perfect. After eight or twelve days, or even longer, if the grapes comport themselves

well, that is to say, if they do not ferment or get musted, they are pressed rapidly, and the mash is put from the small vessels into a vat, and, as soon as the fermentation discloses itself by ebullition, the juice is drawn off and the mark submitted to the press. By that process finer and richer rosy wines are obtained than by immediate fermentation. M. de Sampayo has also applied to the making of red wines the process of putting up the grapes in heaps after the gathering, and before the crushing, and he has obtained richer wines and of better qualities. That is easily understood, since that practice is in some degree the one followed to make liquor wines; the two processes present at least some analogy, it is that in both cases time determines the natural development of the sugar in the grapes separated from the vine. Does sugar really develope itself in such a short time? It might be presumed, if the change which fruits such as apples, pears, &c., undergo is considered. I have commenced the study of those questions, but my experiments have not been numerous enough to enable me to affirm anything on the subject. I have left grapes heaped up for eight and twelve days, and I could not ascertain with the gleucometer the least increase in the saccharine matter of the musts; but as the degree of sugar of those musts remained the same, and they had a slight vinous odor, I concluded that a portion of the sugar had already been converted into alcohol. To ascertain positively that fact I should have made several experiments by distillation, but the time failed me. Be that as it may, I earnestly call the attention of the scientific wine-makers and intelligent vine-growers to Sampayo's process, because it was demonstrated that the grapes put in heaps of greater or less size, without being crushed, *make their sugar* in four, eight, or twelve days; the condition of the rosy and the red wines might be considerably modified; instead of being previously crushed and the stalks taken out the grapes should be put in the vats as intact as possible. Of the two processes by which rosy wines are made, the first is certainly the simplest and most speedy, especially if only one or two casks full are to be drawn from the vat. I will, therefore, repeat to those who make red wines the advice I gave them concerning white wines; not only to make 60 or 80 gallons of white wines, but also the same quantity of rosy wines; whatever may be the coarseness or the fineness of the red or the macerated wines that you are in the habit of making; you will gain more than you can imagine in tasting and causing them to be tasted as rosy wines.

WINES OF MACERATION (BLUE AND RED WINES.)

The contact of the juices with the grapes beyond the duration of the sensible fermentation constitutes the maceration.—As soon as the tumultuous fermentation in the vat has disappeared the carbonic acid ceases to be heard escaping from the liquid, and the heat subsides, the red wine is made. It possesses all the elements of its future qualities, and the vigneron must consider himself fortunate if the wine has not already *spent* too much vigor, if it has not destroyed its grape perfume, and if it has not worn out in twenty-four or forty-eight hours, one half of its bloom and life to acquire that deceiving color which has never been anything else than a quality for the eye and a conventional one; the smell, taste, stomach, muscles and nerves can expect nothing good from it. The wine can obtain nothing beyond that stage of fermentation from the pips, skins, or stalks, but an excess of tannin, salts, starch, azoted matters, and particularly coloring matter, which constitute the faults and vices that it will have to clear itself of, if ever it can, at the expense of long time and a considerable capital. The macerated wine will become good only when it will have deposited the coloring matter, tannin, salts, &c., which it has absorbed without limit or reason.

The good wines must not be macerated.—Maceration must be strictly prohibited for good wines, even for the admirable Hermitage wine, which would fetch double its present price if it

were made without maceration. I have seen the best red wines destroyed by that mischievous practice, which is applied more and more every day, under the erroneous conviction that a macerated wine is a wine of more importance, and that it will keep longer.

Wine is a living and organic liquid.—White, rosy red and black—in one word, all wines, are organic and living liquids, which have their infancy, youth, vitality, old age and decrepitude. They vegetate within themselves without intermission, and the course of their existence is bounded by the fulfilment of a certain amount of work, the best phase of which is the reduction of their compounding parts into water, acids, salts, and, lastly, into mineral elements; when they have reached that point, the wines exist no more, they are dead.

Sugar and alcohol are the principles of the vitality and the durability of the wine.—The vitality of the wine commences by the sensible and is continued by the latent fermentation. The two principles of its vitality, the two elements of its durability and of its conservation, are the sugar and the alcohol; by transforming itself, the sugar nourishes the wine, and the alcohol sustains it, according as it is formed. All the other organic and inorganic elements, dissolved in its vegetable water, are preserved in it by the sugar and the alcohol, like fruits are preserved in syrup or brandy; it is not the fruits that preserve the brandy or the sugar; on the contrary, those fruits decompose in the course of time the two elements of their primitive preservation. The sugar and alcohol only are in reality the principles of the vitality and durability of the wines, the other substances are their antagonists, especially the coloring matter, real proteus that a sunray may transform. The tannin is not subject to less transformation; but, if it is weak in proportion, it has at least the merit of fixing the savor of the wine and of neutralising the albumen when it it is in excess; but, as soon as the tannin goes beyond the limits of that double utility, it becomes one of the most active causes of the decomposition of the wines. The same remark applies to the excess of the ferment.

The coloring matter, the tannin, and the ferment are antagonistic to the vitality of the wine.—Undoubtedly some macerated wines holding in excess substances foreign to sugar and alcohol, keep a long time, and become very good; but this is because they are so rich in sugar and alcohol that they preserve the coloring matter, tannin, &c., as brandy would preserve black currants. But take, for instance, some juice or water, satured, with 10 per cent. of reducible sugar, or 5 per cent. of alcohol; then, by fermentation or maceration for one or two months, cause that juice or water to absorb from the mark all the coloring matter, tannin, and other substances accessory to the wine; and, after six or twelve months, send abroad the wine so made, or expose it to the sun, in six weeks it will be decomposed and turned acid; or keep it in the cellar for twelve months, the same result will take place. Then macerate some marks in water satured with 20, or, better, with 30 per cent. of sugar and 10 per cent. of pure alcohol, and the wine thus made can be kept in a perfect state. The sugar and alcohol, therefore, preserve the substances foreign to their constitution, and it is not those substances that keep the sugar and alcohol. Experience proves clearly that the coloring matter, tannin, acids and salts in excess give to the wine neither solidity nor durability; their presence in a solid and durable wine indicates simply that that wine has sufficient sugar and alcohol to sustain it without peril. But that will become potable and delicate only when it will have deposited all its excess of coloring matter, tannin and salts, either on the sides or bottom of the cask, or bottles; therefore the presence of those substances is essentially injurious to the tastes stomach and general organisation, and, therefore, radically opposed to the good qualities of the wine.

Maceration destroys the wines.—That is not all: I have stated that the wine was an organised and living liquid, and I now say that the tumultuous fermentation and an extended maceration destroys it by transforming suddenly into fixed immediate principles all the vegetable elements, the moderated work of which

forms its vitality, durability, and qualities. A wine in which the sugar is so reduced becomes a flat compound of coloring matter, acid and tannin preserved by alcohol and sugar. I have ascertained the fact in many instances by testing daily fine wines made of well matured pineau, the stalks of which have been carefully taken out and the fermentation scrupulously conducted; the casks treated considerately, and vigilantly filled up. The wines was racked off with assiduity and sold at 7 or 9 shillings per gallon, because they were free from all mixture, or were what is called *loyal*. Well, you taste that limpid wine, with a fine purple color, you smell it, agitate in your mouth, you admire it and swallow it, but you feel only a heavy and flat liquor: that wine has been destroyed by fifteen days of fermentation—that wine is dead. In 1846 I saw a fine vat of black grapes destroyed in that manner at Bouzy, in Champagne. The crop was incomparable, the grapes completely matured; all had a downy skin and not a doubtful berry was to be seen. They were crushed and put in a vat. After twelve hours the fermentation had set in, after five days it was terminated and the must would have produced an excellent wine; after two days it would have made a rosy wine above all praise; but this wine was allowed to macerate for seventeen days to make a *great wine of it*. True, it was strong and black, but heavy on the stomach, flat to the taste and smell: it was killed. It was extolled, however, on account of its origin unquestionably loyal and superior; it was placed everywhere, and served to the Emperor as type of the red wines of Champagne, which the Emperor had wished to appreciate. After tasting it as a *connoisseur*, the Emperor declared that champagne produces good white but poor red wines. He was right with regard to that wine, but he would have thought otherwise if a bottle of red wine taken from the cellar of a simple vigneron of Bouzy had been put before him. The red wine of that place drawn off directly after the tumultuous fermentation is delicious. To judge well a wine the produce of a renowned vineyard but destroyed by fermentation and maceration, one must taste at the same time, a white or a rosy wine of the same production; it will easily be understood that it is the extinction of vitality in the wine that makes it flat, and that the poorest wine, while retaining any vitality, is better for the taste and for the health, than the greatest dead wine.

Why are there any macerated wines made? —If maceration destroys the wine; if the coloring matter, the tannin, the salts that the maceration dissolve in excess, far from assisting the preservation of the wine, always contribute to its decomposition; if those substances, far from adding to the qualities of the wine, destroy them or conceal them to such a degree that they cannot be perceived till the tannin, coloring matter and the salts have been eliminated by a tedious and dangerous method why are there such a large quantity of macerated wines made? Some of those wines are made through a complete ignorance of the qualities of the wine, and of the means of obtaining them, and also through the superstition and idolatry entertained for the color; but the greatest part of the macerated wines are made to blend with weak wines which have little or no color. Those wines are sold for their color and their alcohol, and they are mixed with white wines to make red wines, and also with the poorest Bordeaux, Tourraine, Burgundy, low Champagne, &c., &c., and for that reason there is an immense demand for macerated wines; the purchasers, however, are not direct consumers, but manufacturers and merchants of blended wines.

Blending.—When the blended wines are the result of a mixture of pure, natural and not over macerated wines, they may furnish an agreeable and sufficiently wholesome beverage for ordinary use, especially if they are mixed with white wines, which are always full of life. They are certainly preferable to wines adulterated by the addition of glucoses, molasses, or alcohol produced by the distillation of those wines; they are even preferable to the original wines destroyed by maceration. Unfortunately inferior sugars, now-a-days, are

too often employed regardless of their baneful influence.

Sweetening the wines.—Artificial wines.—If it is detrimental to add sugar and alcohol to wine beyond the equilibrium of its natural elements and its strength, it is still more so for the proprietor and even the wine merchant. If it were possible to bring all the wines to an excellent type, every vineyard would lose its character and commerce, its activity and interest. The small wines make the price of the great wines; the suitableness is found in the varieties; the wines of unfavorable years raise the price of those of good years. When the wines are light they are drunk in large quantities; if the wines were all transformed into dessert wines, the consumption would be reduced to one thousandth part of what it is at present; and, if they were made into liqueur wines, there would not be one hundred thousandth part consumed.

