75° C., and provided with powerful stirring gear. The mash thus obtained is then heated in a steam jacket under a pressure of one atmosphere for about an hour, then cooled to 70° and treated with 1 to 2 per cent. of malt infusion. After two hours the solution is put through a filter press, cooled to 50° and treated with a 15 to 20 per cent. of malt infusion, which is added in 5 per cent. lots every two hours. When thoroughly saccharified, the solution is heated again, filtered, and evaporated to 40° Be., and sold as concentrated beer wort.

Joseph Franklin Gent, of Columbus, Ind., U. S. A., frees maize from the germs and husks by steaming at 160° in a special apparatus for not longer than one minute, and subsequently crushing and sifting the grain. The product thus obtained is then again steamed, pressed into thin cakes, and brought into the market under the name of "Cerealine."

Messrs. Viernseil K. Trohach and Alfred Carls recommend the following treatment of potatoes for the purpose of dextrose manufacture, avoiding thereby the necessity for the separation of the starch from the pulp, which always retains a considerable percentage, and utilizing the roots at the period when they contain most starch, viz., at their harvest time; thus avoiding also the loss of starch which stored potatoes always undergo. The potatoes are washed and ground, the paste put through a filter press, in which the cakes are well washed with a solution of calcium bisulphite, to prevent any fermentation, and then either dried for storing or worked up forthwith. The cakes, made into a suitable paste with water, are saccharified under pressure by acid. The acid sugar solution is thereupon neutralized with calcic sulphite and chalk, put through a filter press, evaporated to 30° B., again filter-pressed, and finally concentrated at 100° down to 35° B., for crystallization. The resulting sugar when separated from the molasses is ready for the usual processes of recrystallization.

Thaddeus V. Korvins Sakoviz and David Rosenblum, of Warsaw, produce crystallized grape sugar from all sorts of starch by boiling 10 per cent. solutions of starch with certain quantities of sulphuric anhydride, which quantities vary from 4.9 per cent. with eleven hours' boiling when working in open vessels to 0.15 per cent. when the operation is conducted in a closed vessel and under a pressure of four atmospheres. The boiling in the first case lasts eleven hours, in the latter only four hours. Instead of using charcoal to decolorize the neutral sugar solution, it is cooled to 45° and about 0.2 per cent. (on weight of starch) of permanganate of potash added, whereby a brown precipitate is formed, the solution after passing through the filter press being perfectly colorless. The crystallization is performed under vacuum, but the crystals cannot be readily freed from the mother liquor.

Alf. Seyberlich, of Riga, and Alex. Trampedach, of Mitau, transform starch into sugar by the action of dilute nitric acid. The starch is made into a milk with water, and run into a dilute boiling solution of nitric acid, and boiled until ten drops of the solution added to 200 c. c. 96 per cent. alcohol no longer produce any turbidity. The proportions used are 1,000 starch, 5 nitric acid, and 2,000 to 3,000 water. They then recommend that the solution be made distinctly alkaline by the addition of sodium or potassium carbonate, thereupon evaporated in the vacuum apparatus to 35-36° Be., and allowed to crystallize. The crystals thus obtained are well developed, and easily separated from the mother liquor.—*Dingl. Polyt. J.*

LINSEED OIL.*

By JAMES C. DUFF.

THE supplies of flaxseed are chiefly from the United States, Russia, and India. As a rule, the colder the climate in which the seed is grown, the greater are the drying properties of the expressed oil; but, unfortunately, the worse is its color. There are two varieties of seed, the white and the red, the former yielding oil more freely than the latter, giving two per cent. higher yield. The red seed always comes upon the market mixed with rape and other seeds, which naturally lessens its value.

Oil expressed from unripe seed is watery and unfit for use. Seed should always be kept from three to four months before crushing, as after this lapse of time a more abundant yield is obtained than when expression takes place immediately after the harvest. The best oil is that "cold drawn." It is paler, less odorous, and superior in every way to that obtained by heat. By aid of a temperature of 200° F. and powerful and long continued pressure as much as 28 per cent. of good oil can be obtained. The Italian variety is said to have a much more highly oleaginous seed than the Russian.

