with the paste, a very variable and interesting series of decorative effects is secured. Finally, by employing colored fluosilicates, as those of copper, chromium, iron, etc., the limestone is colored even in its interior by the formation of insoluble compounds. These colors follow the intimate construction of the stone, and afford designs of considerable beauty.

PERMANENT SILVER PRINTING.

MR. GEO. BRUCE, in the *Photo. News*, says:

"For fourteen years I have made silver prints upon collodio-chloride of silver paper, and find them, although exposed to hot climates, to be as permanent as when first made. When I first began collodio-chloride printing, I used paper made by Herr Obernetter, of Munich; but at present I am printing on paper made by Herr Linde, of Lubeck. Both these gentlemen's papers have given me equally good results. The collodio-chloride paper comes from Germany, carefully packed in zinc tubes, the tubes again being packed in wood boxes. A quire of collodio-chloride paper costs me, including carriage and packing, something like £2 10s.; but as there are now and again streaky sheets in the parcels, that will not produce good prints, the above sum scarcely covers the price I really pay.

The size of the sheets is 22 by 17 inches, which gives thirty C.D.V. pieces, or ten cabinets. More might be cut from the sheet, but as the edges sometimes fray in the toning and washing, it is better to leave a sufficient margin, so that when trimming the prints a clean and firm edge may be secured. The paper will keep good in a cool place for two or three months.

The printing should not be so deep as when using albumenized paper, as collodio-chloride prints lose very little of their vigor in passing through the toning and fixing baths.

Collodio-chloride prints may be kept for a considerable time before toning—two or three weeks may elapse—but I prefer toning as soon after printing as possible.

The toning bath is made as follows:

STOCK SOLUTION.—No. 1.

Sulphocyanide of ammonium 1 oz. 2 drachms.
Distilled water 60 ounces.
Hyposulphite of soda 9 grains.

STOCK SOLUTION.—No. 2.

Pure gold 11 grains.
or
Chloride of gold 22 "
Distilled water 60 "

FIXING BATH.

Hyposulphite of soda 1 ounce.
Distilled water 12 ounces.

The gold I use for toning is prepared according to Col. Stuart Wortley's formula, given in the "Year Book" for 1871, p. 91; and it gives in my hands more uniform results when toning collodio-chloride paper than I ever obtained with the ordinary commercial samples of chloride of gold. Why, I cannot tell, any further than that in preparing your own chloride of gold you know exactly what you have at hand, and strength of the toning bath is more under your control.

This "control" is absolutely necessary to success with collodio-chloride papers, as I find that anything more than the strength given in the formula produces a flat, eaten out picture without any depth; while, on the other hand, too weak a toning bath gives heavy opaque brown tones. Thus, if the toning goes on too quickly, you lose depth and richness; if very slowly, a brown, leathery tone is produced, which is far from satisfactory.

The reason in the first case is that the prints pass so rapidly from brown to black, that before you can well get them removed from the bath, the point where richness lies is often lost. And in the second place, the sulphocyanide of ammonium solution in some measure destroys the transparency and purity of the prints when they are left too long in contact with it. Particular care and attention must therefore be given to the toning bath, so as to have it neither more nor less than the strength stated, as collodio-chloride photographs are much easier stained in toning than prints upon albumenized paper; and when unequal toning does take place, it is more visible in the former than in the latter.

In making up a bath, equal quantities of No. 1 and No. 2 are mixed, plenty of chalk being added, letting the whole stand for from three to five hours before use.

With some samples of this paper, the bath can be used at once; but with other sheets this is not the case, a deposit of gold taking place over the whole prints and destroying the purity of the whites. It is better, therefore, to err on the safe side by making up the bath a considerable time before it is required, and thus be assured of having a uniformity in one's photographs.

When I have many prints to tone, I use two flat dishes capable of holding, say, a dozen prints each. I filter the solution into these dishes to the depth of one-quarter of an inch; were the liquid deeper the prints would not keep flat. I wash in three changes of water; and as the prints generally curl up into tubes, I open each of them separately in the water, so as to get the surface uniformly washed. If this is not done and done in each separate dish of clean water, uneven toning will be sure to take place.

When the prints have been properly washed with a quick but gentle movement, I open up each picture, and lay it flat in the bath face downward; and when the dish is full, I begin at the first and turn it over, brushing the face with a camel's hair brush, and continue the process until the whole have been so treated, afterward turning them back again into their former position, and so on without cessation, until the prints are ready to leave the bath. When stains occur in the course of toning, lift the print out of the solution, dip the brush in alcohol, and rub the spot slightly. Then immerse the print again, when it will be found that the stain has disappeared, and the print has been saved.

