not be overturned; and in consequence of it, each of the Vaudois pastors receives £20 sterling a year. The £60 sterling which is thus provided for them, is estimated by the Free Church Magazine, taking into view the simplicity of their manners and the circumstances of the country, to be equivalent to one half more than the ministers of the Free Church receive from the sustentation fund; that is to say, it is an ample support for them. What more wonderful in all history, than that Cromwell and Napoleon should be found united in producing such a result. "Kings shall be thy nursing fathers."

Science.

IRON SMELTING.

Let us select the smelting of iron as an example of the teachings of Chemistry. If practice, unaided by science, be sufficient for the prosecution of manufactures, this venerable art must be thoroughly matured, and science could scarcely expect to be of much use to it in its present state. But while we find much to admire in the triumphs of practical experience, there is yet great room for the improvement of this art. The cheapness of iron ore, and of the coal used in its smelting, has been so great, that, regardless of their capital importance to this country, we, like careless spendthrifts, use them without thought of the future.

The mode of smelting iron consists in mixing the ore with lime and coal, the former producing a slag or glass with the impurities of the ore, while the coal reduces the oxide of iron to its metallic state. Much heat is required in the process of smelting, but the cold air blown in, as the blast, lowers the temperature, and compels the addition of fuel, as a compensation for this reduction. Science pointed to this loss, and now the air is heated before being introduced to the furnace. The quantity of coal is wonderfully economized by this application of science; for, instead of seven tons of coal per ton of iron, three tons now suffice, and the amount produced in the same time is increased nearly sixty per cent. Assuredly this was a great step in advance. Could science do more?

Professor Bunsen, in an inquiry in which I was glad to afford him aid, has shown that she can. We examined the furnaces, in each portion of the burning mass, so as fully to expose the operations in every part of the blazing structure. This seemingly impossible dissection was accomplished by the simplest means. The furnaces are charged from the top, and the materials descend to the bottom, with the upper charge a long graduated tube was allowed to descend and the gases steaming from ascertained depths were collected and annalyzed. Their composition betrayed with perfect accuracy the nature of the actions at each portion of the furnace; and the astonishing fact was elicited that in spite of the saving produced by the hot blast no less than 18½ per cent. of fuel is actually lost, only 81½ per cent. being realized. If, in round numbers, we suppose that four fifth of the fuel be thus wasted, no less than 5,400,000 tons are every year thrown uselessly into the atmosphere, this being nearly one-seventh of the whole coal annually raised in the United Kingdom. This enormous amount of fuel escapes in the form of combustible gases, capable of being collected and economized; yet, in spite of these well-ascertained facts, there are scarcely half-a-dozen furnaces in the United Kingdom where this economy is realized by the utilization of the waste gases of the furnace.

Large quantities of ammonia are annually lost in iron-smelting, which might readily be collected. Ammonia is constantly increasing in value, and each furnace produces and wastes at the least 1 cwt. of its principal salt daily, equivalent to a considerable money loss. With the low price of iron, this subsidiary product is worthy of attention. As I write a Welch smelter has visited me, to say that he has adopted this suggestion with advantageous results. I might adduce other improvements introduced by Chemistry in the smelting process; but these will suffice to show you that she has added to human power by increasing production, while she has also economized both the time and the materials employed.

Chemical Character of Steel.

Steel is formed by surrounding bars of iron with charcoal, placed in fire-brick troughs, from which air is excluded, and keeping the iron bars and charcoal in contact, at a full red heat for several days: at the end of which time the iron bars are found to be converted into steel. What the nature of the change is, which the iron has undergone, we have no certain knowledge; the ordinary explanation is, that the iron has absorbed or combined with a portion of the charcoal or carbon, and has, in consequence, been converted into carburet of iron. But it has ever been a mystery that, on analysis, so very minute and questionable a portion of carbon is exhibited. It appears that the grand error in the above view of the subject, consists in our not duly understanding the nature of the change which carbon undergoes, in its combination with iron in the formation of steel. Those who are familiar with the process of the conversion of iron into steel, must have observed the remarkable change in the outward aspect of the bats of iron, after their conversion, viz., that they are covered with blisters. These blisters indicate the evolution of a very elastic gas, which is set free from the carbon on the act of its combination with the iron. I have the strongest reasons to think that these blisters are the result of the decomposition of carbon, whose metallic base enters into union with the iron, and forms with it an alloy, while the other component element of the carbon is given forth, and so produces, in its escape, the blisters in question. On this assumption we come to a very interesting question:—What is the nature of this gas? In order to examine this, all that is necessary is to fill a wrought iron retort with a mixture of pure carbon and iron filings, subject to a long continued red heat, and receive the evolved heat over mercury. Having obtained the gas in question, in this manner, then permit a piece of polished steel to come in contact with this gas, and, in all probability, we shall then have reproduced, on the surface of the steel, a coat of carbon, resulting from the reunion of its two elements, viz., that of the metallic base of the carbon then existing in the steel, with the, as yet, unknown gas; thus synthetically, as well as by the analytic process, eliminating the true nature of steel, and that of the elements or components of carbon.