In Europe, carbon disulphide is sometimes used to extract the last traces of the oil. Olive oil thus treated yields from two to four per cent. of the so-called pyrene oil. In this country petroleum benzin is used on account of the lesser cost and danger; but it is slower in its action than carbon disulphide.

Taking the crude oil as expressed, the processes of refining and clarifying it is first encountered. Speaking broadly, they may be divided into two parts, the mechanical and the chemical, although each is capable of many subdivisions. They have for their object the removal of extraneous matter incidental to the modes of preparation and the removal of the resinous substances mixed with and dissolved in the oil, the latter being known under the name of "mucilage" or "mucus." This is removed in a great measure by allowing the raw oil to again settle in tanks, where the mucilage is deposited, together with the extraneous matters. The clear, supernatant oil is then drawn off the top. The oil should be stored for some weeks and even months, to allow these impurities to settle properly. Roasting is sometimes practiced to destroy the gummy matter in the interior coat of the seed.

Among the processes for the purification of linseed oil, are the acid and the alkali processes. Among the former is Thenard's, which is the one most universally used. This consists in adding gradually from one to two per cent. of sulphuric acid to oil previously heated to 100° F., and mixing by constant agitation. When the action of the acid is complete, the oil, after the mixture has stood 24 hours, appears at the top as a clear liquid, but holding flocculent matter in suspen-

sion. A quantity of water, heated to 140° F., equal to two-thirds of the oil is added, and the mixture again agitated until it acquires a milky appearance. It is then allowed to settle a few days, when the clarified oil rises to the surface and the flocculent matter falls to the bottom with the acid liquor. The oil is then drawn off and well washed by agitation in another vessel, with half its bulk of warm water. Filtration is required to make it perfectly clear. This is generally done through cloth.

The acid process is efficient when well carried out, but it must be conducted within narrow limits, as the use of either too much or too little acid may spoil the product, an excess attacking the oil itself, and an insufficient quantity not completely removing the foreign matter. On this account, the alkali process is sometimes preferred. Evrard's process, which is, however, chiefly applied to colza and rape oils, is as follows:

The oil (which should be cold-drawn or at a slight heat) is well mixed with a solution of caustic soda or potash and allowed to settle. The neutral oil floats on the alkaline liquid, a mixed emulsion intervening. The alkaline liquid is drawn off and filtered. The oil purified by this method is superior to that obtained from the acid treatment.

A much simpler alkaline method adopted in Italy for olive oil is to add 400 grammes of ammonia diluted with twice its bulk of water to every 1,000 kilos of oil, agitating thoroughly and allowing to stand three days, then decanting and filtering.

All oil to be used for varnish, or for boiled oil, should be chosen as new, sweet, and as free from rancidity as possible, and should be immediately clarified and allowed to settle for a few months before being used, so as to deposit mucus impurities and the substance used in clarifying it. Raw oil intended for making pale boiled linseed oil or varnish should have a sp. gr. of at least 0.935, as a lower gravity is a probable indication of contamination of oil from foreign seeds. Gummy and mucus matters, water, saline substances, etc., derived from the seed during expression, make the oil turbid, and, moreover, induce a kind of rancid fermentation, greatly impair the keeping quality of the oil, and also hinder its drying.

The simplest of all processes for treating oil consists in heating the oil slowly up to about 500° F., either alone or with caustic lime, calcined magnesia, carbonate of lime or magnesia, in the proportion of 1 to 5 parts in 1,000, and keeping it at that temperature for one or two hours, then allowing it to cool uncovered and undisturbed. The oil should then be transferred to a settling tank to deposit and clarify. When thus freed from the seed impurities, the oil will not become rancid easily, and will improve by storing, becoming more pale, transparent, and drying in proportion to its age.

For boiling oil a copper or enameled kettle or tank is used. It is generally furnished with a mechanical stirrer, and is capable of being raised to the required temperature by a steam jacket or coil. Air is either blown across the heated surface or forced through the heated oil from a ring of pipe or some similar contrivance at the bottom of the kettle, the air being thus intimately mixed with the oil, which is heated in this vessel to a temperature of 212° to 228°, the stirrer put in action, the driers (ground in oil to the utmost possible fineness) are gradually added, and when thoroughly mixed with the oil, the air is turned on, being blown through the mass with powerful agitation, and the heat and blowing kept up for from three to four hours, or until the oil, from the appearance of samples taken from time to time, is shown to be sufficiently boiled. Several modifications in the method of boiling, mixing driers, etc., are made by different manufacturers.