When fixing the prints, the same care is required in laying them separately in the fixing solution, turning them over, and keeping them in motion until they are fixed, which is completed, when the fixing bath is new, in from three to five minutes. When removed from the bath, the prints are immersed for a few minutes in three or four changes of water, and put under the tap for an hour or two. The water is then shut off and they are left all night and throughout the next day until the afternoon; the water is changed now and again. The prints are then trimmed and mounted.

The system in use among many of the profession, of cutting the prints to the exact size wanted before toning them,

cannot be readily adopted with collodio-chloride pictures. In their case the paper should always be a little larger than is necessary, allowing not less than one-eighth of an inch to be cut off all round after the prints have been toned, fixed, and washed. The reason for this is that the edges of the prints are very curly, and the film becomes frayed in the course of washing; by cutting away this frayed curly part, they are more easily and neatly mounted. As it is impossible to lay these prints upon blotting paper and dry them in a flat state without cracking the surface, another method has to be put in practice for the purpose of trimming them. I use a piece of thin plate glass, cut to the exact size of what the *carte de visite* print should be, the edges being ground and the corners slightly rounded, so as not to scratch the picture. If the prints are more than ordinarily curly, I open them *underneath* the water and lay the sheet of glass upon the face, and then lift both of them out of the water at once, the moisture between the two enabling me to move and adjust the glass over the print with the greatest ease. I then, with a pair of long bladed scissors, cut along the four edges of the glass, and thus secure a straight, clean cut print, without damaging the surface of the photograph.

The medium I use for mounting is starch, carefully boiled, as thick as possible. It is, while still warm, poured into the center of a muslin cloth, the corners of which are drawn together and held firmly with the left hand, while the right hand presses the bag and causes the pure starch to exude through the interstices of the cloth—the result being a paste perfectly free from gritty matter, and of the right consistence for mounting.

A sheet of thick plate glass is covered with a damp cloth, and the prints are lifted from the dish and laid upon it in a wet condition, the water on the face of the prints and the damp cloth preventing them from curling. They are then pressed quite flat with another cloth, and dried before they are starched.

After the prints are mounted, dried, and spotted out, I roll them upon a hot steel plate; they are then put up in dozens into paper and laid upon the machine plate, and when warm are rubbed over with "Solomon paste,"* which gives them a richness and transparency they would not otherwise possess.

If desired, these photographs may very easily be covered with "Mawson's print varnish" or "enamel collodion," by coating them with a camel's hair brush of the same breadth as the card. In my own practice, however, I rarely varnish the pictures, as I think they are more beautiful and artistic when simply finished with wax paste. After fourteen years' experience, I can speak with a considerable degree of confidence regarding the stability of collodio-chloride pictures. I am not, however, prepared to assert that out of the many thousands of photographs which have left my hands throughout the course of these years, none of them have faded. At first the manufacturers of collodio-chloride papers were not so careful as they are now regarding the basis on which the collodion film rests; nay, I have reason to believe that sheets of albumenized paper were then used as a support for the emulsion. In such a case, the prints made from those sheets are liable to fade. But, notwithstanding this, the fact remains—and I am glad to be able to say so—that out of many dozens of photographs in my possession, dating back to the year 1869, I do not find any fading prints among them. Some of these prints have been lying loosely on shelves in a room where I have made up developers, boiled negative baths, made chloride of gold, toned, washed, and rolled my photographs for nearly a decade of years, and yet, so far as I can judge, they still retain their pristine purity.

PERFUMES AND ESSENTIAL OILS.†

A NEW MODE OF EXTRACTION BY MEANS OF VACUUM AND COLD.

By LAURENT NAUDIN.

THIS communication has for its principal object the description of a new mode of extraction of essences and perfumes by volatile solvents with the aid of vacuum and cold.

The collection and preparation of odorous substances date back to the most remote periods of historical tradition. Perfumes have, in short, from the earliest ages occupied a prominent place in the religious services of the most diverse nations, and even in the present day incense is burnt in the ceremonies of many creeds. The etymology of the word perfume alone—*per fumum*, by smoke—shows the manner in which the substance it designates was used, and that the art of combining delicate and refreshing odors, or more properly the art of the modern perfumer, originated in the ancient custom of burning incense on the altar.

