or specific gravity to any extent, but the alluvial deposits are not so uniform in their character. A formation of clay has been found to vary continually, more particularly as regards its specific weight, or rather the weight of the particles composing the formation. Take as an instance the uncombined silica, which is present more or less in every alluvial deposit. The high specific gravity of these uncombined particles as compared with the other substances present, naturally causes them to separate from the remaining portion of the conglomeratic mass, when the agitation of the mixing process ceases, unless the solidity of the mixture is sufficiently dense to hold those silicious molecules in suspension. A percentage of uncombined silica is not an objection in the process of cement making, provided the proportion is not in excess, the particles are not coarse, and the quantity is equally diffused throughout the mixture. These varying properties in weight lead to serious results in the settling beds, unequal subsidence occurring, thereby rendering a perfect chemical combination in the process of calcination impossible.

Another difficulty presents itself in the serious wear and tear and continual dilapidation of the drying flats, in consequence of the unequal and sudden expansion and contraction of the floor, unavoidable when subjected to the influence of the heat given off from the coke ovens beneath, and the frigid temperature of the semi-liquid slurry when deposited on the floor above.

The liberation of the waste heat given off from the kilns, without an attempt at utilization, is also unquestionably an imperfection.

I have drawn your attention to the shortcomings of the cement maker, with the hope that you will appreciate a hasty description of some improvements which have recently been introduced in the manufacture of Portland cement.

Johnson's patent chamber kiln most effectually annihilates two of the objections just referred to, inasmuch as it takes the place of the extravagant flats and coke ovens, and serves to utilize the waste heat given off from the kiln. Mr. Johnson's invention consists of a kiln of the ordinary construction; but, instead of being surmounted with the usual cone, through the top of which the waste heat is liberated, it is arched over, forming a crown of semicircular shape. One side of this arch is continued with a flat bottom, in a horizontal direction, forming a semicircular flue of chamber, supported on tiers or groundwork. The waste heat from the kiln traverses the length of this flue, and eventually escapes through a chimney at the further end. When the kiln is charged, the liquid slurry from the wash mill is pumped or conveyed through pipes to the top of the flue or chamber; these pipes are furnished with outlets through which the slurry flows, dropping through manholes on the roof of the chamber, and finally depositing itself on the floor of the same, which is composed of ordinary concrete.

Sufficient material having entered the chamber requisite for the re-charging of the kiln, the manholes and other apertures are closed, the kiln is fired, and the heat evolved, passing over the slurry in the flue or chamber, thoroughly dries the material ready for the re-loading of the kiln. Thus the heat given off from one charge is made to dry the slurry requisite for the re-loading. The chamber is constructed of sufficient height to enable a workman to move about in it conveniently.

When describing the process of mixing the crude materials in the wash mill, I mentioned that a large proportion of water is necessary to secure thorough amalgamation. As this large amount of water requires to be drawn off again through the agency of the objectionable subsiding ponds, or by evaporation where the patent chamber kiln is employed, it is obvious that any system which will insure satisfactory results, and at the same time will allow the manipulator to dispense with a large proportion of this water, is very valuable. Goreham's patent system possesses this advantage. Mr. Goreham subjects the materials to a process of wet grinding, which takes the place of washing. The chalk and clay are thrown together into a mill exactly similar to the old-fashioned arrangement, but instead of being reduced to a liquid with the usual large proportion of water, they are brought, by the addition of only one-third their weight of water, to a consistency just thin enough to flow out of the mill. But as this mixture contains a large proportion of coarse particles of the aggregates, which require further reduction, the mixture is passed through horizontal millstones.

By this process the particles are speedily reduced to an impalpable paste of sufficient solidity to render the intermediate process of settlement unnecessary, and the evaporation in the patent chamber an easy task.

Several cement manufacturers have recently adopted the combined processes of Johnson's chamber kilns and Goreham's wet grinding, with results far exceeding their most sanguine expectations, and can it be wondered at? When new appliances are introduced in the process of any manufacture, the adoption of which results in the economy of fuel and labor, as well as greatly diminished space requisite for manipulation, the advantage gained by the manufacturer must be considerable; but, if these economical changes can at the same time insure higher perfection in the quality of the finished manufacture, the value of those appliances cannot be over-estimated.