The law should prohibit artificial wines or require that when sold their composition be specified.—Vignerons and proprietors of vineyards, wine merchants and consumers, should unite to arrest the career of any man who pretends to make fine wine with sugar and verjuice, and also to denounce the proprietor who pretends to make great wines from the same plants that produce good ones only under the most favorable circumstances. The proprietor who employs sugar deceives himself or deceives, and certainly wrongs, everybody. But the one who ought to be severely condemned is he who makes wines with water diluted with sugar mixed with some verjuice and macerated with marks of pressed grapes, he deceives as to the real nature of the merchandise: he robs like the merchant who would sell calico for linen unless he inscribes upon his casks, "Wine made with sugar, water and marks of grapes," or "Wine made with one fourth, one third, one half, as the case may be, of the juice of grapes, and three fourths, two-thirds, or half water and sugar." With such true brands, every one remains free to sell whatever substance he chooses to manufacture, provided it contains nothing venomous or otherwise dangerous to the health. The Legislature should pass a law to effect that object. Such a law would protect the vigneron proprietor, the conscientious merchant and the consumer of wine, against the frauds and the evils with which the community is threatened by the manufacture of sugar-wine.

The acidity in wines should not be removed by artificial means.—When maturity has been incomplete, the wine-maker should not attempt to neutralise the vegetable sub-acids by any chemical process; nothing impoverishes the musts more than the use of lime or carbonate of lime. Such operation takes away the indispensible elements and deprives the wines of any ulterior amelioration. In course of time the sub-acids transform themselves and contribute to the richness and quality of the wines.

Artificial temperature to be given to the must and the air to favor fermentation.—When musts have a suitable richness, 9 or 10 degrees of the gleucometer, they possess the base of a very good fermentation, and they possess besides the necessary amount of ferment to determine the fermentation; but that double condition would not be sufficient if the temperature of the liquid mass and the temperature of the ambient atmosphere were below 49 degrees, and the fermentation would progress badly and slowly if the temperature was not above 39 degrees; a temperature of 77 degrees is the best and the most stimulating for fermentation. When the temperature of the atmosphere is maintained at from 68 to 77 degrees Fahrenheit by a stove, in the place where the casks containing the musts of white wines are kept, it is sufficient to heat those musts within 24 or 48 hours, and to determine the fermentation, because the vessels are small, and the absence of matters foreign to the pure juice permits the heat to penetrate through the whole mass of the wine. The vats for red wines, holding from 20 to 25 hogsheads, would require from three to six days to be heated throughout, and during that time which would precede fermentation an unfavorable maceration would necessarily take place; besides, fer-

menting houses are not generally fitted in a manner that would admit of being artificially warmed or to retain the heat any length of time. It would, therefore, be important to find some means prompt and sure to raise the temperature of the mass of the must above 59, and, if possible, from 68 to 77 degrees. To obtain that object some people increase the temperature of a portion of the must to 120, 170 and 212 degrees. I condemn this method absolutely, because, besides being difficult of execution, costly, and almost impractable in large vineyards, it is exceedingly injurious to the natural constitution and the vitality of the wines; the must, heated and especially boiled, reduced, and, above all, freed from acids, is a dead element with respect to wine. With regard to the heat applied to the vat it is proportionately weak, and it cannot be maintained. Twenty-two gallons of boiling must raised to 68 degrees, 198 additional gallons having a temperature of 49 degrees; therefore, about 100 gallons of boiling must would be required to give the proper heat to a vat holding from 20 to 25 hogsheads; but that heat would remain only a very short time in the must, whatever might be the care taken to cover up and protect the vat; and, if the fermentation does not set in, or set in slowly, within that short time, the operation must be repeated again until it has fairly started. This repetition either spoils the wine or makes it detestable. I have practised that method, and I as well as my neighbors have had to regret it. I, therefore, advise all vinegrowers to employ steam tubes to raise the temperature of their must when necessary. With steam or boiling water circulating in tubes appropriately fixed in the vats the temperature can be raised easily and speedily from 59 to 68 or 77 degrees; 17 gallons of evaporated water raises the temperature of 20 hogsheads of must 19 degrees; and, when covered over with a tarpaulin, 7 gallons of evaporated water will maintain that temperature for 24 hours, which is sufficient to allow the fermentation to establish itself perfectly.

To accelerate and regulate the fermentation properly the air in contact with the head of the mark in the vat must not be cold.—It is for that reason that the use of a tarpaulin or mattings to cover the vat is recommended. The necessity of putting the must in contact with heated air to determine a brisk fermentation has been demonstrated by numerous practical facts, and here is one of those facts. To retain the carbonic acid when the Champagne wine is put in bottle, to complete its fermentation, great care is taken that the decanting is made in a place the temperature of which is kept at about 68 degrees, so that the air left in the bottle (about one cubic inch) will be of the same temperature. Without that precaution, and if the air was below 49 degrees, the fermentation would not proceed properly, and the sparkling properties would be lost.

Drawing off the wine.—When the fermentation of the rosy, red, or dark wines is completed the drawing off takes place; the wine is put into the cask and the murk or residue is carried to the press. Of whatever kind the wine may be it is advisable to complete the filling up of the casks with the wine obtained from the pressing of the murk, and all those wines must be kept in a warm or temperate place until their active fermentation be accomplished, or, in other words, when well filled up, there is no more scum thrown off, and no more gas bubbles are seen escaping through the bung hole. When the wine is in that state the casks are put in cellars.

General condition of the vitality in wines.—The wine being brought into existence and formed, as I have described it, will henceforward undergo all the phases of its inner life; it will make itself reach its perfect state by passing through periods more or less extended and apparent; then it will gradually get weaker in its qualities, till it loses them all and ceases to be a wine. Four general conditions stimulate or retard the ascending or descending periods of the existence of wines: the *temperature*, the *mass*, the *light*, and the *motion*.

Action of cold upon wines.—The wines exposed to cold without congelation (from 17 degrees above to 5 below freezing point) pro-

ceed very slowly in their periods; the more they are refrigerated, the more they remain stationary; if the cold ameliorates them, it is not by active work, but because the cold diminishes the volubility of certain elements that they contain in excess, and which elements precipitate according as the temperature goes down. The wines purify themselves in a cold temperature, and acquire a great limpidity. For that reason wine may be advantageously exposed to cold before racking off. Under the influence of cold, wines do not suffer from contact with the air. I will not speak of the congelation of the wines or of their racking off during congelation; it is a process of concentration of the spirituosity which has nothing commendable because it destroys in the wine all proportion and equilibrium of its elements; and, if the wine is bad, it will not render it good; and, if it is good, that process will alter it completely and compromise its value and existence.

Action of heat upon wines.—According as the temperature rises above 49 degrees in the wines and in the ambient atmosphere their internal activity increases; thus the wines exposed to 59, 68, 86 degrees or more, attain their maturity sooner if they are young; their old age if they are mature, and their decrepitude if they are old, than they would reach those phases at a temperature 10 degrees lower. The intelligent ænologue or the ænophile will conclude from that truth, resulting from the generality of facts, that he must guard the wines which have arrived, or nearly so, at maturity, against an excess of heat, and that he must keep his old wines in the coolest place possible. On the other hand, if he wishes to hasten the maturity of his wines he can attain that end by keeping them in warm cellars; and if those wines are young and contain large quantities of sugar they will benefit more by that treatment and run less risks of misscarrying. For instance, liqueur wines which are only matured at 30 or 40 years, will reach that state in 15 or 20 when exposed to a temperature of 68 degrees, and in 5 or 10 years at a temperature of 86 degrees. A Bordeaux or Hermitage wine, which is made in 8 or 10 years in an ordinary cellar, will certainly attain the same perfection in 4 or 5 years if kept at a temperature of 59 or 69 degrees, and in two or three years at 77 or 86 degrees.

The heat comprised between 105 and 195 degrees is disorganisatrix for a great number of wines, for red and macerated wines especially, but not for all; and when a wine resists against those high temperatures, it is observed that at 77 degrees the fermentation is more active than when the temperature is above 95 degrees. The wine evidently follows the law which rules the internal activity of the vegetable, which activity commences at from 49 to 59 degrees, increases up to 68, 86 and 105 degrees; then it diminishes at that point, and is quite extinguished at 201° as it does at 32°. As everybody knows, in April and August the wine in the vessels which contain it undergoes internal motions, which correspond to the two saps of the vine and of the trees in general. When the wines are confined in impermeable vessels, hermitically closed, such as in bottles well corked up, 212 degrees of heat suspend all action of apparent or latent fermentation, by fixing certain azoted elements, and by depriving the ferment and air of their ordinary influence. Under the influence of a boiling heat as well as of the cold below freezing point, the vitality of the wine is what it would be if the latter had gone through all the stages of its existence. Extreme cold or heat produces on the wine the same effects as upon all organised matters: 1. by the heat in the Appert's process; 2. by the congelation. The preservation of those matters lasts until they are again subjected to the influence of air in the first case, or heat in the second.

Process for preserving in the wines a portion of their sugar.—By Appert's process, light and white wines can unquestionably be preserved with a portion of their must not reduced. That process is only applicable during a certain stage of the fermentation. In opposition to that heating method, I have heard it said that at Sillery, in bottling off the wine in December, during an intense cold and a hard frost,

and leaving a small quantity of air in the well corked bottles, which were kept afterwards in very fresh cellars, the dry Sillery wine was obtained. The process of making that wine is now lost, consequently the conscientious merchant does not undertake to furnish it. There might have been a great deal of truth in that tradition. I had commenced experiments while living at Sillery, but time failed to conduct my operations to any conclusion.

Influence of the mass upon the wine.—The larger volume, or, in other words, the larger the vessels that contain the wine, the more rapidly it goes through all the phases of its existence. The smaller the vessels the longer the wine remains in the state in which it was put in them. The vessels used for keeping wines vary considerably in their dimensions. They may be classed as follows :—

Closed Vats Tuns Cisterns	holding	from 220 gallons to 2000 and upwards.
Pipes	,,	45 to 220 gallons.
Piece or Barrique	,,	35 to 50 ,,
Half piece	,,	22 to 28 ,,
Octave	,,	12 to 15 ,,
Baril or Barrel	,,	1 litre to 12 gallons.

and at last the bottle and half bottle. The litre (1·760,773 pints) is the legal measure, but it is rarely used to keep wines in.

Advantages of vessels of uniform capacity and legal standard.—It is to be regretted that the vessels used to hold the wines have not a uniform capacity and a legal standard. Commerce would be greatly facilitated, and the expenses would be reduced, for the casks would never require to be made again to suit the usages of the locality they happen to come in. Besides, it would facilitate observations upon the treatment and conservation of the wines. With regard to the closed vats, tuns and cisterns, they are immoveable reservoirs which have nothing in common with the legal measures.

Large vessels are dangerous for light wines. —Very few wines can remain a long time in large vessels without being deteriorated or spoiled. Wines very rich in sugar and alcohol or very strong wines, only, improve and keep in large vessels. I mean, of course, at the ordinary and mean temperature of cellars or fermenting houses where those vessels are usually fixed, because, at a temperature always equal and cold, the wine works very slowly in large vessels. On the other hand, it would work rapidly in a bottle placed in a temperature varying from 68 to 95 degrees.

WINES OF MACERATION (RED AND WHITE WINES).