This art has been handed down during several centuries without any great modifications. Thus the processes for the extraction of essential oils and the preparation of waters and scented oils that were used in India and by the Arabs are the same as those carried on in the laboratory of the modern perfumer. Mechanical improvements have aided in perfecting the apparatus, which, however is not very complicated. Progress has been made, not in the extraction of the rich and varied perfumes of nature, but solely in the compounding of mixtures of perfumes. Indeed, it is curious to read in ancient writings textual descriptions of the principles upon which the processes still employed in the current manufacture of perfumes are based.

Lenormand, in his "Traité de la Distillation," states expressly that the Arabs have from time immemorial effected the extraction of the aromatic parts of plants by distillation. These people in their incursions into Europe introduced their processes successively into Italy, Spain, and France. But in France this industry was localized first in the department of Hérault, from which it has almost completely departed to settle in Provence, under the beautiful climate of the Alpes-Maritimes. Algeria commenced to send her products into the market, but owing to the absence of any systematic cultivation of flowers the perfume industry in this French colony has nearly died out. Thirty years ago Millon called the attention of perfumers to the immense resources of Algeria, but his urgent appeal, though justified by the richness of the Algerian vegetation, was not listened to.

At present essential oils and perfumes are obtained industrially by distillation, hot and cold enfleurage, and expression.

The mode of extraction by distillation with steam consists in placing the odoriferous vegetable substances (flowers, seeds, wood, roots, etc.) together with a certain quantity of water in an ordinary still, and heating to the boiling point. Under the influence of this temperature (100°) the

plant cells are ruptured, and the essential oil carried over mechanically by the steam is condensed with it in a cooled receiver and separated in an oily form. Formerly the heat was applied by a naked fire, but the essential oil then acquired a very marked empyreumatic flavor; recently the use of steam has replaced this barbarous way of applying heat.

There are two great objections to this mode of proceeding—the destruction of a part of the perfume, owing to the high temperature that is necessary, and the great modification sustained by the undestroyed portion of the perfume from contact with the steam. Consequently the essential oils obtained by this mode never contain the perfume of the flower in all its perfection, but inevitably possess an odor known to perfumers and distillers as the "flavor of the still." The quantity of perfume destroyed by the steam may amount in certain cases to as much as 50 per cent.

In the hot enfleurage the flowers are digested for a sufficient time in oil heated in a water-bath. When exhausted they are withdrawn from the oil and submitted to a strong pressure in order to recover the fatty matter with which they are saturated. To the inconveniences enumerated when speaking of distillation, the following may be added: (1) the loss of the fat remaining in the cake of flowers submitted to pressure; and (2) the rancidification of the fatty matter when heated to a high temperature. It is known in practice that the glycerides heated to 100° C. acquire a rancid flavor.

Cold enfleurage is adopted in the case of the more instable perfumes, which are destroyed by heat, rendering it necessary to impregnate the oily body at a low temperature. For this purpose the flowers are laid in contact with a linen cloth saturated with oil or on a glass tray having a layer of oil spread over the bottom. The flowers are renewed at intervals of twenty-four hours. One inconvenience of this primitive method is the rapid rancidification of the oily matter under the influence of a partial fermentation of the flowers and of the humid temperature of the climate in which it is necessary to carry on these operations, and the consequent alteration of the perfume. It may be mentioned that in the flower season, the same oily matter stands, for a month at least, in contact with air at a temperature of 35° to 45° C. Besides this there is a loss of a great part of the perfume, the flowers never being quite exhausted when renewed, as well as the loss of the oily matter left in the flowers. To obviate these inconveniences, it has been proposed to employ glycerine and sirup of sugar in the place of oil and fat in the processes of hot and cold enfleurage. Neither of these bodies is susceptible of rancidity, but the solubility of glycerine in alcohol, and the instability of sirups when exposed to contact with air, have prevented their practical employment.

Several years ago paraffin and vaseline were tried as substitutes for olive oil in hot enfleurage; but paraffin has been abandoned, while vaseline yields alcoholic extracts of which the perfume is contaminated with a petroleum odor.

Expression is undoubtedly the best of all the processes at present in use. It is applied, however, only to a limited class of oils; those of the lemon, bergamot, orange, cedrat (*Citrus medica*), and lime (*C. limetta*). The products derived in this way from the rind of these members of the genus *Citrus* are incomparably superior to those obtained by distillation or enfleurage.