In conclusion, I would remark that since these improvements have been introduced, rendering the difficulties previously referred to things of the past, and imparting to the manufacturer almost absolute control over the varied physical changes of the crust of the earth, I am led to believe from experiments, and the practical experience of others as well as myself, that the day is not far distant when, aided by the chemist, the geologist, and the engineer, Portland cement makers may seek a wider field for their raw materials than the oceanic deposits of the chalk system and the alluvial clays of the tertiary period.

REDUCTION OF NITRATES DURING METALLIC SUBSTITUTIONS.

By DR. GIACOMO GUETTA.

THE metallic nitrates, if heated with a metal capable of substituting itself for the metal of such nitrates, are partially reduced to ammonium nitrate. This reduction the author considers is in great part due to the heat liberated during the substitution of the metals, and which is capable of effecting, in the presence of the electric element formed by the two metals, the decomposition of the water, and of communicating to the hydrogen resulting from such decomposition the power of deoxidizing the nitric acid and converting the nitrogen into ammonia.

DYEING RECIPES.

THE following recipes we have translated from foreign sources. We reproduce them under the impression that many of our readers may be interested in knowing what is being done on the Continent, and of course we wish it to be understood that we give no opinion as to their practical value:

Black on Cotton.

For 100 lb.: 1st, Boil cotton and dry. 2d, Put through pyrolignite of iron (black liquor) at $3\frac{1}{2}^{\circ}$ to 4° Be. for one hour. Lift, leave on sticks over night, and dry in stove. 3d, Put through cold chalk bath and rinse thoroughly. 4th, Dry with 5 lb dry extract of logwood, $1\frac{1}{2}$ lb. fustic extract (liquid), and 6 lb. sumac. Enter cold and heat gradually, in order to reach 55° to 60° C. after one hour. Next rinse well and dry.

Blue Black on Cotton.

For 100 lb.: Prepare a bath containing for every 100 gallons 36 gallons black liquor, at 10° Be., and 18 gallons red liquor, at 10° Be. Work one hour in this bath, lift, leave on sticks till next morning, dry. Pass through chalk bath, wash well, and dye with logwood alone, or in connection with fustic, or sumac and fustic. Enter cold, heat gradually, in order to reach 110° to 140° F. after one hour; finally rinse and dry.

N.B.—It is always necessary to dry cotton before mordanting. Dry in stove at a medium temperature, heat for five to six hours. The chalk bath is not absolutely necessary, but will be found very useful. A little soda added to the logwood bath will be found beneficial.

Yellow on loose Cotton, to stand milling.

Prepare bath with 25 lb. extract of bark (quercitron), and 15 lb. sulphate of alumina. Boil cotton one hour, then add 3 lb. tin crystals. Boil half to three-quarters of an hour, lift out, wash, etc. The bath may be used for fresh lots, only of course for less material.

COLORS FOR PRINTING ON WOOL.

(From *Muster Zeitung fuer Faerberer*, etc.)

Black.

1 kilo. logwood extract, at 12° Be. (1,000 grammes make 1 kilo.), 164 grammes starch, and 400 grammes dextrine, are well boiled, and to the boiling paste is added 50 grammes alum, 100 grammes acetate of indigo, at 12° Be., and 300 grammes nitrate of iron, at 43° Be.

Red.

1,875 cubic centimeters cochineal solution at 6° Be., and 156 grammes starch. Boil and add 13 grammes tin crystals, and 25 cubic centimeters berry liquors, at 5° Be. Mix well and use.

Violet.

Boil $2\frac{1}{2}$ liters logwood decoction, at 2° Be., and mix with 188 grammes cochineal ammoniacale, 68 grammes alum, and 38 grammes indigo carmine, to be thickened with 750 grammes gum arabic, and 95 grammes muriate of tin added when cold.

Grey.

1 liter water, and 35 grammes starch. Boil and add 56 cubic centimeters logwood extract, at 6° Be., and 56 cubic centimeters bimas, at 6° Be. Boil and when still hot add 5 grammes nitrate of iron, at 40° Be. and 8 grammes sulphate of zinc.

The following have been specially contributed by a practical dyer

Dark Green on Loose Wool.