Under all circumstances, the variable or constant temperature, the light and obscurity, rest and motion, and atmospheric pressure, being equal, the wine will go through all its periods quicker in large vessels than in small ones ; and, on the other hand, the smaller the vessels the greater will be its longevity, and the more stationary it will be in its youth, maturity and old age. The consequences of that law are easily applied to making, improving and keeping the wines. A large proprietor in Burgundy was expressing to me his intention of building cisterns with hydraulic cement to keep his wines in. I advised him to abandon his idea, because the greatest portion and the best of the Burgundy wines would not keep three years in cisterns or vats, containing only 1200 gallons, and *a fortiori*, 2500 or 20,000 gallons. The wine would be dead before the anticipated result could be accomplished. The experiment was made; I have observed several instances during the course of my life. I have seen the building of the cisterns of my cousins, Messrs Douge, of Gye-sur-Seine, my native place ; the vats bought and placed by tens and by hundreds in Burgundy and in Champagne, and I have noted the progress of light and fine wines in those large vessels. They mature with a wonderful rapidity, and this rapidity is sometimes so great that there is no time to moderate it. I have seen large quantities of wines lost in this manner, and under the singular pretext of dispensing with buying casks in years of abundance, when they are always dear. That is a paradoxical idea, which has caused serious losses to many vineyard proprietors. I can imagine the establishment of large wine vessels in places where the wines are sold in bottles, as in Cham-

pagne; but, where it is sold in casks, each crop requires new vessels, which must be bought sooner or later to expedite or deliver up that crop. In such a case the storing of the wines in large vats is only transitory, and the expenses of that storage, and the wear and tear of the vats will certainly be greater than the difference in the prices of the casks. In reality the use of large vessels, considered only as wine reservoirs, is a source of loss to the proprietor, besides the risk of losing his wines, to which he is seriously exposed. The large vats do not permit fining, easy racking off, change of locality, nor of temperature; they are inconvenient and dangerous under any circumstances. Unless, therefore, it be for practical reasons, which concern the making of the wines and the progress of their periods of improvement, fine wines must not be kept in cisterns, nor in large vats; they must be made and kept as much as possible in the vessels in which they are habitually delivered and exported.

Diseases caused by accumulation—Law of Ampere.—Wines, like vegetables and animals, are liable to diseases, which spread themselves by means of contact and continuity, and by a law which the celebrated Ampere has often demonstrated to us, in his lessons at the College de France, a law which really exists, and which he has called the law of assimilation. He told us that, "when a certain quantity of water contains in solution the elements of several crystallisable salts, if a formed crystal, the elements of which are contained in that water, is introduced, a mass of analogous crystals will be found, and no others. I explain," he used to add, "the small pox, scarlet fever, &c., by a similar influence." M. Ampere supported his law by a great number of examples drawn from the mineral, vegetable and animal kingdoms. That law would find in wines a thousand confirmative facts. If special circumstances transformed into vinegar some portion of the mass of the wine, however small it may be —be it by the contact of the air at the bunghole, or by the insertion of a tap—the law of assimilation does not delay long before manifesting itself, and by degrees the whole mass of the wine gets acetified. Such an accident is of no consideration if it has affected only one bottle, or even one hogshead, but, if it extend to a vat holding 1000 or 2000 gallons, the loss becomes serious. The wines which contain only a medium quantity of sugar and alcohol mature so rapidly in large vats that they cannot be kept in that manner even till the end of the first winter, if their ultimate destination requires that they should retain a certain proportion of their non-fermented sugar. Thus, in Champagne, a white wine, which would be stored in large vats after the making, would not effervesce, or not, at least, sufficiently when bottled after the winter, as it is generally done. The Chablis wine, on the contrary, which requires to be very dry, and to give not the slightest sign of effervescence, can be kept in large vats without any inconvenience for several months; but, as it ripens rapidly, and is also a delicate wine, it must be put into small vessels as soon as it approaches maturity. In Champagne, all the white wines are kept in casks holding forty-five gallons; casks holding only half that quantity would be preferable, but the cellars dug in chalk are so fresh and so excellent, that the sugar of the wines is well preserved, even in casks containing forty-five gallons.

Time when the wines should be put into smaller vessels.—If the conditions of the wines produced necessitate the use of large vats, and their being kept in a temperate or warm atmosphere so as to accelerate their ripening to the desired degree, that object once obtained, or nearly obtained, it is time to divide the mass of the wine by putting it into smaller vessels, which are then kept in cellars of a lower or more equal temperature. After that operation the work of ripening goes on slowly, and it requires a long time before any amelioration becomes perceptible; but it is only when the wine has attained its quasi-perfection (I except the sparkling wines) that it can be put in bottles, and in a place with a constant and fresh temperature.

The bottle preserves the qualities of the wines but gives none.—It is an error to believe that the bottle is the vessel in which the wine

acquires most of its qualities. The special object of the bottle is to preserve the qualities of the wines and to preserve them longer than any other vessel. In the bottle the wine works slowly, perfects itself by small degrees, almost imperceptibly, unless it has been bottled too young, but then the great difference which might be remarked can only be the result of many years keeping in bottles. I could give many other indications referring to the influence of the mass upon the wines, combined with the temperature to accelerate or retard the various stages of the life of the wines; but I have said enough to call attention to, and to instigate the use of, the best appliances of vinegrowers and wine makers for the production of the best possible wines.

Influence of light upon the wines.—The light direct from the sun accelerates the working of the wines, and especially the colored wines. Its influence is very prejudicial; it spoils rather than improves the good composition of wines; it transforms and destroys the coloring matter; and the colored matter, thus modified, re-acts in its turn upon the other elements so as to cause the wines to become acid, bitter or watery. It is not, therefore, without some advantage, although the practice might be due to chance, that the wines are put in bottles of colored and scarcely transparent glass. And it is not without efficacy either that the freshness of cellars is combined with a quasi-obscurity. However, the light is only injurious when it acts during its full power in day time, and especially when it acts directly; but a partial light, a reflected or polarised light, the light of the moon or that of artificial means, is not powerful enough to produce any perceptible effect. I have lighted cellars, the largest in the world I believe, by immense tin reflectors upon which the sun light falls directly, and is diffused at right angles in the axis of the vaults; that light almost polarised, has not apparently, during 15 years, modified in the least the state of the wines in bottles.

Influence of motion upon wines.—Voyages and transports act upon wines like light, volume and heat; they accelerate the period of their existence. The maturity of wines rich in spirit and sugar is greatly advanced by sea voyages. The results of such voyages for Port or Maderia wines are really marvellous. The high temperature of the tropics is the principal cause of the amelioration obtained, but the movement is certainly not foreign to it. But, if long voyages are favorable to strong and young wines, they are destructive to the old; and weak wines, to bear long voyages, must have naturally a large quantity of non-reduced sugar or spirit. The direct and isolated influence of motion is evidently shown when wines are removed as soon as they have apparently gone through the sensible fermentation. If wines in that state are carried on drays for a distance of a few miles, or even on wheelbarrows for a distance of a few hundred yards, the carbonic acid is again disengaged and sometimes in such an abundance that it would blow off the head of the cask if a small hole was not made near the bunghole to facilitate its escape.

Influence of noise upon wines.—Another sort of motion which affects wines is the motion of vibration or trepidation. Wine does not live long and does not do well in cellars contiguous to paved roads where there is a large traffic; it is quickly destroyed in cellars of cities and especially in streets where heavy vehicles pass constantly and at a rapid pace. The vibrations of the ground brings age in young wines and destroys old ones. In fine, cellars near factories where heavy hammers play, and near strong and frequent shocks, are never good. Musical sounds accelerate equally the inmost work of wines; most of the old wines would be destroyed in a cellar that was transformed into a music hall. Therefore, wine placed in small vessels in a fresh cellar without light or noise and in erfect quiet, is in the best possible condition to live slowly and long.

Effects produced upon wines by electricity, ozone, hygrometry, and pressure of the atmosphere.—Electricity has a great influence upon wines. During storms, the increased breakage of bottles of champagne proves it sufficiently. Ozone, or the vivifying state of the atmosphere,

a state that corresponds to the rising of the sap, starts the working of the wines. Hygrometry, or the state of humidity of the air, seems to have a direct influence upon wine in bottles, for as soon as the weather becomes rainy, all the bottles of champagne piled up in cellars will be covered with humidity. It is a a phenomenon which is not easily explained, although it appears extremely simple at first sight, because one would suppose that the atmospheres of the cellars became more damp and more saturated with vapor, but the temperature of the air of the cellars remains identically the same; consequently, the atmosphere retains the same relation with the bottles. If the bottles are not cooler than the atmosphere they cannot condense the humidity. Does the bottle, then, cool itself by the stoppage of the latent work which the wine it contains undergoes? Is the life of the wine repressed when the barometer falls, or when the weather is about to change unfavorably? I do not see any plausible hypothesis to explain the hygrometric power on bottles full of wine; chemists will understand me if I say that empty bottles are not affected by the hygrometric phenomenon In order to settle the question, experiments should be made upon bottles filled up with water mixed with bottles filled up with wine. In fine, the pressure, barometrical or artificial, has a great influence upon wines; the higher the barometer, the more limpid are the wines; they become turbid and thick when the barometer is very low. Under a pressure of three or four atmospheres the wines clarify better than under the free air; it is an ascertained fact in the case of champagne wines. Some useful applications for other wines, may perhaps be drawn from the favorable influence of the atmospheric pressure.

SUMMARY OF THE PRECEPTS APPLICABLE TO THE KEEPING OF WINES.

It was necessary for me to show the principal influences of the general modyfying agents on wines before giving the last observations as concerning the care to be taken after the first fermentation; a few words will now be sufficient. It will be necessary to observe the following rules, namely: To *fill up* completely all the vessels containing wine, firstly, every two or three days, then every week and every month, and lastly four times a year, and always with the same sort of wine, or wine of the same nature. To *rack off* once at least upon the first lees, without fining, in dry and cold weather, during the first and second winters expose the wines as much as possible to a cold air varying from five degrees below the freezing point to as many above, and effect the drawing off at that temperature. To *fine* only wines which are not limpid before the racking off. To *clarify and rack off* wines which are to be bottled or removed. To *put in small casks* the wines which have been kept in large vessels when those wines approach the point at which they become drinkable, and to place the small casks in fresh and quiet cellars. To *put the wines in bottles* only when they are fit to drink so as to be able to keep them good long and to wait till they become better. To *pile up the bottles* in the coldest and darkest part of the cellars; each kind of wine must be properly labelled and a record of the age and time of bottling must be noted in a book kept for that purpose. Such are the most general rules to be observed in the treatment of wines. If there is one cask of old wine for which no similar kind can be obtained to fill up, the ingenious process recommended by M. de Monny in his book of the *Vigneron* is practised. Stones which do not effervesce when put in vinegar or acids are put in the cask, but those stones must be first well boiled. in water and washed afterwards in cold water. If after having been one or two years in bottles the wine deposits an abundant and soft lee, it should be decanted with great care. To effect that operation a small tin tube about eight inches long and slightly bent is used; this tube is introduced into the bottle and against the upper side so that the air can get in freely while the bottle is gradually inclined to allow the liquid to run out. This decantation must only be practised in case of absolute necessity, and must not be followed by any other. If the operation

is effected during cold and freezing weather the quality of the wine is not altered. To complete the preparation of wines I have still to speak of the liqueur and sparkling wines.

LIQUEUR WINES.