In 1835, Robiquet described the preparation of the delicate perfume of jonquil by means of ether, but the process was not then carried out industrially. Two years after, Buchner, in a note on "L'Arome de quelques Fleurs," expressed the idea that practical application might be made of Robiquet's method. Afterward, Millon, the principal of the Central Chemical Laboratory in Algiers, in an able memorandum on the nature of the perfume of flowers and on some flowers that might be cultivated in Algeria, mentioned a series of experiments as to the employment of volatile solvents in the extraction of perfumes of flowers. The solvents were chloroform, carbon bisulphide, ether, methylic alcohol, vinic alcohol, etc.; but he distinctly gave the preference to ether. His coworker, Ferrand, took out a patent with this object, in which he described the mode of working. It consisted in introducing the flowers into a displacement apparatus, covering them with ether, and allowing the liquid to run after being in contact for about ten minutes. The ether was evaporated in an ordinary distilling apparatus, the perfume being left as residue.

Apparently Millon and Ferrand had no knowledge of Robiquet's experiments twenty years before, but however this may be, the results announced by Millon were important. Trials were made on a large scale, but it was nevertheless found necessary to abandon this process on account of the danger of using large quantities of ether in open vessels and the loss of a considerable quantity of the solvent in each operation, through its being impossible to drive off the last traces of it from the perfume. Dr. Quesneville, as early as 1857, had perceived and pointed out the moderate practical value of the process. Since that time, however, new attempts have been made in the same direction, some of which are worthy of notice.

An industrial experiment of Lemettars and Bonnière, of Rouen, had for its object the extraction of the perfume from dry species and fresh plants by carbon bisulphide rectified by treatment with alkalies and lead salts.

Deiss, of Marseilles, introduced a system of purification of perfumes extracted by carbon bisulphide. In his patent Deiss stated that the employment of carbon bisulphide, easily decomposed by the water contained in fresh flowers, communicated a sulphurous odor to the perfumes. He therefore proposed to wash the perfumes with an alkali solution or a solution of monosulphide of sodium for the purpose of removing chemically the solvent retained mechanically by the perfume mixed with the wax of the flowers. Considering the extreme alterability of certain perfumes by alkalies, this idea was hardly a happy one.

Then came the experiments of G. Ville with chloroform and De Hirtzel with the light petroleum. Neither of these modifications of Millon's method was, however, able to stand a practical test.

The official reports of the Exhibitions of 1862 and 1867 show that the question of solvents had not yet been solved. The reporter at the Exhibition of 1878 mentioned as the only improvement worthy of notice the substitution of steam for the naked flame in the heating of vessels; no mention was made of the industrial employment of volatile solvents.

It is only just, however, to notice the persevering efforts of Piver to replace the ordinary process of enfleurage by what he called the pneumatic method. Piver also proposed in 1862 the washing of the perfumes extracted with carbon bisulphide with an alkaline solution, an idea that had already been patented by Deiss.

This rapid *résumé* will show that the use of volatile

* See "Standard Formulae," in "Year Book."

† Abstract of a paper in the *Moniteur Scientifique*.

solvents had not been rendered practical, because (1) owing to the work being done in open vessels, there was a great danger of fire and serious accidents; (2) the loss of the solvents was not less than ten per cent. each treatment; (3) for the purpose of entirely getting rid of the solvent, it was necessary to raise the temperature considerably, and in doing this the perfume was sensibly altered. Therefore, notwithstanding the incontestable truth of the principle discovered by Robiquet, this method has been practically abandoned.

The author of the present paper, M. Naudin, has been occupied with the study of this question for four years, and has contrived an apparatus by which he seeks to avoid the causes of failure before mentioned. This apparatus, based on the distillation of volatile solvents in closed vessels in a vacuum and at a very low temperature, is composed of the following six elementary parts: (1) A digester (A) in which the perfume is extracted by contact of the volatile liquid with the odoriferous substance. Instead of a single digester, a series of vessels can be used communicating with each other in such a manner as to allow of a systematic exhaustion being carried on. (2) A decanting vessel (B) in which the perfumed solution is purified by decantation from the aqueous portion of fresh flowers, removed mechanically during the digestion. (3) An evaporating vessel (C) in which the volatile solvent is distilled off, leaving the perfume as a residue. (4) A suction and forcing pump (P) for the purpose of hastening both the distillation of the volatile solvent by the aspiration of its vapors, and the condensation and liquefaction of the vapor, by compression in the refrigerator (F), and to collect, at the end of the operation, the traces of the solvent remaining in the different parts of the apparatus and drive them into the refrigerator (F). (5) A cylindrical refrigerator (F) in which the volatile liquid is condensed. The condenser is kept cool by one of the known methods, such as ammonia, sulphuric acid, etc. (6) A receiver (R) in which to store up the solvent employed.