The Farm.

Power of the Soil to retain Manures.

BY PROF. J. J. MAPES.

We propose in our present number to show the power of the soil to retain manure, and the means of improving this property when required.

For a long time it was supposed that all materials soluble in water would pass downward in solution, and thus be lost to plants—those who worked clayey soils claimed that, because water could not readily percolate their soils, that hence, they were not *leachy*, and therefore retained manures—while other operators with sandy soils argued that manures passed downward and were soon lost to the surface soil.

All these positions are false. It is true, that a fair proportion of alumina is valuable to soils and in the absence of carbonaceous matter is absolutely necessary for the retention of manures, but it is not true that the tenacious property of clay need exist to such an extent as to prevent the free filtration of pure water before the manures will be retained—for many soils which will pass pure water readily, will still retain, from impure water, all its impurities, permitting only the pure water to descend. Indeed this is true of all arable soils, and if it were not so, the water in all our wells would be unfit to drink from being surcharged with soluble organic matter.

Even the brown fluids of a barn-yard will not leach downward in the soil, without leaving all the fœtid matter in the surface. Dig in an old barn-yard, but a few inches below where the soil has been before disturbed, and it will be found not to become dark-colored, and not to contain any undue proportion of the soluble matters resident at the surface, but to be like the subsoil of adjoining fields.

Alumina (clay) has the curious property of receiving and retaining all animal and vegetable substances, and their gaseous products, until abstracted again by growing plants, and for this reason a free clayey loam will purify water during its passage through the surface soil, retaining all the fertilizing substances originally held in the solution, and permitting the pure water to pass downward. Nor does this retaining power cease with organic substances alone, for many of the alkalies are also retained, and all of them to a certain extent. Excess of lime, potash or magnesia will pass down and therefore the chemist finds variable proportions of these alkalies in our well water.

This peculiar property of clay was noted by Mr. Teschmaker, of Boston, in his public addresses many years since, and in our published addresses before the American Institute, as far back as 1840, the same truths are set forth. Within the last two years, Professor Way and other English chemists are claiming this as a new discovery.

Alumina is not the only substance in soils which has this retaining power, for carbon in every form has similar properties, and it is not important whether charcoal dust be artificially added, or exist in the soil by the decay of former vegetation or of manures; for in either case carbon is the result, and as such, has similar retaining powers to those of clay.—Thus charcoal dust placed for a time near a fermenting dung heap, will receive and retain the gases arising from decomposition, and if placed in the soil will give out these gases again to the roots of growing plants. Privies, stables, &c., are rendered inodorous by the use of charcoal dust. Decomposed peat, turf, swamp muck, &c., are but varied forms of carbon, with some more partially decomposed vegetable matter. The dark color of soils is due to the presence of carbon; humus, vegetable mould, &c., are but modifications of carbon.

All know that an old and black garden soil will retain manure longer than field soils, and that a less quantity of manure will act in them, for the simple reason, that the carbon (charcoal,) contained in them, and arising from previous decay, retains the resultant gases from the decomposition of the manure until used up by plants.

Let any farmer try the following experiment, and he will be satisfied of the truth of our statement:

Prepare four barrels by taking out the upper heads and boring small holes in the lower heads, stand the barrels on end and fill them with the following substances:—

No. 1.—Barren sand with one-tenth the bulk of clay intimately mixed throughout the mass.

2.—Barren sand with one-tenth of finely ground charcoal dust.

3.—A dark colored loam or garden soil.

4.—Barren sand alone.

Pour on all four barrels the brown solution from the barn-yard, and it will be found, that the water running out of the bottoms of Nos. 1, 2, and 3, will be colorless and without smell; while that from No. 4 will be unaltered, and as offensive as when placed on the top.

The question may now be asked, "If the soluble results of vegetable decay do not filter dowuward, what becomes of them?" We answer, that resident in the earth's surface, from the combined influences of sun and air, they decay, and take the gaseous form; if the soil contains either clay or carbon, these gases are absorbed by them, until abstracted by growing plants. But if these substances are not resident in the soil, then the gases rise into the atmosphere, and are absored by better prepared soils elsewhere, or are carried to the ocean and are thus lost for a time to the land.