Driers are substances incorporated with drying oils to increase their power of absorbing the oxygen of the air, and so cause them to dry more rapidly. The only ones whose reputations have survived to the present day are the oxides and other compounds of lead and manganese. The function of a drier is to act as a carrier of the atmospheric oxygen to the molecule of oil in its immediate neighborhood. The action should be, so to speak, regenerative and continuous. Each molecule of drier, after giving up some of the oxygen it contains, is reduced to a lower degree of oxygenation. On exposure to the air it immediately returns to its highest state, through absorption of oxygen from the air, ready to impart fresh quantities of oxygen to the oil. This is continued indefinitely. Oxide of manganese possesses this power to a high degree. Less than one per cent. is used to make a pale drying oil. Lead oxides in quantities exceeding five parts in 1,000 give very dark colored oils when heated to a high temperature, as in ordinary boiled oil. Red lead is generally used for this oil on account of low cost. Used alone, it is capable of giving the oil the highest possible drying power, but it also gives it a very deep brown color.

The amount and nature of a drier in a pure oil is easily and quickly determined by burning say 25 grammes of the boiled oil in a porcelain crucible. The weight of the residue (ash) will be the amount of the drier in the oil. The nature of the driers can be determined by a qualitative examination of this ash.

Characteristics: Freshly expressed linseed oil is a brownish green or yellowish liquid, having a bitter acid taste and smells of flaxseed. The sp. gr. of pure raw oil varies between 0.932 and 0.937. At 0° F. all solid fat separates out from the oil, while at 17.5° it solidifies to a yellowish mass. The oil dissolves in 1.6 parts of ether and in 40 parts alcohol at ordinary temperatures. The fresh oil saponifies readily, giving a yellow and very soft soap with soda. By saponification it yields 95 per cent. of fatty acids, chiefly linoleic, with a little oleic, palmitic, and myristic. When mixed with fuming nitric acid, the oil is ignited. The sp. gr. of pure boiled oil varies between 0.939 and 0.950. The quality of this oil, even when pure, varies greatly. The quantity and nature of the driers, the amount of boiling, etc., naturally affect the character of the oil. The boiling of an oil can be prolonged until it becomes a solid, elastic mass, bearing a remarkable resemblance to India rubber. For the manufacture of printers' ink, the oil is boiled until strings drawn from it leave no greasy stain upon paper.

For perfectly satisfactory methods of testing and examining linseed oil, there is still much to be desired. Several tests for adulterations are in vogue, some of which are given. For the detection of fish oil in a suspected sample, pass a current of chlorine gas through the oil for three quarters of an hour. A darkening is

produced when fish oil is present. If a red emulsion is produced by boiling the oil with a solution of caustic soda, 1.34 sp. gr. fish oil is present. Pure oil thus treated gives a yellowish emulsion.

The color produced by treating a small quantity of oil with sulphuric acid is a useful indication of the purity of linseed oil. About 20 drops of oil are treated on a white tile, with a drop or two of acid, and the color observed both before and after stirring. When resin or fish oil is present, a reddish brown mixture is formed. For the detection of resin boil the oil for a few minutes with alcohol, pour off the supernatant liquid and add to it a small quantity of an alcoholic solution of acetate of lead. If pure, a slight turbidity only is produced, while if resin be present a dense flocculent precipitate is formed. Resin may also be detected by the smell of the oil when burned. Hydrocarbon oil adulterations are detected by saponification of the samples with alcoholic potash and subsequent separation. The halogen absorption test is often used with very good results for the examination of linseed oil. A very good test of boiled oil is made by noting the time required for it to dry on a glass plate. The plate is flooded, held perpendicularly for five minutes to drain, and then placed in a perfectly horizontal position. By treating a sample of known purity similarly, and using this as a standard, a very good idea is obtained as to the drying qualities of the oil under investigation.

The sp. gr. of the oil is useless as indicative of purity, as by a skillful mixture of oils of higher and lower gravities, an extensively adulterated oil can be obtained, having the proper density.