The liqueur wines are more particularly produced in the vineyards of the extreme south of France, but they could, if needed, be produced wherever the vine is cultivated. A liqueur wine may be obtained from any grapes by evaporating the water from the juice of the latter, until that juice marks 20 degrees with the gleucometer ; or, in other words it is made by a slow fermentation to contain 20 per cent. to 15, 16, and 18 degrees of spirit, and the surplus in sugar non-reduced. This result is obtained by three different principal methods :— The first, which is only applicable in hot climates, consists in allowing the direct evaporation of the water by the desiccation of the grape on the vine ; the desiccation is effected by twisting the stem of the bunch, or by cutting the bunches and leaving them to dry by the foot of the vine. Under some favorable circumstances, two or three days are sufficient to obtain the partial desiccation of the grapes, a dessication which is adequate to realise the richness sought for in the must ; generally six or eight days are required to attain the desired result. The juice of the grapes being thus concentrated, they are gathered and brought into the press house where the most shrivelled berries are separated from those that are less so : each are crushed separately ; the most juicy of the berries produce a liquid must which is used to dilute the thicker must obtained from the more desiccated grapes. The mixture of the two musts being effected, the whole is subjected to the action of the press, and the liquid obtained is the basis of the liqueur wines. The second process consists in gathering the grapes when in their highest state of maturity and in effecting the desired evaporation either by putting the grapes upon hurdles made of wicker-work, and exposing them to the air, or keeping them under cover or in ovens made for that purpose. This method, of course, can be employed in any country and under any climate. When the desiccation reaches the desired degree, the grapes are treated as in the first process. These two methods produce the best and most natural *liqueur* wines, provided, however, that no other grapes are used but those from the finest *cepages* and those most suited to produce the most perfect wines of that kind. The third process, the worst of the three, is unfortunately the one most resorted to ; it consists in concentrating the must of the grapes by a protracted ebullition in vast coppers, until it has acquired a density greater than necessary : for instance, 30 ° instead of 20 ° ; it is left to cool down, and then it is mixed with non-reduced juice until the density is brought down to 20 ° of the gleucometer. If the process is carried out as I have just explained, and especially if neither marble nor chalk is used to absorb the acids ; if, in fact, plaster is not employed, and the concentration is obtained by evaporation only, good liqueur wines may be produced ; the destruction of the natural acids renders vapid and kills any kind of wine. Colored liqueur wines of high qualities are obtained also by fermenting the must of red grapes with the skins, and after the drawing off of that must, mixing it with the prepared liquor. The more saccharine elements the liqueur wine contains, the slower is the fermentation, and they require a long time to reach perfection, and for that reason they can be kept in large vessels placed in dry and warm rooms.

SPARKLING WINES.

Although I have made, for a great number of years, sparkling wines, and particularly champagne ; although I have followed that occupation with delight and employed all the efforts of my knowledge and intelligence t that special branch of French industry, I must only say here a few words on that subject, as an indispensible conclusion to the rapid and superficial remarks I have made upon the various parts of vinification. Most of the French wines would lose much by being converted into sparkling wines : the sparkling wines of the Champagne are one of the great

national sources of wealth, and that wealth is so much more estimable as it is due to an extraordinary sagacity for observation, a spirit of progress, and scientific investigation, but especially to a respect for tradition seldom met with now-a-days in vine culture and wine making.

Causes of the superiority of the sparkling wines of Champagne.—The choice of the *cepages* has always been the subject of the greatest solicitude for the vinegrower in Champagne ; his vineyards are planted with the finest. The large black and the large white sorts are strictly proscribed ; this is the reason why the world want wines from Champagne, as it wants wines from Upper Medoc, and as it will always want wines from the districts where regard for the *cepage* has predominance over any other considerations. If Upper Champagne was to cease now to produce sparkling and to make only dry wines, it could not produce them in sufficient quantity to supply the demand, like Sauterne, Montrachet, the beautiful Chablis, and like twenty other places of untarnished and good reputation. But the delight and the luxury of the effervescense in wines, added to that first and solid basis, is an industrial produce which has its value and which deserves special remuneration. That produce is equally the fruit of traditional observation and scientific progress, and under this double advantage of its fine *cepages* and its progressive processes founded upon long experience, Upper Champagne deserves, and will always retain, the sceptre for sparkling wines.

Sophistication.—Notwithstanding their fair name, the œnophiles of Champagne number among them a few false brothers and several impostors and deceivers, who make Champagne wines with grapes bought outside the department of the Marne, and who even add to those wines numerous hectolitres of sugar-water; but this deception upon merchandise, these very exceptional sophistications, are yet more rare in Champagne than in any other renowned wine districts, the reputation of which is always a marketable article for audacious speculators. All these abuses will cease as soon as a law, severe without being oppressive to industry, nor restrictive to honest liberty, shall require that the producer declares the elements of his produce, and that each produce sold bears the description of its composition.

Treatment of the grapes.—All grapes, in any country and under any climate can produce sparkling wines. In Champagne, the black grapes, nearly all belonging to the pineau kind, are preferred, for making the best sparkling wines, to the white grapes, which however belong to the same species. To make sparkling wines, the grapes must be gathered with care, cleaned, and crushed before any fermentation takes place. The juices are either put in casks immediately or are left to deposit for a while in the vats. Their fermentation is effected in casks of 45 gallons, and in rooms with a temperature of 66 or 77 Fahrenheit. The fermentation proceeds quietly and slowly and lasts from eight to fifteen days, more or less, according as the ambiant temperature is high or low. The essential point to be observed when the wines are taken into the cellars with a temperature of 55 or 59 degrees, is that those wines retain about one half of their sugar (non-converted into spirit and carbonic acid) at the time when their active and sensible fermentation is stopped and transformed, by cold, into a slow and latent fermentation. So far, the treatment of the wines intended to be sparkling does not differ from the general treatment employed in ordinary white wines. It commences to be different when it is necessary to retard the first fermentation of the intended sparkling wines by removing them into a fresh place, so that they can retain a sufficient quantity of sugar in their must. This faculty of retaining their sugar and interrupting their first fermentation is far from being so marked in all wines as in those of Champagne ; a great number of white wines in the south of France cannot be treated naturally for sparkling wines. The wines of Champagne retain their sugar with such a tenacity, that it is very difficult to make them dry, even after two or three years of delay; at every sap they work a little and their sugar

becomes creamy or a little sparkling, if they are kept in bottles well corked. The wines of Champagne have therefore a true predominance over the great industry which has been founded upon them and of which they are the legitimate standards. The sugar which remains in the wines continues to reduce itself during the winter by the latent fermentation to a certain extent, which must be ascertained frequently and correctly, if natural sparkling wine is to be the result of the operation, because the effervescence depends exclusively on the quantity of sugar that remains in the wines when put in bottles.

Effervescing wines put in bottles must contain an accurate proportion of sugar.—If the wine does not contain enough sugar when it is put in bottles, the effervescence is deficient; if it contain too much of it, the effervescence is too strong, and breaks the bottles to a ruinous extent, or forces the liquid through the corks or between the corks and the glass, and partly empties the bottles. The first condition to make effervescing wines is to have some practical system, simple and sure, to ascertain the quantity of sugar which is in the wines when they are about to be bottled.

Relations of the sugar with the weight and volume of the carbonic acid gas.—The sugar of the grapes as well as most of other sugars is decomposed by fermentation into two parts, nearly equal in weight, namely, carbonic acid and alcohol. The alcohol, which is a liquid at the ordinary temperature, remains naturally and without effort, mixed with the water of the wine; but the carbonic acid being a gas excessively elastic, escapes immediately from the liquid into the atmosphere if that liquid is not hermetically closed, and it remains in the wine, and dissolves in it only in proportion to the pressure which is opposed to its escape or expansion. It is therefore the carbonic acid alone which by the expansive activity developed to effect its escape from the wine renders that wine sparkling, and forms the effervescence by dilating and raising it in an infinite number of bubbles. But, if the carbonic acid alone renders the wine effervescent, the sugar alone gives the carbonic acid to the wine, and that gas represents nearly one half the weight of the sugar; and the carbonic acid, representing the 49 hundredths of the weight of the sugar, gives a volume of gas exceeding three cubic inches for every fifteen and a half grains of acid, from which it follows that thirty grains of sugar giving fifteen grains of acid, furnish nearly a pint of that gas. Sixty grains of sugar would thus produce nearly one quart of gas, from which it follows that if 300 grains of sugar were reduced into alcohol and carbonic acid in a bottle of wine hermetically closed, the bottle would contain upwards of four quarts of gas, which, according to Marriotte's law, would make an effort equal to to nearly five atmospheres to break the vessel, or drive out the cork. That is, in effect, what takes place in the bottles of sparkling wines in which the gaseous tension is supposed to be four or five atmospheres.

Tension of the gas in the bottles.—If the volume of carbonic gas retained in the wine or free in the empty part of the neck of the bottle, or in the bilge of the bottle, when laid down horizontally, was not equal to an internal pressure of four atmospheres, the effervescence would be too weak or defective. If that pressure exceeded six atmospheres, few bottles, even of the best glass, could withstand it long without bursting, and few corks, however well selected and fixed, could prevent the scape of the liquid.

Quantity of sugar to be left in the wine to obtain a good effervescence.—To avoid missing the effervescence and to prevent breakage, it is essential to bottle only wine which contains no more and not less than two pounds of non-decomposed sugar for every ten gallons. To ascertain that the above proportion is exactly in the wine, the following process is employed:—I will suppose that, after the wine was made, the casks were put in fresh and quiet cellars, and that the removal was effected when one-half of the sugar was still in its natural state. I will suppose also that the must of the wine, when previously tested, marked 11 degrees with the gleucometer, which would show about 1 lb of sugar for every gallon, allowing one degree

to represent the salts and acids ; thus, about three quarters of a pound of non-reduced sugar per gallon would remain when the wine is put in the cellars ; of that quantity scarcely one-half would be decomposed before the 1st of January, which follows the making, and at that time six ounces of sugar would still remain in its natural state ; that quantity is yet double of what is required for the bottling. One can, therefore, wait till that epoch without any apprehension or care concerning the state of the wines, except for the regular filling up and racking off at the winter solstice ; but, from the first fortnight of January, the state of the sugar must be carefully ascertained weekly in each kind of wine.

Cuvees in Champagne.—A *cuvee* in champagne is a mixture or blending of several wines which have been ascertained by tradition and testing to improve by that process. The districts from which these wines are obtained differ in sites and aspects, such as the vineyards of the *Mountain of Rheims* exposed to the north, and the vineyards of the *Marne* exposed to the south, the vineyards of *Vertus*, *Oger*, *Semenil*, &c., exposed to the east, and the vineyards of *Cui s*, *Groves*, &c., exposed to the west. These wines differ also, unfortunately, with those bought by unscrupulous speculators, in districts which nature has not endowed with the same advantages as Champagne ; in truth, a *cuvee* is a mixture of various wines which, by the blending effected after the first and separated fermentation of each of the components, forms a perfect homogeneous mass. Thus, *cuvees* of 2000, 100,000 and 250,000 bottles aro made. It is a great art that of making well the *cuvees*. There are successful and unsuccessful *cuvees*. It is rarely that the proprietor is not present and presiding at the making. A correct and minute account is always kept of the composition of each of them, save in case of adulteration, for the success or the failure of a *cuvee*, its good or bad ulterior keeping, the favor it meets with when brought into the market, carefully recorded in the archives of the proprietor form traditional and precious instructions for the family.