For 120 lb. clean wool, $4\frac{1}{2}$ lb. bichrome, and $4\frac{1}{2}$ lb. argol. Boil one and-a-quarter hours; rinse well in cold water. In a clean pan boil the following for ten minutes: 25 lb. fustic, 11 lb. logwood, 25 lb. bright madder, and 35 lb. mill madder. Cool, and enter wool; boil one-and-a-quarter hours, or to shade required.

Rupert Brown.

For 120 lb. loose wool, $4\frac{1}{2}$ lb. chrome, and $4\frac{1}{2}$ lb. argol. Boil one-and-a-quarter hours; rinse wool well in cold water. In a clean pan boil 8 lb. ground fustic, 8 lb. camwood, 10 lb. bright madder, 10 lb. mill madder, and 12 lb. ground logwood. Enter wool below boiling point; boil one-and-a-quarter hours, or to shade required.

Risset or China Orange, on Woolen Yarn, 36 lb.

$1\frac{1}{4}$ lb. chrome, $1\frac{1}{4}$ lb. argol. Boil one-and-a-quarter hours; rinse well in cold water. In a clean pan boil 5 lb. ground fustic, $4\frac{1}{2}$ lb. bright madder. Enter yarn below boiling point; boil one hour, or to shade required.

Drab, on Woolen Yarn.

For 30 lb. woolen yarn 1 lb. bichrome, 1 lb. argol. Boil one hour; rinse well in cold water. In a clean pan boil for ten minutes $1\frac{1}{2}$ lb. fustic (ground), 1 lb. bright madder, 5 oz. ground logwood. Boil one hour, or to shade required. —*Textile Manufacturer.*

NEW COLORING MATTERS.

WE mentioned some time ago an alizarine carmine. This dye, which is obtained by treating dry alizarine with strong sulphuric acid, does not seem to have made much progress in the dyehouse, apparently on account of the opposition manifested by dyers to substitute it for madder; moreover, its high price has doubtless also been in the way. As it has been found possible to produce a good carmine from alizarine of lower quality and at a cheaper rate, hopes are entertained that this new product will find extensive applications in wool dyeing, for the production of thoroughly fast shades. Alizarine carmine finds very strong competitors in the naphthol scarlets of much cheaper cost, but it has the advantage over them of much greater solidity.

For dyeing with carmine the wool has to be mordanted with 10 to 15 per cent. alum, and 6 per cent. tartar. Boil one hour, leave to cool, rinse, and dye in bath containing 8 to 12 per cent. carmine of alizarine at 18 per cent. Add to dye bath 50 per cent. tartar of the weight of color used, and dye at the boil for one hour. Instead of tartar, bisulphate of soda may be used; this gives a fiery madder red. A yellow shade is obtained when to the alum bath another of 10 per cent. tin crystals is added, in which the goods are worked for one hour at 140° F., and dyeing with only half the amount of color.

Violet shades, by using for 100 lb. wool, 2 lb. bichrome and 4 lb. tartar, for the mordant. Violet black shades with 5 lb. copperas, and 4 lb. tartar, or 15 lb. chrome alum, and 6 lb. tartar.

We have seen in the *Teinturier Pratique* a splendid sample of blue on cotton yarn. It is produced by preparing the cotton in a boiling soap bath, containing 15 lb. soap for 100 lb. of cotton; it is left there for one hour, then taken out, wrung out, and dried; then comes into the dye bath prepared as follows: In the boiling bath dissolve 50 lb. alum and 12 lb. soda ash, and necessary amount of coloring matter (sky blue) previously dissolved. Enter cotton, work well, then leave in bath till dry.

We should recommend this method for dyeing with soluble aniline blues, for, although rather expensive, it gives very bright shades.

We read that Dr. W. H. Gregg, of Elmira, N. Y., has discovered a new yellow coloring matter from camphor, which he calls *laureline*.

The new product is said to be absolutely fast against all tests, and capable of easy application on linen, cotton, wool, or silk, giving very brilliant shades.

A good yellow having all the properties claimed for *laureline* is a great desideratum, and we hope ere long to hear more about it. —*Textile Manufacturer.*

GUM LAC FROM ARIZONA.

By J. M. STILLMAN.