A simple practical test for boiled oils is to mix the sample with three or four times its weight of dry pure white lead, and cover evenly a plate of glass or metal with the paint. An exactly similar experiment is made at the same time with a standard sample and the ratio of drying and the characters of the coatings compared. Small quantities of non-drying oils retard the drying considerably.

The best oil is that which dries quickest, and gives at the same time a good ultimate product. Dried oil may be tough, very elastic, hard or brittle, or rotten. An oil giving a hard surface is always to be preferred.

Filtering a boiled oil is sometimes resorted to by the inexperienced, to separate impurities before using; but unless the oil is protected from the oxidizing action of the air, the characteristic oxidation products are constantly formed, and these, after some of the oil has passed through, clog the filter, and finally are left behind as a tough, elastic, translucent scum. After boiled linseed oil has stood exposed to the air for some time it becomes viscid, or, as it is termed, "fat," and is then unfit for use in paint.

As it is sometimes necessary to distinguish off-hand raw from boiled linseed oil, and vice versa, a few simple and rapid methods are given for so doing. Allow a drop or two of each kind of oil to fall upon glass plates, and then smear with the finger into a circle of a couple of inches in diameter; at the end of two or three hours the raw oil will be still greasy, while the boiled oil will be sticky or "tacky." Samples of each in narrow test tubes are examined by transmitted light; the boiled oil appears brown, and the ordinary, yellow. Shake 12 c. c. of oil with 6 c. c. of a solution of glycerin containing lead oxide in a test tube, and then place in boiling water for three minutes; the boiled oil forms a thick, semi-solid mass, while raw oil forms two liquid layers, the lower one as clear as water.—*Western Druggist.*

COMPOSITE PHOTOGRAPHY.*

By ELLERSLIE WALLACE.

OUT of the mixed mass of matter that modern photography presents to us, there are some things that would be better suppressed altogether. It is a matter of great regret that considerable numbers of those practicing our beautiful art do not scruple to lower it to absolute quackery, sometimes to revolting indecency, often to the multiplication of "cheap and nasty" forms of design, and still oftener to silly pastime or childish absurdity.

With many persons, indeed, the idea seems to be to pursue photography in any and all ways rather than the legitimate ones that have rendered it so useful to the world and so universally and justly admired.

I do not propose to enter at any length into a subject like this, which must have forced itself upon the attention of every thinking man who has any interest in the camera, but there is one of these absurd quackeries that seems to be commanding the serious attention of people of education and attainments, and who really ought to know better. I allude to the so-called composite photography. Now, it is well to have the desire of hearing new things and seeing new inventions, but when I see such nonsense as composite photography gravely treated in a scientific manner by respectable magazines that are read by the general public, and even by the journals devoted to our own craft, I can only say that it makes me feel very sorry.

Composite photography claims to give a normal type or average of the features of a number of individuals; and the assertion that each exposure on each subject partially destroys and partially adds to the image previously existing on the film is just one of those nicely contrived bits of scientific speciousness that can easily hoodwink any one not understanding the technical part of photography.

If a draftsman draws on a rough-cast wall with a chunk of dry color, or on the smoothest of paper with the finest pointed pen, he makes an outline in either case, because he attempts the representation of one object in one place. Composite photography attempts the representation of an unlimited number of objects in one place.

For the same reason we cannot compare the "composite" with a badly focused plate, because the latter has an outline, no matter if the image be hardly discernible. The form is there, just as it is in the drawing on the rough cast wall.

A "composite photograph" cannot claim to be a picture in any sense, because it is merely a jumble of uncombined outlines. The expression "uncombined" is a foolish one, perhaps, for two outlines cannot be combined upon the same surface or film. Let us take an example from the stereoscope; here we have two images the same in size to a hair's breadth, just as the

* Read before the Chicago Chemical Society, Oct. 15, 1887.

* Read before the Photographic Society of Philadelphia.