Method to ascertain the quantity of sugar which remains in the wines.—Whatever may be the skill displayed in the making of the *cuvees*, they differ in the quantity of sugar they contain, and in the course of their transformation. It is for that reason that from the first fortnight of January, I have said that the state of the saccharine matter should be ascertained weekly. The best process to effect that object is the following : 750 grammes of wine (25·78 oz, avoirdupois) are weighed exactly and put into a porcelain capsule, the weight of which is previously ascertained. The capsule is put over a gentle fire, or in a steam bath, and the evaporation of the wines is allowed to proceed till it is reduced to one-sixth part or 125 grammes. The residue is then poured into a glass tube to cool itself down to 59 or 60 degrees, at which temperature the gleucometer is immersed in the liquid, and if it marks 12 degrees it is time to draw off the *cuvee*. The drawing off is still good at 11 degrees ; it is less favorable at 10, but it produces yet a good effervesence. Below 10 degrees artificial means must be resorted to ; above 12, the wine must not be bottled, no matter how far the season is advanced. The drawing off may be effected from January to June.

The wines must be bottled as soon as they mark only 11 to 12 degrees with the gleucometer.—Whatever be the epoch of the winter or spring, when the liquid of a *cuvee*, reduced to a sixth by evaporation, and marks only from 11 to 12 degrees, the drawing off and bottling can be proceeded with. But it must not be forgotten that if it is cold, the effervescence will only be perfect by effecting those operations under an artificial and constant temperature of 77 degrees ; and this condition not only causes the rapid absorption by the ferment of the oxygen of the air confined in the chamber or the bilge of the bottle, but also enable the bottles when filled up in the same place and under the same temperature, to receive an impulsion that produces promptly the formation of the effervescence.

Signal of the formation of the effervescence,—

The signal of the formation of the effervescence is given by the detonation and the breaking of some bottles in the pile. That phenomenon manifests itself generally in the third day after the bottling. When it is ascertained that the effervescence has set in, the bottles must be removed at once into a very fresh, and quiet place : breakage which would continue if the bottles were left in a warm places, ceases altogether if they are new and of good glass.

The bottles should be new.—I say *new* because under the internal pressure of four atmospheres during two years, the glass loses its cohesiveness, and the bottles which have been used once cannot be trusted a second time. This is a fact well established and which was verified under my own eyes at a great cost ; out of three thousand excellent bottles which had contained sparkling wines and filled up a second time, 14 or 17 only withstood the pressure. The glass of the bottles must be very coherent. I say that the bottle must be of good material, because the tenacity of the glass and its resistance to disintegration vary according to the materials melted in the furnace. Several persons, whose opinions are authoritative, think that the enormous adhesiveness of bottles is due to the great proportion of vitrified oxyde of iron contained in the glass. It may be so, but I think, according to my observations, that the imperfect tenaciousness results from the abundant use of broken bottles ; silicates lose their cohesion by a second fusion. It is for that reason, I believe, that the glass manufactories of Sevres and Bercy which recast an immense quantity of broken bottles gathered in Paris, could never furnish bottles that resisted sufficiently the pressure of sparkling wines.

A slow fermentation saves breakage.—It is not sufficient to avoid the breaking of bottles that the wines contain a proper proportion of sugar to be converted into alcohol and carbonic acid, but it is necessary that the latter be developed slowly, and that the wines have time to dissolve it. Water dissolves about an equal volume of carbonic acid under the ordinary atmospheric pressure ; alcohol dissolves about three times its own volume under the same pressure ; so that wine at ten degrees of alcohol dissolves about one and a fifth of its volume of carbonic acid gas ; but the facility which liquids possess of dissolving the gas increases proportionately to the pressure ; consequently, under a pressure of four atmospheres wine dissolves four times and four-fifths its own volume of carbonic acid ; whence it follows that the active pressure is the result of the reaction of the gaseous atmosphere contained in the neck or in the bilge of the bottle. To prevent the pressure being disproportionate in the neck or in the bilge, the gas formed must have sufficient time to dissolve in the liquid. That time is wanting if the decomposition of the sugar is too rapid. This is the cause of the breakage commencing as soon as the third or fourth day after the bottling when effected in a warm place. At that time not one-fourth of the sugar which is to undergo the chemical transformation is yet decomposed, but the small quantity of gas already formed has accumulated in the bilge and exercises a momentary pressure of 8, 12 and 15 atmospheres, which bursts bottles that would not break in a fresh place, because the carbonic acid would have developed itself slowly, and would have dissolved in the wine according as it was formed. Everything that accelerates the development of the fermentation, as soon as it has commenced, in such manner as to insure its continuation, must be avoided; heat, shocks, noise, sounds that can vibrate in unison with the bottles. It is possible, indeed, to increase the breakage at will, by rendering the fermentation active and tumultuous, and to reduce it by contrary influences, independently of the larger or lesser quantities of sugar to be transformed into alcohol and carbonic acid. The presence of acids in the wine greatly diminishes the solubility of the gas, and accelerates in a remarkable manner its issue from the liquid.

Sparkling wines establishment.—The *locality* must have a temperature of 20 degrees. Each cask is previously brought there, and the bottles

re filled directly from the tap or by the aid of a box mounted with tubes, and a lever that lets the exact quantity of wine required to fill one bottle pass through each tube; this box is supplied by a tap with a floating ball. In each bottle an empty space of about two inches must be left to give room for the cork and the air chamber. One or two boys place the empty bottles at the tap, and carry them to the corker, who, with the aid of a machine for the purpose, puts in the bottle a good cork, well cleansed, well softened by heat and dipped in a liqueur wine to facilitate its slipping down the neck of the bottle. Several ingenious machines have been invented by which one thousand bottles may be corked daily with corks the size of which seems altogether disproportionate to the opening of the bottle. When the bottle is corked the corker hands it over to another man, who fastens the cork with a string. Another man receives the bottles and fastens the cork again with the wire. Sometimes a tin capsule is usefully put on the top of the cork before fixing the wire; it prevents the latter from cutting the cork, which is constantly pressed outward by the gas. Under equal circumstances, respecting the quality of the corks and their binding, this precaution may safely be estimated at a difference at least of 10 per cent. for leaking bottles. When the bottles are so prepared, they are piled up in the best manner possible to prevent those bursting from breaking any more. As soon as, by the formation of deposit, or by the breaking of several bottles, the effervescing work is known to have commenced, the bottles are taken down into cellars which remain at a constant temperature of 10 degrees; they are piled up again and left there for 18 months, two years or more, according to the wants of the trade. During the stay in the cellars the breakage increases alarmingly at the rising of the sap in May or June, but it is not so great in August, and still less in the following spring; it is also noticed more or less during storms under the influence of electricity. Breakage was so considerable not many years ago, under certain circumstances and in certain cellars, that the loss was sometimes above 50 per cent. of the bottles; the principal condition for the production of the effervescence was then unknown. Now, the losses do not exceed more than 9 or 10 per cent. under the most unfavorable circumstances, and do not often go below 2 per cent. under the best conditions. The average of the losses occasioned by breakage is 5 or 6 per cent.; if it goes beyond, it is owing to the ignorance or carelessness of the manufacturer. After one and-a-half or two years, when the deposit is well formed, and the wines are perfectly limpid in the bottles, they may be prepared for expedition. They are taken from the pile and fixed head down in planks bored for that purpose. The holes must be large enough to permit the bottles to be put first in a very slanting position, then a little more vertically and at last quite so. While giving those various positions, the workman, who is called the stirrer, takes each bottle by the bottom, and, without lifting it up, gives it one or two rotatory oscillating motions upon its axis; the object of the above operations is to bring gradually the deposit lying in the bilge of the bottle, down the neck and on the cork, without disturbing the limpidity of the wine. In most cases the object desired is obtained in six weeks or two months. The deposit is then cleared off by a peculiar manner of taking the cork out. It happens sometimes that the deposit is greasy and adheres to the place where it had settled; this accident leaves a stain called *masque*, and necessitates violent shaking of the bottles, and, not unfrequently, a complete decanting, operations which are all effected by hand, or by ingenious mechanical processes, the description of which does not come within the limits of this work.

New method of piling up the bottles.—The breakage is often increased by the mode of piling up the bottles. The old system was particularly favorable to that evil. It can easily be imagined what were the consequences of the shell-like bursting of one bottle amidst 3000 or 4000, laid horizontally on the top of one another. To avoid those disasters I have adopted a process which isolates each of

the bottles, although they are piled up in hundreds upon moveable shelves of pine impregnated with sulphate of copper. On these shelves, which are called *table-tas*, the bottles are inclined 45 degrees; they are placed there immediately after the bottling, and are only removed when wanted for expedition to undergo the operation of clearing off the deposit. In that position the deposit settles at once on the cork, and thus the *table-tas* saves the preliminary piling up, the temporary inclination of the bottles, the shaking, the *masque*, and reduces the breakage to a small proportion. This system of piling up, employed for more than ten years, has given the best possible results.

The carbonic acid is retained by affinity in the Champagne wine.—I consider it necessary to examine why almost the whole of the carbonic acid remains in the wine in an open bottle; for during the time the deposit is being taken from the bottle, the wiping of the neck, and the re-corking, the bottle remains open. That time, although short, would be sufficient for a bottle of Seltzer water to lose three-fourths of its gas, while a sparkling wine, the Champagne wine above all others, keeps four-fifths at least of its gas, notwithstanding that the dissolving power of water for carbonic acid is 100, and that of the wine only 120; the difference does not explain the retention in the wine of three or four times its volume of gas, capable of producing a pressure of three or four atmospheres as soon as the bottle is hermetically closed. There is, in truth, in the Champagne wine a power of cohesiveness, an attraction which, when in contact with carbonic acid, counterbalances the tension of three atmospheres; but ordinary wine does not possess that power, for a great number of manufacturers of wines in Paris and other places treat the white wines, which do not effervesce, as water is treated to make sodawater and lemonade. To poor and weak white wines, from Touraine, Lorraine, and other places, they add liqueur of alcohol in fit proportion to imitate the genuine wines, and then they impregnate them with carbonic acid, extracted from lime, marble, or chalk. These wines, which are called *grands mousseux*, drive off the cork with a great noise, but the carbonic acid gas escapes immediately in the proportion of three-fourths of its volume, as it escapes from the Seltzer or other aerated waters. The adulteration is easily detected. The more natural the sparkling wine, and the finer the *cepage*, the more its carbonic acid adheres to the liquid, and the smaller are the bubbles of the effervescence, the less it is acid, the longer it keeps its sparkling properties. By pouring acids into wine loaded with carbonic acid, the gas disengages itself rapidly, as if the new acid was taking its place in some sort of combination; points, sharp angles, electrictrity, heat, shocks, sounds, tend to disengage the carbonic acid from the wine. However, there is no combination between the gas and the wine, for the wine of Champagne does not admit, and is no conductor for, sonorous vibrations, which proves that the gaseous liquid is a mixture without homogeneity. Any one can ascertain that fact by filling up a tumbler with water or ordinary wine, and one with good sparkling wine, saturated with its gas; the first glass, struck with the blade of a knife, will give a clear and long sound; the other a dull one, which will immediately die away, as if the glass was muffled. The longer a sparkling wine retains its gas, the more it is natural and of fine origin. A good bottle of effervescing wine left open for three hours, when half full, should, if carefully recorked, drive off the cork with some noise on the following day. The above remarks explain how the bottle may be opened to take out the deposit in the chamber without damaging the wine, especially if the operation is effected in a fresh cellar.