Let our readers reflect that both the vegetable and animal productions of the earth's surface are continually decaying, and that nothing but the facts we have stated can account for continued fertility. For if the results of decay could filter downward in solution with water, long before this time, the whole amount of organic constituents would have passed below the fertile surface, all our wells would be filled with masses of filth, and both animal and vegetable life would have ceased. The simple facts are, that all organic manures do decay in the earth's surface, and are only lost by rising in the gaseous form, and not by sinking below the roots of plants, and therefore they should be plowed under to such a depth that their resultant gases when rising shall meet with a sufficient quantity of alumina or carbon to arrest them.—*Journal of Agriculture.*

Hints as to Manures.

Hoofs, hairs, feathers, skins, wool, contain more than fifty per cent. of carbon, and from thirteen to eighteen per cent. of nitrogen, besides sulphar, salts and lime of soda and of magnesia. These substances hold, therefore, the first rank, as it were, among manures; and as a long time is required for their decomposition, their action may often last for seven or eight years. They yield excellent results, especially when made into a compost for potatoes, turnips, hops, hay, and, generally, on meadow-land. Hairs spread upon meadows are said to augment the crop threefold; and the Chinese, we are told, are so well aware of the very great value of that manure, that they carefully collect the hair every time they have their heads shaved—and the operation is performed every fortnight—and sell it to their farmers. Now, the crop of hair which every individual leaves at the hair-cutter's yearly, amounts to a half a pound; reckoning, therefore, at thirteen million, the number of individuals who in Great Britain and Ireland, are undergoing the process of shaving and hair-cutting, we have a production of about three thousand tons of hair—that is, of manure of the most valuable kind—since it represent, at least one hundred and fifty thousand tons of ordinary farm-yard manure—which might be collected almost without trouble, but which, on the contrary, such is our carelessness or indolence in those matters, is, I believe, invariably swept away in our street or sewers, and utterly wasted.—*Farmer's Manual of Agricultural Chemistry.*

The Garden.

The older we grow, the fonder we become of our garden. The time was "in our hot youth, when George IV. was king," that we haunted the stream, and loved to drop the lure, softly as thistle down, the dimpled pool. But the love of the "gentle craft" subsided somewhat with the advance of years, and seems disposed to pass away imperceptible into a pleasure of the imagination. With the return of the sweet vernal season, the piscatory passion, indeed, duly revives, and we betake ourselves strenuously to repair our tackle, and to study "Stoddard." But were it not that then, too, Piscator junior returns home from college, and excites the weaker flame in the paternal bosom by the ardour of his angling enthusiasm, and succeeds in hurrying us away to Lochard, or some cherished upland stream, we doubt exceedingly if whether the most inviting, and streams of the most perfect tint, and reports the most propitious regarding the inclinations of the finny tribe, would withdraw us from our glowing polyanthuses and bright-eyed ariculas. We feel, indeed, that our affections are gradually concentrating themselves on our garden; and we have satisfied ourselves, on the high grounds of philosophy, that it is wise that they should do so.

Cicero gives it as his opinion, that the superintendance of a garden is an employment appropriate to mature years; and although the Tuscular sage left his theory unenveloped, it is not difficult to see how the pursuits and pleasure of horticulture should be in unison with a disciplined understanding and a calm breast. Perfect wisdom placed the perfect man in a garden, to dress and keep it. The place and the duty must have been divinely congenial with the exercises of an undepraved heart. The love of man's primeval calling seems yet to linger fondly in the bosom of the exiled race. The first pleasure of children is to gather fresh flowers from the daisied mead, or to play their little hands in the allotted patch of garden ground. "Heaven lies about us in our infancy"—some faint visionary gleam from Eden seems yet to rest on the infant soul, and, with the dawn of reason, the first voice of childhood seems to say that Paradise should have been its home, and horticulture its proper vocation. It is sadly true, no doubt, that adverse lessons in gardening have come to us from Paradise—promptings of an apostate kind from beyond the Euphrates. Boyhood and the succeeding period of immature manhood, with their tumultuary passions and noisy pleasures, show themselves alien to the tranquil delights of the garden. But "years that bring the philosophic mind," and that chasten humanity with their mildning influence, conduct the belated pilgrim back to the garden, and teach him there to find pleasures serene and unalloyed. —*Blackwood's Magazine.*

Grass.

In rich, moist spots, grass will grow rank, and sometimes lodge before the end of June. This should be cut early, and another crop may be taken from the same ground.