Images of any object are when formed upon the retinae of the two eyes. The only difference between them is that the one taken with the right hand lens gives a rather more right hand view of the subject, and *vice versa*. How are they made to combine? By means of an ingenious and beautiful optical trick, which diverts the lines of vision from their normal course; the prismatic lenses of the stereoscope acting in the one case, and the simultaneous outward rotation of both eyeballs (binocular vision) in the other, when no stereoscope is used. But suppose we cut a stereo slide in two, set each half in a magic lantern, and project the images on a screen. We may make them overlap, but have we combined them to a perfect whole? No. So, in the stereoscope, the images are but apparently combined, and the very beauty of the quasi-solid picture lies in its unreality.

I take it that any picture, to be a picture, must have an outline. A "composite" of ten sitters made with ten exposures, no matter how carefully graded, would have ten outlines. Is it therefore ten times a picture? It certainly is not ten pictures. We have ten outlines, each striving for the dominant position, but we know that two outlines can no more occupy the same place than two bodies can occupy the same space at the same time.

Let us suppose that twenty of us here to-night were walking on a beach by the sea, and that we determined to make a "composite" footprint in the wet sand. The form of each man's foot would then be impressed over the preceding one, and the result would be a lot of tramped-down sand, nothing more. This comparison with composite photography is a perfectly just one.

Again, suppose the twenty of us were to commission one of the number to go to some sculptor or moulder in clay and request him to make a "composite" statue of the whole twenty, with or without twenty outlines. I should rather expect him to be answered as the old gentleman was who desired the London judge to recover his stolen property for him: "Sir, does your mother know you're out?" This comparison also is a perfectly just one.

I have recently seen a "type composite" of some seventy lady graduates of a well known college. While I am hardly in a position to judge of the intellectual average thus shown, I can say that a phrenologist would look in vain for the bump of photographic common-sensitiveness or chemico-physical comprehensiveness.

If I am entirely wrong in this matter, however, and if such a thing as composite photography really exists, I shall always regret that I did not attempt some "composites" of European scenery when abroad with my camera a few years ago. "What is sauce for the goose is sauce for the gander," and if it is possible to make a composite of eighty different people, it is also possible to make a composite of eighty different outdoor views. I think that a composite of English cathedrals, Dutch windmills, French and German timbered houses, Belgian hotels de ville, Swiss mountain scenery, and street views pretty much everywhere, all combined on the same plate, would have been a new departure in landscape photography, and, together with the portrait composites, might well bear the title, "Confusion now hath made his masterpiece."

Constantin, in his "Idees Italiennes," has remarked that the "rapidity and suddenness of movement on the part of the demoniac sprite in Raphael's great picture of the transfiguration is such that the draperies have not had time to follow the impulse of her body. She alone has turned. Her girdle, left behind by her movement, seems to be placed awry, but we soon perceive that if she were to return to her former attitude it would be in its proper place."

"Raphael always leaves around his figures the space necessary to indicate the position in which they were at the moment immediately preceding that chosen for the painting, and is very careful not to fill up the void which they have thus left behind them."

It is thus that Raphael succeeds in giving a spontaneity of movement to his figures which is truly marvelous.

Instances may likewise be selected from the work of Titian, in which the expression of motion and animation is masterly portrayed. In a small picture representing Christ appearing to Mary in the garden, the Magdalene seems fairly to run forward to meet the Lord, her streaming hair and drapery denoting the utmost rapidity of her action, while the hand stretched forth to touch him is suddenly checked at his words, "Touch me not."

I have never had the privilege of seeing the originals of the great masters, but even in the engravings and photographs which are accessible, the indescribable charm of motion is not lost.

Michael Angelo is rich in illustration of the power of conveying the idea of motion by suggestion, but we have cited enough examples. Even among the minor painters we often find the previous position of the figure indicated by the manner in which the apparel is disposed upon the ground or upon some near object, as a chair. We believe the photographer would do well to imitate the painter, if he desires to convey the idea of motion rather than to seek for action in transient attitude alone. A transient attitude may indeed be depicted, but not isolated. There must be other objects associated to carry the mind from one phase to the other, so that it weary not of the perpetual sameness.

How insupportable do those statues of heroes become upon their solitary pedestals, with arms extended, for ever holding the uplifted sword! Yet place the same figure in the same attitude in a painting, marching at the head of a victorious host, with streaming banners, and the mind has something to turn to for relief, and the impression is strong and full of enjoyment.

With what delight have we watched the wonderful play of sunlight upon the waves of the ocean, and how grieved, because our cameras gave so tame a rendering of their beauty.