Recoulage.—When the wine is the produce of bad or middling years, it is necessary to add a proportion of wine of a good year; this addition is called *recoulage*. For instance, the wines of 1847 were blended in that manner with 10, 15, 20 per cent. of the excellent wine of 1846. It is by the *recoulages* that the wines of Champagne can be offered every year, and upon

the markets of the whole world, with about the same qualities; for that reason the large and wealthy merchants buy at any price the greatest possible quantity of wines of the good years; it is their treasure—their essence to enrich and perfume the wines of poor years. Without a stock of first-class old wines in a bad year a house is lost for the great commerce. This fact shows that the production of the wines of Champagne is an industry, an art and a science at the same time. It would still be better shown if I had time to enumerate and describe all that is identical to the filtering of the liquids, and to the machinery employed to bottle them without coming in contact with the air, the corks and their preparation, the string, wires, capsules, &c. To make known all the ingenious process, all the marvellous machinery, all the invention and observation relative to the preparation of Champagne wines, several volumes would scarcely suffice. But I must confine myself to a succinct and simple description of the practice of that industry, and refer the reader for further and ample information to the work of M. Maumene.

Corks.—The cork used for the last bottling should not be so deeply driven in as it is at the first drawing off. The corks for expedition must be new, of first quality, well washed with wine and softened by steam.

Mode of selling the produce of the vineyards in Champagne.—Notwithstanding the interest that the great industry of the Champagne wines deserves, it is only as an important branch that it is connected with the general question of the French wines, and my sole object in giving the foregoing summary statement of that industry was to make known the difficulties; that statement will be sufficient to show that it goes far beyond simple viniculture and ordinary wine-making, and that it is not easy for the ordinary vinegrower to annex it to his establishment. In Champagne, most of the proprietors sell their grapes to the manufacturers of effervescing wines, or they sell their wines in wood, and it is only seldom, and when the wines are good and too cheap, that they run the risk of making a *tirage*. To make a *tirage* for the proprietors is to bottle the wines in their own cellars and at their own expense. After one or two years, according as the time appears to them the most favorable to obtain a good price for their *tirage*, they cause their wines to be tasted, and their qualities appreciated, by professional tasters, who then offer them to the trade. The manufacturers remove them to their eastablishment, and prepare them for sale. Thus, even in Champagne, the proprietors decline the trouble and risks of the manufacture of sparkling wines, and I appreciate their prudence. It is for that reason that I will never advise a proprietor of vineyards to engage inconsiderably in an industry which too often leads to ruin through erroneous speculation and estimates. I here close the general description of the preparation of French wines; I have now to speak of the use of the lees, low wines, vapid wines, and the mark of white and red wines.

USE OF THE LOW WINES AND THE MARKS.

Distillation of the low wines and marks.—The lees obtained from fermented wines must be washed successively in two waters, and those waters may be added to the wines intended for distillation. In large rural establishments, all the marks (residuum of the pressed grapes), but the marks of white wines better than those of the red, put in casks or vats, may be made to furnish a very wholesome and fortifying drink to be used in the same year. If the casks in which the marks are kept are filled up with water in the proportion of one half of the juice that they have produced, and they are left to macerate for ten or twenty days in that quantity of water, the latter will become saturated with the salts, tannin, coloring matter, and 4 or 5 per cent. of spirit. By adding 10 per cent. of sugar, the beverage can be doubled in quantity, and improved in quality by the more active fermentation that it will undergo; but those products must be consumed on the spot; for field laborers they are far superior to water; they are

even preferable to beer, but they cannot replace the wine.

Distillation of the waters used for washing the marks.—To extract the alcohol contained in the marks which have not been used to make the beverage above mentioned, the best method, and the most convenient, consists in filling up with hot water the vessels containing the marks when dried and cold. When the water has become cold, it is drawn off as the wine would be, and that water, distilled in the proper apparatus, gives spirits of good taste and flavor. The last residuum of the marks is used to make turf for burning, or to feed poultry, or it is mixed with the composts of soil and stable manures to be used in vineyards.

DISEASES OF THE WINES.

I speak of the diseases of the wines only to say that it is a very unimportant question, and that it bears only upon rare exceptions, foreign to the general production and to the great commerce of wines.

Wines well made are never unsound.—I speak on this entirely under the influence of Comte Odart's opinion, and I have myself ascertained that pure and well made wines, produced by good and well matured grapes, put in good casks and kept in good cellars, are never sick except through caducity, which disease is incurable. I have noticed that the medium or bad wines, or even the good wines, which have been placed in conditions that caused their mucous, acetic or putrid fermentation, were deprived of the elements which nourish them, that is to say, of sugar and alcohol, and that they never could be made again marketable wines; their treatment and their cure is therefore only an affair of domestic economy, for public hygiene, as well as conscience and probity, must forbid the sale of vitiated or defective wines, as it forbids the sale of vicious and unhealthy animals.

Treatment to prevent the grease.—The grease in wines is the same as in beer; they turn slimy. Prevention, says M. Monny de Mornay, is better than cure. That precept has been applied with great advantage in Champagne, where the white, light and delicate wines were often subjected to viscocity. That disease has disappeared by the use of tannin in the proportion of 15 to 20 grammes ($\frac{3}{4}$ to $\frac{1}{2}$ oz) per 22 gallons, added to an alcoholic solution three or four weeks previously to the bottling. The tannin neutralises and precipitates the excess of azoted matter, an excess which produces the viscocity of the wine. That preventive medication was recommended by M. Francois, a skilful chemist, who has rendered immense services to the manufacturing of effervescing wines; he had ascertained that the wines, affected with the grease, recovered their dryness and limpidity by the addition of tannin, and drew the conclusion, as simple as rational, that the addition of that substance would prevent the disease. The same results would be obtained for all the white wines (the only wines which are liable to that disease) by immersing in them, after the pressing, a portion of their stalks and allowing the latter to remain during the whole of the latent fermentation. That practice would be preferable to the use of tannin or gallic nut: 1st, because the tannin extracted from the stalk is not identical with the tannin extracted from the gallic nut; 2nd, because it is more natural to the wine, less sensitive to the taste, and less hard to the stomach. I express here the opinion of M. Maumene, an opinion which I share entirely. Other diseases can be prevented in the same manner by giving to the wines the elements the absence or insufficiency of which render them liable to. With regard to the sulphuring of the casks, although it has the unquestionable property of suspending momentarily all fermentation and all action of vinous decomposition, I cannot recommend it, for it kills the wines, and often gives them a bad taste. I am still less in favor of the use of alum milk, and of any other matter, mineral, vegetable or animal, foreign to wine. However, the use of good olive oil takes sometimes from the wine its bad taste, without being hurtful in any way.

TASTING AND APPRECIATING THE WINES.

In its appreciation the wine is subject to two jurisdictions; one all sensual, the other all physiological. The sensual appreciation of the wine is akin to three of our sensual organs: the eye, the anterior and posterior nasal fossæ, the posterior and anterior parts of the mouth.

The wine judged by the eye.—The wine pleases the eye by its limpidity and its color; whether it be red, rosy, yellow, or white, it must always be perfectly limpid and of a determined color; none of the tints of the wine are false or doubtful, even when extremely old. If one should not, or cannot, decide that a wine is good when it is agreeable and inviting to the sight, one can always say that it is not good, or, at least, that it is not in the best condition if its transparency and shades are doubtful. The purity of the color and limpidity are favorable signs; they are not qualities; but the contrary appearances are proof of real defects in the wine.

The wine judged by smell.—The two bouquets of the wine.—Wine reveals itself by two sorts of odors or bouquets to the function of the organ by the inspiration of air. The first is the general and common odor, although peculiar to all wines; when the wine is new it is stronger, but it is always inherent to good wine, and distinguishes it however old it may be. The first bouquet of the wines seems to reside in the expansion of the spirit, which holds in dissolution an essential oil more or less fugacious, having more or less strength, and being more or less characteristic of each species of wine; that bouquet is a sign of real quality; it is generally very strong and very expansive during the first years; it concentrates itself, refines and attenuates as it gets old. The second sort of aroma, on the contrary, developes itself with the age of the wine, and seems to owe its existence to the reaction of the vinous acids upon the spirit, a reaction which determines certain ethereal combinations; that bouquet, whether it be more or less agreeable, indicates, nevertheless, decomposition unfavorable to the salubrity and the durability of the wine; no wine derives its reputation from that second sort of bouquet, and the aroma so well known and justly appreciated of the Bordeaux wines belongs clearly to the first sort, to the only one that must be generally considered.

The wines are not made especially to please the eye or the smell.—The aroma as well as the color is a favorable or unfavorable, agreeable or disagreeable, sign, but wine is an alimentary beverage before all; it is good, very good, that the eye and the smell be flattered, but it would be absurd and even ridiculous to exalt beyond measure the satisfaction of the sight and the smell, and to pretend to found the superiority of a wine almost exclusively upon the approbation of those two senses, and sometimes of one only. I make this remark intentionally. I have seen persons calling upon their guest, with a disagreeable persistence, to admire the limpidity, and especially to smell their wines and even the empty glasses during the repast, even to the risk of causing thirst. The true connoisseur, the taster, knows well how to judge and love wine, but he knows as well that the appreciation of the sight and smell must immediately be followed by the introduction of the liquid into the mouth. The color and the aroma are two introductive notes of a gastronomical theme; if they are alone, they have no relative value, and the theme is not understood.

The wine judged by the taste, that is to say, by the mouth, anterior and posterior.—Before speaking of the impression of wine upon the sense of taste, I must say that that sense is the only one which has a double apparatus of perception, one on the tip and on the edges of the tongue, the other at the root of that organ, and upon the palate. The first perceives the acid or electro-positive savors by the two lingual nerves, and the other perceives the alkaline or electro-negative savors by the two glosso-pharyngeal nerves; the savors perceived by the anterior part of the mouth, in beverages as well as in aliments, are not the same as those perceived by the posterior parts of the mouth; an alkaline salt, for instance, gives to the anterior part of the mouth acid, styptical, salted and

sweet savors, and gives to the posterior parts of the mouth its basic, bitter and amylaceous savors. I have established those facts by direct experiments, in 1829, with Dr. Admyrauld, and by experiments upon animals, in 1833, with Dr. Cazalis.