THERE was received lately at this university, sent by Mr. John A. Culbertson, of Phoenix, Arizona, a quantity of a substance of resinous character, forming a coating of considerable thickness on the twigs of a plant called in that neighborhood "Greasewood," but which I am assured by Prof. Hilgard and by Dr. A. Kellogg is the *Larrea Mexicana*. The plant was identified by means of leaf, flower, and seed sent by Mr. Culbertson. The specimens were gathered in the vicinity of that place on the 22d of December last.

The form of occurrence is precisely the same as that in which the gum lac in India is said to occur, as a coating of hard, brittle resin of a reddish color. The gum lac from Siam is said to occur sometimes in deposits of a quarter of an inch in thickness. None of these specimens are so thick, but some exceed $\frac{1}{8}$ inch in thickness, and most are of nearly that thickness.

The gum lac of India is of cellular structure, and in these cells are developed the ova of the insect (*Coccus lacca* or *C. ficus*) whose puncture is said to cause the exudation. These cellular cavities contain at the proper season a red substance, which probably serves as the food of the young insects and in which the eggs are deposited.

The specimens from Arizona exhibit the same structure, and in working with the gum the fingers were frequently stained by the crushing of the pulpy substance of blood-red color, in which the eggs could be readily perceived with the lens or microscope.

The following characteristic properties of the gum lac, given by various authors, have been found to be also properties of the specimens examined by me.

(1) Contains a red coloring matter, partly soluble in water (and resembling cochineal). I found 3 per cent. of such coloring matter by one method, 1.4 per cent. by another method given below. (2) Partly soluble in alcohol with a reddish color. (3) Almost entirely soluble in dilute caustic alkalies with a deep red color. (4) The resin of the gum lac (shell lac) is soluble in dilute borax solutions on heating with a purplish red color, and the solution has a peculiar sweetish odor. The resin of this product also is soluble in dilute borax solution, the color is a little brighter red and the odor a little stronger than in the case of the shell lac, but this may be owing to the greater freshness of the Arizona product, as the shell lac used for comparison was at least four or five years old. (5) The lac resin softens at comparatively low temperatures. This product becomes soft and plastic when it feels but just warm to the touch. (6) When warm has a peculiar aromatic odor.

Quantitative analyses of the crude lac (stick lac) have been made by different chemists with varying results.

HATCHETT.

Resin.....	68.0
Wax.....	6.0
Coloring matter.....	10.0
Gluten.....	5.5
Foreign bodies.....	6.5
Loss.....	4.0

DR. JOHN.

Resin sol. in ether.....	66.65
" insol. ".....	16.75
Coloring matter.....	3.75
Extractive.....	3.92
Insect skins.....	2.08
Wax.....	1.67
Laccic acid.....	0.62
Salts.....	1.04
Sand.....	0.62
Loss.....	2.90

FRANKE.

Resin.....	65.7
Substance of the lac.....	28.3
Coloring matter.....	0.6
	94.6

It will be seen from these that exact analyses of the lac into its various constituents could not identify it with the India lac when no two analyses agree on the constituents nor on the proportions, the resins being given at from 65.7 to 83.40, and coloring matter at from 0.6 to 10.0 per cent. A partial analysis, however, was made for the purpose of establishing identity as far as could be done by this means.

A portion of the Arizona stick lac was carefully removed from the twigs and boiled with water, and in this way 30 per cent. of the deep red coloring matter (colored extract) was obtained. The residue was extracted with boiling alcohol, and about 61.7 per cent. of alcoholic extract, probably mostly resin. Of the residue the greater portion was soluble in dilute caustic potash with deep red color, and reprecipitated by acetic acid for the most part, though a certain coloring substance soluble in caustic potash, but not precipitated by acetic acid, could be detected by again neutralizing the acid filtrate.

A second more thorough examination was made by first extracting the powdered resin, dried before weighing, with hot absolute alcohol, which was found to leave the coloring matter nearly all behind; then extracting the residue with boiling water, and extracting the residue from this with dilute caustic potash. The final insoluble residue was dried and weighed, and caustic potash solution precipitated with acetic acid, filtered, washed on the filter, and the precipitate dried and weighed. By this process there was lost a certain