The three vessels, A, B, C, and the refrigerator can be hermetically closed by means of joints. The tube, T, T', which is in connection with the whole apparatus, distributes the vacuum caused by the pneumatic pump (P). This tube communicates with the vessels, A, B, C, by the tubes, *t*, *t'*, *t''*, supplied with taps. Air is readmitted at pleasure by *r*, *r'*, *r''*, or by means of compressed air, consisting of

rated. For this purpose, a given quantity of alcohol, contained in the vessel, S, is drawn up through the tube, L, by means of a vacuum into C, and is left there to digest some time. Solution is favored by the readmittance of air through K, which agitates the mass violently; the liquid is then drawn off into the vessel, S, which is kept at a temperature of -10° in order to precipitate the wax, while the perfume remains dissolved in the alcohol, and the whole is filtered at the same low temperature. The perfume thus prepared consists of an alcoholic solution.

In the manufacture of perfumed oils or fats, this manipulation with alcohol is not necessary: the perfume, mixed with its natural wax, is dissolved in the oil or lard, which are the vehicles generally employed.

The exhausted flowers in the digester, A, mechanically retain some of the solvent. To recover this the mass is heated by the introduction of steam into the outer jacket, and the solvent is condensed in a special refrigerator. The employment of a vacuum allows the whole of the solvent to be recovered.

It will be seen from the foregoing description that the movement of the solvent liquids from one vessel to another is effected simply by differences of pressure, and that the volatile liquid circulates in closed vessels in a vacuum, without ever coming into contact with the outer atmosphere while passing from liquid into the gaseous state, or *vice versa*.

The other advantages presented by this apparatus are that there is no danger of fire; the perfume is completely and quickly extracted, however unstable it may be; solution is effected in a few hours in an appropriate menstruum (alcohol, oil, grease, or glycerine); pure perfumes, containing all the aroma, are obtained, owing to the low temperature maintained during the extraction; the perfumes are condensed in an exceedingly small volume, and in a form which allows them to be kept for an indefinite period; the greater value of the yield from all the perfumes than in the old method; and the use of extremely volatile liquids, among which the following have been tried:

	Boiling point.
Hydride of butyl.....	0°
Hydride of amyl.....	30°
Chloride of ethyl.....	9°
Chloride of methyl.....	-23°
Light petroleum spirit.

air removed from the apparatus and forced into a special receiver. The manometers, M, M', M'', indicate at any moment the state of the vacuum in each vessel. The level of the liquid solvent is shown by means of a glass window in each vessel (see E in A). The vessels, A, B, and C, have each a double lining so as to allow the introduction of air or hot or cold water.

The flowers, leaves, etc., are introduced into the digester (A), and confined in a basket (U). The vessel is closed, and a vacuum, obtained by opening the tap (*t*), causes a suitable quantity of the solvent to ascend from the receiver (R) by the tube, *n*, *n'*. The materials having been left to digest for about fifteen minutes, the solvent liquid charged with the perfume is passed from A into B, in which a vacuum has been previously made, by connecting A and B by means of the tube, G, H, which proceeds from the base of A. The water contained in the flowers is carried over mechanically by the solvent, and accumulates at the bottom of the vessel, B, whence it is got rid of by the tube, I. A glass window (E) allows the distinct separation of the two liquid layers. Communication being established between the evaporator (C) and the refrigerator (F), a vacuum is established by means of the tube, *t'*; the solvent, charged with perfume and free from water, is then allowed to run from the vessel (B) into the evaporator (C). Communication between B and C is then closed, and the refrigerator (F) cooled energetically, after which the pump (P) is set to work. The vapors of the solvent are drawn from C, and then forced into and rapidly condensed in F. During the distillation, the evaporator (C) is kept at the temperature of the surrounding atmosphere; this is effected by passing a current of water between the double lining, which restores the latent heat borrowed by the volatile solvent upon its conversion into vapor.