Tasting.—All the acid, sweet and styptical savors of the wine are felt upon the tip of the tongue when it is introduced into the anterior part of the mouth. All those shades united must please the organs by leaving neither acid sugar, nor astringency to predominate. The wine is then absorbed in the posterior part of the mouth, where it is detained by a slight gargarismal motion; it is there that the weakness or intensity of the alcoholic strength is felt; it is there that the earthy taste, the insipidity of the salt, the bitterness, the bad odor of the cask or cork, are appreciated. If the whole of the savors pleases the posterior part of the mouth by the absence of any disagreeable impression, one must, to complete the tasting, not spit out the wine, but swallow it, because, as soon as it has passed the root of the tongue, the palate and its pillars, a well marked odor ascends from the pharynx into the nasal fossæ, and carries there a new and more powerful sensation than the exterior smell; besides, the last contact of the wine with the pharynxical mucus leaves a long impression of savors of which the disagreable sensation has been designed under the collective name of distaste.

Good and bad wine judged by the senses.—If then, a wine is perfectly limpid and has a pure color, if its odor is agreeable, and if, on the whole, the acid, sweet and astringent savors please the anterior parts of the mouth by a fusion which seems to form a unique savor as several notes form a perfect harmony; if to that first harmonious impression, the posterior parts of the month add the sensation of warmth and vinous richness, exempt from any alcoholic taste; if, lastly, the deglutition crown the whole by a natural bouquet without being followed by any bad taste, the wine is sensually good. It is imperfect if it is wanting in one single point, and it is so much the worse according as its acids, sugar, and salts get more isolated and more distinguishable on the tip of the tongue; according as its vapishness, its essential oils, its earthy taste, and especially the isolated predominance of spirit, manifest themselves at the base of the tongue; as the after-bouquet is less pleasant and as its twang, or bad taste, is felt longer and more disagreably.

Misunderstanding concerning the savors.—In this explanation of the tasting I have endeavored to be clear, and I feel that I am not yet sufficiently so. It will be impossible to come to a proper understanding about the savors as long as science has not established signs or words to represent their different shades, their peculiarities and their relation to each other; the science of savors is yet to be entirely founded. Till then the *chefs de cuisine* (cooks), and the skilful caterers will remain isolated geniuses or quacks; with regard to the tasters and epicureans, they approve or criticise, but they do not compose. It would be a curious collection that contained all the expressions that tasters, wine merchants, travellers, amateurs, use to express the sensations they feel in tasting wines. I have known an Englishman who did not like a wine "unless it makes the peacock tail in the mouth" *(la queue de paon dans la bouche)*. Everybody knows the expression that the Auvergnat (a native of the province of Auvergne) used when drinking a glass of old and generous wine—"It is a yard of velvet that goes down the throat."

Physiological effects of wines.—The physiological effects do not offer so much difficulty and uncertainty in their appreciation. The supreme judges of wine are the stomach, the muscles, the heart and the head. Whether the wine has pleased your eyes by its purity of colors, your smell by its perfume, the anterior and posterior parts of your mouth by "making the peacock's tail," whether it has gone down your pharynx and œsophagus "like a yard of velvet," if you pay for those fugitive sensualities by heavy digestion, by an epigastrical tension, by a muscular prostration, by a torpor

in the head and a general uncomfortableness of several hours, you will have a right, dearly bought, to declare that the wine which produces such effects is no good. If a host sees a quarrel arising among his guests, and sometimes worse, at the end of the repast; if, instead of mirth and cheerfulness that good wine produces, a sullen silence and coarse jokes are the only manifestations of the company, that host may safely affirm that his wines are not good, and must exert himself to replace them by others of better qualities if he wishes to see shine at his table wit, cordiality and cheerfulness, which should animate his guests during long evenings. Drinks not only act upon individuals, but react also upon families, tribes, nations; and I am decidedly convinced that the wines of France are the true cause of the frankness, generosity, prowess and gallantry of the French character, unquestionably superior to all other nations. The inhabitants of beer drinking countries will never have the same liveliness of mind nor the gaiety of the inhabitants of a wine drinking country; and cider makers will never have the same frankness as wine makers; it is not, then, the alcohol which constitutes the value and quality of wine, since beer and cider may contain as much, and sometimes more than the former. A good wine is not a wine more or less spirituous. Any natural wine, weak or strong in alcohol, is a good wine if it retains its organic life and manifests it by a pure odor, by the blending of all its elements into a savor pleasing to the taste, by an easy digestion, a sensible increase of muscular strength, and by a greater activity of the body and mind. Whether the savor of the wine be fresh, piquant and light—sweet, luscious and rich—arid, hot and sharp, the wine is good if it sustains and increases the corporeal and intellectual faculties without impairing the digestive organs.

Wine is good relatively, and not absolutely. —Good ordinary wines should be the first object of wine making. For sensual, and especially for physiological considerations, a good wine is not good absolutely; a wine is good according to the purpose for which it is and can be used; an excellent liqueur or dessert wine becomes distasteful when used as an ordinary beverage. It is not, therefore, without reason that wines are classed as ordinary wines, and liqueur and dessert wines, which could also be distinguished as wines of small, medium and large glasses, according to the quantity one could and ought to drink. Good pastry is good if used moderately, but to eat constantly, and in large quantity, bread is infinitely superior, and will always be preferred by all the world. I would pay more for a cask of Macon, Chablis or Bordeaux than for one of Lunel, if I was obliged to make it exclusively my ordinary drink, and I think that everybody would be of my opinion. It is, then, of greater importance to make good ordinary wines than good wines of the *entremet* character, and more important to make good wines of the latter class than liqueur wines, and this precedence concerns the interest of the internal and external consumption, as well as the interest of the producer, the consumer, and the public hygiene. The good ordinary wine, the alimental wine, for the wine is positive and excellent nutriment, is not a wine strong in spirit, nor even one of a first-rate year, it is a wine of fine *cepages*, containing not more than ten per cent. of alcohol, and sometimes only six per cent. In twenty years of production fifteen at least can produce naturally good ordinary wines; these are perfect as a hygienic beverage in their second year, and can remain so for four or five years; they become bad and are rejected by the great majority of consumers if they are raised artificially to the alcoholic power of *entremet* wines, that is to say, to 10° and 14° of alcohol. There will be an unlimited demand for light, natural and lively wines if these truly sensual and hygienic qualities are known, and if the producers and the merchants cease to make the quality to consist in alcoholic richness. They deceive and defraud themselves by establishing and propagating that false opinion, for the organic instincts do not remain duped long; one may allow himself to be persuaded at first, and to buy, but the intrinsic worth of the wines and their melancholy organic effects incite well-founded mistrusts, and one

looks elsewhere for qualities which will be more in accordance with his natural taste. Assimilation does not take place in a wine which contains a quantity of alcohol beyond its strength; such a wine intoxicates brutally, in the same manner as spirits, but as spirits diluted in a mass of liquid, and therefore deprived of the stimulating power which facilitates their digestion by a reaction of the digestive organs, proportionate to their strength. With the present means of transport and communication the good ordinary wines can be consumed over the whole universe, and twenty years hence, twenty million acres of vineyards, added to the existing five in France, will not cause the price of those wines to fall below two shillings per gallon, a price which insures to the grower of our fortunate country a magnificent present and future. But these remunerative prices can only be maintained under the strict condition that the best cepages will be cultivated. With fine cepages the good years will naturally produce good wines of the *entremet* class. With regard to the liqueurs and effervescing wines, special to the south and Champagne, they can only gain by being made from fine cepages, and the increase of production of those wines will certainly be proportional to the general movement of the French wines.

Chapter V.

Remarks on the Organisation of Vendangeoir.

Of the buildings and implements in reference to the extent of the vineyards.—The average production of one hectare (2a 47, or about 2½ acres) of vineyard planted with fine cepages, well cultivated and well kept, gives commonly 100 hectolitres (1 hect. is 22½ gallons), of fruit, or about 40 hectolitres of made wine. To get in the crop in one day it requires 40 gatherers, 8 porters, and one overseer, besides two draymen, and two assistants to load and unload. We will suppose that the transport is effected in vessels containing one hectolitre, so that the whole materials will consist of 2 horses, 2 drays, 50 baskets, 50 scissors, and 100 tubs for every hectare and every day of gathering. We have said that the gathering should be effected in ten days; consequently the material of each day will suffice for ten hectares (25 acres). To gather the produce of 100 hectares in ten days, it would require for each day 400 gatherers, 80 porters, 10 overseers, 20 draymen, and 20 assistants; also 500 baskets, 500 scissors, 1000 tubs, 20 horses and 20 drays. The number of hands for the gathering is rarely supplied by the population of the establishment alone, for the gang required for 100 hectares (250 acres) numbers 530 or 540 persons, of which 130 or 140 are strong men, 400 being women, children, and old men; in other words, from 110 to 140 families; while the best culture of the vine, entirely effected by handwork, requires, for 100 hectares, only 200 persons, that is to say 100 men and 100 women; occupied and remunerated during the greatest portion of the year. That number is generally found in 50 or 60 families, who will suffice to cultivate well 100 hectares. The extra hands for the gathering come from the neighboring districts, when the cultivation of the vine is not mixed with agriculture. It is the culture of cereals, potatoes, beetroots, colzas, cabbages, vegetables, &c., which supplies the vignerons with supplemental hands, and, reciprocally, the vignerons of many districts assist the agriculturist during harvest. A model vineyard should be so organised that one or two hectares could be sold out or let annually to each family of vignerons; the payments to be made by easy instalments. A house or garden could be let or sold under the same conditions. With the certainty of being lodged, of obtaining a remunerative kind of labor, and a piece of land to cultivate for themselves, the working men would soon hasten to accept the offer, and form settled families. This was accomplished under my eyes in my own establishment, although I had not anticipated such a happy consequence of my undertaking. The extent of the buildings must be regulated especially according to the

number of casks employed for each crop. Whether the grapes have been gathered to make white or red wines, or any other variety, those wines must be put in casks either after having passed through the press or the vats ; if then each hectare produces annually 40 hectolitres (900 gallons), the proprietor must be provided with the number of casks according to the number of hectares of his vineyards, and the produce calculated in the above proportion, say, five pipes containing 150 gallons, or sixteen hogsheads containing about 60 gallons, or 20 casks of 45 gallons, or even 36 of 28 gallons. I take the 45 gallon cask for the basis of my calculations, but I must remark at the same time that less room is required to store wine in large vessels than in small ones; in other words, the area required for casks of 28 gallons is larger than for pipes. It is, therefore, upon the produce of a vineyard, and the quantity and capacity of the casks which are destined to receive and to keep it one or more years, that the proprietor must base the size and disposition of his cellars. I take the 45 gallon cask for basis and type, because it possesses all the advantages possible; its dimensions are well suited for filling up the cellars. Its weight is moderate, and offers no obstacles to removal, loading or unloading, and its construction is easy and not costly. In proportion to its capacity it is the cheapest and strongest.

Areas of the cellars.—For one hectare of vineyard twenty casks will be required; therefore, for one hundred hectares (250 acres) 2000 casks will have to be procured. To store these 2000 casks, the cellars, built in one or two vaults, must be 756 ft long, and have a free width of 36 feet; because casks containing new wines cannot and should not be stowed away in superposed rows. The same cellars would hold double or treble that number of casks containing old wines by superposing the rows.