What has the sensitive film, with its quick perception, done with those peculiar elongated streaks of ever shifting light, which excite the rapture of the painter, which not only interpret the form of the large masses of water, but also the shape of the tiny waves sculptured upon its surface?

The instantaneous photograph reveals the truth, but the vision of beauty has vanished. "Truth is not beauty" here. In the photograph, in place of the lines of light presented to our vision, we have but

rounded dots of the reflected image of the sun, which become elongated by the motion of the waves, and are so impressed upon the vision.

Waves breaking upon the beach, for similar reasons, appear different to our eyes from instantaneous photographs of the same. The impression we receive is not of any single wave movement, but the resultant of the rapid presentation of several movements in succession.

The opacity of instantaneous pictures of waterfalls, and the transparency of real ones, is no doubt due to the same physiological cause, the infirmity of our vision.

THE COLONIAL SECTION OF THE FRENCH EXHIBITION OF 1889.

WORK on the Colonial Exhibition is to be begun in a few weeks on the Esplanade des Invalides. At present, the exhibition takes in the entire width of the esplanade for a length of 815 feet. It is probable that it will extend further, toward the Dorsay quay, the

While not making it their study to reproduce any given type, the architects have yet fully succeeded in giving their work a certain exotic character. This pavilion will be of iron, brick, and glazed tiles, and the roof of many-colored tiles.

All around the central pavilion will stand numerous villages, with their dwellings and inhabitants. Everything will be reproduced therein with the most scrupulous accuracy. The huts of the various peoples will be brought from their native country by the aborigines themselves, and be set up by them. Here will be a Senegal village hidden among trees, and, in the center of it, the tower of Salde, faithfully reproduced with material brought from Senegal; and there will be a Pahouin village with huts in line like so many cages; and further along will be an Alfourou village, surrounded with high palisades, whose separated huts will recall the beehives of our gardens.

In all these villages the aborigines will be continuously working at their occupations, just as they would do

FIG. 1.—CENTRAL PAVILION OF THE FRENCH COLONIAL EXHIBITION OF 1889.

present plan not yet including the Tunisian and Algerian exhibition, which will occupy quite a wide area. Messrs. Sauvestre and Des Tournelles, who drew the plan which we reproduce in Fig. 2, and under whose direction the entire work will be executed, are endeavoring to give the exhibition the greatest extension possible. It is by placing before our eyes our numerous colonial riches, by showing the easy life that our colonists lead, and by proving to us that the climate of the greater part of our colonies is not so unhealthy as has been stated, nor the peoples who inhabit them so ferocious, that the taste for colonizing will be usefully developed.

The best means of reaching such a result is an instructive exhibition. So the present exhibition will assuredly be full of interest.

The architects' general plan includes a central building (Fig. 1) in which will be exhibited the manufactured products of our various colonies, without distinction of derivation. This building will not be a reproduction of any special architecture, but rather a mixture of the architectures of all the colonies. Here is a programme difficult to carry out, and here are many interests to be provided for, for it is necessary that each colony shall be recognized in the arrangement of this palace.

In their own country. In the midst of the villages, in which good order will be preserved by detachments of Tonkin, Annamite, and Singhalese troops, will be located numerous shops for the sale of small wares manufactured by the natives under the eyes of the visitors, refreshment rooms, and restaurants served in the fashion of the country. One of the most curious of these establishments will be the Creole restaurant, all of one portion of which will be built upon piles. The Angkor pagoda seen in the plan will be constructed at the expense of the King of Angkor, who proposes to inhabit it with numerous attendants during his stay among us.

Cochin China will have a special exhibition, established in a magnificent reproduction of a temple of the Desert of the Tombs.

Opposite the entrance of the central pavilion there will stand a Tonkin gate of quite a peculiar character. This will be sent from Tonkin a few weeks previous to the opening of the exhibition. To the right and left of this entrance will extend lakes on which Tonkin sampans will sail.

The aboriginal villages will be grouped as follows: to the right of the central pavilion, Africa and Oceania; to the left, America and Asia.—*Le Genre Civil*.

FIG. 2.—GENERAL PLAN OF THE COLONIAL EXHIBITION.