When a very energetic source of cold is at disposal, the employment of the pump as a means of liquefaction may be dispensed with. In this case the vapor passes directly from C to F. After complete evaporation a white or colored residue is found on the sides of the evaporator, C, which may be a solid, liquid, oily, or semifluid substance, eventually becoming solid.

When the distillation is finished, the distilled liquid condensed in F is allowed to run into the receiver, R. If a sufficiently low temperature has been maintained during the distillation, this liquid will not be sensibly tainted with any odor, and may be used in the manufacture of different perfumes. The perfume mixed with the wax of the flowers and leaves, dissolved also by the ether, requires to be sepa-

The choice of a solvent for a particular perfume is not without importance, the delicacy and sweetness of a perfume depending upon the nature and purity of the solvent. This method yields extremely delicate results, and in operating with care the slightest variation in nature may be reproduced with extraordinary fidelity.

Commaille reports that the separation of the odor of the milk of the cow has enabled Millon, as well as himself, to recognize certain plants eaten by these animals, the *Smyrnum olusatrum* among others. M. Naudin has made a series of experiments which show what accuracy can be obtained in this direction. By using a mixture of hydride of butyl and amyl as a solvent, he has been able to distinguish clearly and isolate the perfume of roasted coffee from different sources. He obtained a similar result with the fine shades of quality in tea. He also gives instances of isolating and fixing different special odors, as toasted bread, the human skin, raw or cooked food, earths, etc.

The time of collection of the flower is very important. Each flower must be gathered at an appropriate time of the day, and in a certain degree of bloom which experience alone can recognize. Thus the pink only yields its perfume when collected two or three hours after being exposed to sunlight. On the contrary, roses must be gathered in the morning as soon as they are well open. The flower of the jasmine ought to be picked a few minutes after the first exposure to sunlight. The false acacia always gives a fragrant perfume, but differing according as the flower is gathered in the morning, in the evening, or even in the middle of the day.

In distillation, as Millon has already remarked, all the modifications of the flower are mixed in one and the same essence, which does not resemble any of them exactly; but probably the mixture corrects, up to a certain point, the defective parts of the collection. In the new mode of extraction, the slightest alteration, the least variation in the state or quality of the flowers, is revealed in a perfume; to obtain, therefore, a perfume possessing all the freshness and fragrant of the flowers it is necessary that the flowers used be fresh and fragrant.

The perfumes obtained by the solvent method, instead of dissipating like ordinary essences, are marked by a great permanence. In fact, perfumes become altered by contact with other principles of the plant, which involve them in their own decomposition; but when once isolated from the destructible organs of the plant, the perfumes escape their influence, and obey their own laws of transformation or decomposition.

Millon states that he has kept isolated perfumes for several years in open capsules or tubes, without finding any sensible loss. M. Naudin also has experimented on perfumes that have been in his possession four years. The experiments were at first limited to flowers gathered under the climate of Paris, such as the pink, narcissus, violet, rose, lilac, hyacinth, the lily of the valley, etc.; but have since been extended to the flowers of Cannes, such as the orange, rose, jasmine, false acacia, and tuberose. All the perfumes obtained from these flowers have remained unaltered even in contact with air.

As already stated, the perfume, although it remains unaltered in the presence of the oxygen of the air, becomes involved in the general decomposition if left in the presence of the decaying organism of the flower from which it was derived. Now, the decomposition of certain flowers when plucked from the plant is extremely rapid; it is therefore obvious that when the apparatus for extraction is at a distance from the place of collection, the perfume obtained does not exactly resemble that of the flower, even when extracted by the solvent method. Thus, it is known that the essence of neroli manufactured at Cannes, the center of floral cultivation in the Alpes-Maritimes, is superior to that made at Grasse, about ten miles distant. The reason is that some time is necessarily lost between the moment of gathering and the time of manipulation; besides this, there is the transport of flowers in the hottest days of summer, the effect of which is manifest in the diminution of the yield.

The above inconvenience can be met by keeping the fresh flowers in a special vessel, void of air and full of vapor of the solvent, as of ether. The presence of the latter body and the absence of oxygen prevent fermentation, especially if the temperature be kept sufficiently low. The perfume of the orange has thus been kept in its intensity with the flower itself for a month. A manufacturer could thus preserve his materials from fermentation upon the days when the great abundance of flowers—sometimes 20,000 to 30,000 kilogrammes—would render his digesters of insufficient size to treat the whole at the same time.