Number of presses.—If the produce of the vineyard is all intended for white wines, a good Troyen press, which can perform four operations in twenty-four hours, each operation rendering 900 gallons, will suffice for four hectares (six acres) per day, or sixty acres during the ten days of the gathering. But, if it is considered that it is not always possible to work day and night, either for the want of hands or on account of accidents to the presses, it will readily be understood that a large allowance must be made for contingencies, and that four presses in good order will be required for a vineyard of 250 acres. Three double Dezaunay's presses would effect the same object. To avoid difficulties and confusion, each single press must occupy a space of 33 ft. x 20 ft, and the double press 50 x 20.

Number of vats.—As the musts of white wines should be put in vats for about twenty-four hours, to deposit the heaviest portion of their lees and other foreign matters, every press house must be provided with a double set of vats, which can contain the double produce of a day's work—that is to say, eight vats, holding each 900 gallons ; but, as one of the presses can remain idle, the number of vats for clarifying would be reduced to twenty-four for a vineyard of 250 acres. However, it is advantageous to have forty vats, each of the capacity of 1200 gallons, because that number is necessary to hold the murks, whether they be used to make wine for the laborers, or whether they are intended for distillation. For this double purpose the vats must have a hoop inside, and about three inches from the top, to fix the head.

Buildings, accessories and lodgings.—To the principal buildings are attached a distillery, a joiner's and wheelwright's shop, a forge, stables, closed and open sheds, the whole being enclosed by a wall or fence; houses to lodge the permanent staff of the establishment are also in the proximity. When the vineyard is some distance from towns or villages, the staff should be composed, as near as possible, of workmen belonging to industries connected with building and agriculture. The following list will convey an idea of what it ought to be:—1st, a chief cooper, commanding eight; 2nd, a distiller; 3rd, a joiner and two apprentices; 4th, a carpenter and two apprentices; 5th, a blacksmith and one apprentice; 6th, a man to roof houses and one apprentice; 7th, a mason and one apprentice ; 8th, a plasterer ; 9th,

a wheelwright; 10th, a painter and glazier; 11th, a tinsmith; 12th, a plumber; 13th, a well maker; 14th, a lime burner; 15th, a gardener; 16th, a basket maker; 17th, a drainer. Those special men must be engaged to do everything, and work at all operations, even the most foreign to their trade. It is these who do all the indoor work, the egrappoirs, presses, vats, casks, &c.; they treat the wines, attend to the cellars, buildings, repairs, terraces, plantations, &c.; and each of them works at his trade as soon as the general service of the vineyard is terminated. A staff so composed, or composed of other special trades, according to localities and provisions, gives marvellous results with regard to economy and speed of execution. In establishments of viticulture or agriculture, workmen of exclusive trades are always a nuisance and a burden. The man of all works and occasional specialities works with pleasure and spirit at anything which does not belong to his trade, and brings into that work all the resources and contrivances of his speciality; they improve and perfect each other; from the carpenter the mason learns to fix a beam, and the latter teaches the carpenter to dress a stone. In agriculture, and particularly in viticulture, men handy in all works, and not fitters up of trade, are required; but to attract and to keep them, the proprietor must insure them board and lodgings before high salary; when lodgings and food are insured, permanent work, if the men deserve it, good treatment, punctuality and equity in the payment of wages promised, constitute the most powerful attraction for the working men. Like all other men, the workman places above everything security, consideration and justice; extreme wages is never, in his estimation, a sufficient compensation for the indifference, harshness and bad faith with which they are too often treated.

Necessity of lodging the vignerons.—If it is intended to establish a great vineyard in a locality remote from a town or a village of importance, it will be necessary, not only to provide lodgings for the permanent staff of mechanics, but also for the 200 vignerons and laborers, men and women, of fifty or sixty families, required for the cultivation of 250 acres of vines. Even in the neighborhood of a large village or town such a provision ought to be made, because neither workmen nor good services will be obtained from that village or town. The village and the town regard such an establishment as a prey, and, if the workmen are obliged to seek there food and shelter, they will spend all their earnings; it is only with time and success that a large enterprise of that kind becomes recognised and gains respect; when it has imposed itself by its services and by time, the neighboring populations accept it and serve it; it has obtained its rights, but till then the desert is preferable to the atmosphere of a town.

House for the proprietor.—A house for the proprietor is necessary to complete a vineyard establishment. To that house must be attached gardens, orchards, and pleasure grounds as extensive as the magnitude of the establishment will permit. The more decorous and tasty the master's residence, the more charming will be the dependencies, and the more steady and satisfied will be the workmen. The sight of what is proper and handsome wins the admiration and attaches all men, even the most simple minded and the poorest; they are happy to see their fine estates, they are proud of the richness of their good master, and their fair and good mistress; it is for them luxury and wealth; the house of the vineyard is the steeple of the village, the cathedral of the great cities; it must therefore be proportionate to the importance of the establishment*

* This may be true for a gentleman creating an estate which he will manage, as a merchant prince manages his business. It is recreation for him, besides he cares little or not whether he gets four or five per cent. interest upon his capital, for the greatest part of the returns of his vineyards will be devoted to the keeping and embellishing of the residence. It is for him an income which he means to spend for his comfort. But it is not the case in a vineyard established by a joint-stock company. The shareholders' object is dividends and not the ludicrous whim of making a Sardanapalus of their manager. Indeed a company should do quite the reverse of what Dr. Guyot recommends. A manager is only a servant, and it would be idle to expect his fellow workmen to admire him. If he is good and qualified for his post, he will be respected,

Estimates of expenses of the buildings and implements for a vineyard establishment.—We have seen (chapter xi.) that a vineyard of 250 acres cost, in planting and cultivating, until it is in full produce, 600,000 f. (£24,000.) We have seen that the 250 acres, arrived at that state of production, would give a minimum return of £4000 of net profits; or, in other words, the revenue of £40,000 at 10 per cent. or of £80,000 at 5 per cent. Thus, upon a capital of £40,000 or £80,000, only £24,000 are expended. The capitalist expends, therefore, or can expend, £26,000 or £56,000 * for implements, cellars, sheds and accessories, for men's cottages and for the master's residence, according as he wishes to obtain 10 or only 5 per cent. upon his capital. Of the expenses for the realisation of the above objects, that for the implements and utensils is the least susceptible of alteration, for these things must always be good and complete, especially when profits are aimed at. Here follows an estimate of that expenditure:—

FOR THE GATHERING.

500 baskets	£10	0	0
500 scissors	15	0	0
1000 tubs	200	0	0
20 drays	240	0	0
20 horses	480	0	0
Ladders, pulleys, accessories	15	0	0
Sundries	40	0	0
Total ..	£1000	0	0

FOR THE VENDANGEOIR.

4 presses, fitted up	£240	0	0
50 vats, each containing 1200 gallons ..	600	0	0
2000 casks do do 45 do ..	560	0	0
5270 feet of skidds, fixed and moveable	96	0	0
Egrappoirs, stamping stakes, baskets, small vats, tubs, funnels, syphons, taps, bits, pumps, gleucometers, &c. ..	80	0	0
Cranes, hand-cars, wheelbarrows, chains, ropes, cooper's tools, &c.	104	0	0
Sundries	120	0	0
	£1800	0	0
For the Gathering ..	1000	0	0
Total general ..	£2800	0	0

But if the expenditure for the furnishing of the vendangeoir and for the gathering cannot be reduced or varied, it is not the same with the different buildings of the establishment. If the principal building is reduced to its three indispensable floors—one underground cellar, for the casks, one above for fermenting house, and one under the roof for the cooperage—that building may be, if needed, in most countries, strongly constructed, but without luxury, for two pounds sterling the square yard, including the thickness of the walls; whereas, if there is an extra floor of cellars and a granary above the coopers' floor, or, altogether five floors, and if the openings in the windows are built with hewn stones, it will cost nearly four pounds sterling the square yard. The annexed constructions may be reduced to a little under 500 square yards, and built for 25 shillings the yard. The 200 men can be comfortably lodged in 900 square yards, at 25 shillings the yard. In this space the mess-room is not included. Or each of the 60 families may occupy a small cottage with yard and garden, costing about £80. In a few words, the cost of the buildings, indispensable to the cultivation of 250 acres, may be only £7600, or may be raised to £16,060. If to the sum of £7600 the price of the working stock and implements (£2800) is added, the total expenditure will reach £10,400; of £16,000 unexpended £5600 will still remain disposable. In that case, £2400 or £2800 may be employed in the construction of a residence for the proprietor, and the balance would be laid out on the small farm which would be attached to the vineyard; upon all the above expenses a return of 10 per cent. would be insured. If the price of the working-stock and implements, £2800, is added to the £16,060, the total expenditure will be £18,860, which, added to the £24,000 spent on the vineyard itself, will amount to £42,680. There will remain still £37,320 for the construction of a spacious and fine residence for the proprietor, and for the establishment of farms. The interest on the whole capital would then be 5 per cent.

and he can wish for no more. In effect, a luxurious residence would only give rise to feelings which would certainly be contrary to the interests of the shareholders.—*Trans.*

* Dr. Guyot supposes the proprietor possessed of one or two million francs (£40,000 or £80,000.)—*Trans.*

CONCLUSION.

While closing this succinct treatise on vine-culture and winemaking, I hasten to say that I have not pretended to lay down absolute figures, and indicate infallible results. I express a personal conviction based upon all the observations, experiments and comparisons that I have made, and the deductions I have drawn from them. I sincerely believe in the truth of my statements, but I have done too many things in my life to ignore that reasoning and observation, and even experiment, are sometimes brought forward to give to an error the appearance of a truth; time alone judges sovereignly the good or bad ideas, the good or bad practices.

PLANTING VINES, &c.

A Table showing what number of Vines are required to plant a given quantity of ground.

The left hand column shows the quantity of ground, the column at the top shows the distance of the plants in feet, and in the angle formed is the number required.

A. R. Po.	1 ft.	1½ ft.	2 ft.	2½ ft	3 ft.	3½ ft.	4 ft.	4½ ft.	5 ft.	5½ ft.	6 ft.
0 0 5	1711	762	428	274	190	140	107	84	68	56	47
0 0 6	2053	914	513	329	228	168	128	101	82	67	57
0 0 7	2395	1066	598	383	266	196	150	118	96	79	66
0 0 8	2737	1219	684	438	304	223	171	135	109	90	76
0 0 9	3080	1372	770	492	342	251	194	152	123	101	85
0 0 10	3422	1524	855	548	380	279	214	169	137	113	95
0 0 20	6845	3045	1711	1095	760	559	428	338	274	221	190
0 0 30	10267	4572	2566	1642	1141	834	642	507	411	339	286
0 1 0	13690	6095	3422	2190	1521	1117	855	677	548	452	381
0 2 0	27880	12191	6845	4380	3042	2235	1711	1350	1095	905	760
0 3 0	41570	18285	10628	6570	4563	3352	2566	2032	1642	1358	1140
1 0 0	54760	24382	13690	8761	6084	4470	3422	2709	2190	1810	1521

1 Acre	7 ft	8	9	10	11	12	13	14	15	16	17	18	19	20	22	24	26	28	30
	889	680	537	435	360	302	257	222	193	169	150	134	120	100	90	75	64	55	48

THE END.

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