The chemical nature of perfumes has been studied by Millon. He recognizes two classes, the essential oils and the perfumes, properly so called. His experiments led him to the conclusion that the extremely small quantity of these bodies contained in the flowers renders their chemical study difficult, if not impossible. In a great number of cases only a milligramme of pure product can be obtained from a kilogramme. He is of opinion that the perfume of flowers is a fixed or rarely volatile principle, remaining unchanged in air and contained in the flower in only imponderable traces. It is decomposable by heat when the temperature is raised above the ordinary limits of the atmosphere, but is nearly always volatile without apparent decomposition in alcohol, ether, oily bodies, and a great number of liquids, such as carbon bisulphide, chloroform, benzene, etc. The perfume is nearly indefinitely diffusible in air, that is to say, it vaporizes and denotes its presence there by a fragrant odor, but does not suffer a sensible loss of weight. It is equally diffusible in water, to which a beautiful aroma can be imparted by the addition of a few drops of an alcoholic solution of perfume.

As already mentioned, Millon makes a distinction between essential oils and perfumes. M. Naudin thinks this may be correct as long as the term essential oil is confined to those of which the odor forms an integral part of the properties of the body, such as the oil of wintergreen or salicylate of methyl. Most of the oils with well defined chemical functions (alcohol, phenol, ether, etc.) may be entered in this class, but the oils of the genus Citrus and of the labiates cannot be included in the broad definition which Millon gives. He also believes that in many cases the isomeric hydrocarbons of the group $C_{10}H_{16}$ are probably only the substratum of the perfume. A very simple experiment tends to prove this. If the oils of lemon, bergamot, orange, lime (*C. limetta*), and cedrat (*C. medica*) be boiled for a short time with a slight trace of caustic soda, the odor peculiar to each oil will be replaced by a common odor similar to that of terpene— $C_{10}H_{16}$. Indeed, the energetic action of caustic alkalies is not necessary to destroy these odors, since light alone, aided by time, has enough influence over these oils to change their special odor into that of oil of turpentine. Oil of angelica, obtained from an umbelliferous plant, gives a $C_{10}H_{16}$ carbide—terebangeline—with an odor of hops, and possessing the same organoleptic character.

Further than this, these general considerations on perfume can be applied to the special odor of fatty oils. No attempt has yet been made to isolate the perfume dissolved in the glycerides, but no doubt it would reveal the same fact, the solution of a very minute quantity of a very odorous and strongly flavored body in an inodorous or nearly inodorous vehicle.

Perfumes have not yet been chemically classified; their organoleptic character alone has served to distinguish them, through want of a more intimate knowledge of them. The question therefore remains very obscure; but M. Naudin is sanguine that this new mode of extraction, by putting uncontaminated substances within the reach of chemists, will allow of deeper research into their nature. In any case he believes that therapeutics will find, in pure perfumes, a new field of research, and will perhaps discover the means of applying them as medicaments.—*Pharmaceutical Journal*.

SIR ROBERT RAWLINSON, C.B.

HER Majesty lately conferred the honor of knighthood upon this eminent civil engineer and most useful member of the Civil Service, who has long held the office of Civil Engineering Inspector of the Local Government Board, and has now retired at seventy-three years of age, having been in the Government service thirty-five years, and having done a vast amount of very important work. He was, though born at Bristol in 1810, the son of a builder at Chorley, Lancashire, in which town he learned to work with his own hands as a mason, bricklayer, and carpenter, and afterward as a mechanical engineer, before entering the Liverpool Dock Engineer's office, in 1831, under Mr. Jesse Hartley. In 1836, he was employed under Mr. Robert Stephenson in the construction of the London and Birmingham Railway, after which he returned to Liverpool as assistant surveyor of the docks. At the end of 1844 he became engineer to the Bridgewater Canal. In 1847 he devised a scheme, which was admired but never carried out, for supplying Liverpool with water from the Bala Lake; and he took part in the erection of St. George's Hall, at Liverpool. He was appointed an engineering inspector under the first Public Health Act, 1848, Lord Morpeth, Lord Ashley, and Mr. Edwin Chadwick, C.B., being commissioners. Mr. Rawlinson held the first inquiry and wrote the first report, on Dover. Subsequently he visited, inspected, and reported upon the principal towns in England, from Berwick-upon-Tweed to Penzance, from Liverpool to Scarborough. He drew up suggestions for the