No study so interests the young as free hand drawing. It does not weary as do studies which exercise the mind without practising the hand; and if the pupil is put to it in early youth, it cultivates a habit of keen and thorough observation which of all things is the most important discipline to which a young mind can be subjected.

The fault of superficial observation will scarcely ever be found in a pupil who has been taught to sketch from nature. Perhaps no greater or more universal fault than this can be met with in the men and women of America. As a rule, things are glanced at, not seen. In all matters except accounts, we are as a people inaccurate. Hasty, careless, we plunge along headlong, and things pass by us in a confused stream, as do the near objects we view from the windows of an express railway train.

Now while we advocate rapidity in all matters of mere motion, and never yet traveled a hundred miles by a quick train without wishing we could do it quicker, we know that we defeat one of the main objects of life when we attempt to force our minds beyond their normal pace. Let us refuse to look at things at all, rather than to waste time by a half look.

We believe the fault in American character would be greatly remedied by a system of general instruction in free hand drawing, and that the effects upon progress of the discipline thus obtained would be felt most favorably in all the other departments of study pursued in our schools. It appears somewhat astonishing that this fact, proved by years of experience in Europe, should have remained so long unrecognized by American educators.

THE STUDY OF BOTANY.

The study of botany has claims to far more general favor than it receives. No science can be pursued with greater facility, without the aid of a living teacher. It requires but an inexpensive apparatus. A good magnifying glass, small pincers, a press for preparing specimens, a tin box for collecting plants, a pocket knife and a good text book are all that are needed. Any section of country affords ample scope for filling a herbarium, which, by exchanges, can be made as complete as desired. Specimens are easily preserved, and when well cared for, always afford great pleasure in their exhibition.

The advantages of the study are, besides the pleasure derived from any healthy mental occupation, the healthful exercise of body in searching for specimens, the cultivation of the finer tastes, and the vast fund of useful information to be obtained. The dependence of mankind upon vegetable products, for supplies of food and clothing and articles of luxury, is greater than upon either the animal or mineral kingdoms. The animals that give us labor, or from which we obtain food, derive their sustenance from vegetables, and thus indirectly plants are made to contribute to the direct demands made upon them for the sustenance of the human family. A large number of the medicines that we rely upon to cure "the ills that flesh is heir to" are of vegetable origin. We adorn our homes by surrounding them with beautiful flowers, and even the resting places of the departed are made attractive by the sweet scents and exquisite colors of the floral realm.

It is pleasant enough to inhale the fragrance and to feast the eye upon the softly shaded tints of beautiful flowers, but there is all the difference, in the pleasure ordinarily derived from this source and that afforded through the intelligent inspection of flowers by the skilled botanist, that exists in the degrees of delight, derived by cultivated and uncultivated ears from music. To the botanist, there is far more in flowers and foliage than mere color and odor. There are delicate structures, each of which has a definite purpose and meaning. There are beautiful analogies, properties hidden from the common eye, and nice relations which form a basis of classification. All of these things are delights to the minds that comprehend them.

But there is practical profit in the study, as well as unfailing pleasure. Every intelligent farmer ought to know something of botany. By it he often can tell when his land is in danger of being seeded with troublesome weeds, and can exterminate them before they overrun the soil.

We once lived in a rural neighborhood where the practising physician was a proficient in botany. He had doubtless saved the farmers of the county in which he resided thousands of dollars by his gratuitous hints. We once heard him give warning to a farmer, pointing to a conspicuous plant that reared its head above the fine green of a luxuriant meadow. "Pull up by the roots every weed of that kind that you see on your farm." There were few, and it would have cost little to obey the good doctor's injunction. It was disregarded, and three or four years later the farm was literally seeded with a plant till then scarcely known to any farmer in the region.

But little need be said by way of instruction to those who may be induced by our remarks to undertake the study of botany. The driest part of the study, as sometimes taught, is the terminology and nomenclature. Instead of attempting to master all this at once, the better way is for the student to commence with a plant specimen, and endeavor, by means of the analytical method explained in all good text books of botany, to ascertain its name and properties, looking up the necessary definitions as he proceeds. A flower of good size and of simple structure, such as an apple blossom, a butter cup, or sweet briar blossom, should be first undertaken, the many rayed, composite flowers being more difficult. By pursuing this course, the task of learning many definitions is distributed so much as to be almost insensibly accomplished.

The practice of preserving specimens should always be followed. Nearly all text books describe the proper method of doing this, and we need only add to their directions that success in it depends principally upon the patient thoroughness with which the work of laying down the plants in papers for pressing is performed. A plant well pressed is easily mounted so as to look well, while one ill pressed is not worth mounting at all.

Some of the best and most instructive studies in this latitude are found in plants that appear in bloom while the snow has scarcely melted away in the spring. Indeed we have often found anemones and trailing arbutus on the sunny side of a knoll while the snow still rested on the other, and one must start early in the season to find some of the crowfoots in blossom. How many of our young readers will make a beginning next spring?

PURE AIR.

We recently heard a Professor of Chemistry say that the greatest curiosity in his cabinet was a specimen of pure iron. This metal, which is present everywhere, is so difficult to obtain free from impurities, that not half a dozen men on the face of the globe have ever seen it. We are beginning to entertain the same opinion of pure air. Of all the chemical mixtures known to the man of science, we doubt if any gases are so rare as pure and unadulterated air. If it starts right, it soon gets mixed up with organic germs, dust spores, mephitic gas, carbonic oxide, sulphuretted hydrogen, cholera in disguise, and typhoid in odors, until plants wither and animals die, and lamps cease to burn. That this should be the condition of things is not astonishing; on the contrary, the chief surprise is that, with all mankind diligently engaged in filling the waters with pollution and the atmosphere with gases, we are not worse off than we really are.

The habits of the present generation are such as to give rise to more refuse matter and poisonous products than those of previous ages. The fuel we use, the articles we manufacture, and the waste of sewage, combine to create more impurities than were known to our forefathers; and if it were not for the fact that science has given us remedies, nearly in proportion to the increased evil, our population would diminish under the high pressure system which at present prevails. Considering this state of facts, it is not at all astonishing that the attention of Sanitary Commissions, Boards of Health, and Parliamentary Committees is called to the subject, and that we hear of so many reports and propositions to remedy the evil.

The recent illness of the Prince of Wales has occasioned an inquiry into its probable cause, and we see that it is traced to the imperfect sewage of the district of country where this nobleman's party were recently hunting. The disease, from which the Prince appears to have fortunately recovered, is called typhoid, or more properly "night soil fever," and "cess pool fever." Since its rise has been unmistakably traced to disorders of the intestines, the medical faculty have been disposed to give it the name of *enteric* fever; and by this name it appears likely to be henceforth known. The approach of the fever is, in most instances, slow and insidious, and hence the particular occasion on which it was contracted is often overlooked; but all authorities agree that the foul air, proceeding from sewers and cesspools, is the chief cause of this form of disease. By reference to the reports of the Metropolitan Board of Public Works of London, it will be seen that different experiments were made to improve the ventilation of the sewers; but all of them were declared to be too expensive, and no other way could be found than to allow the gases for the future to continue to escape from the middle of the streets. To burn the gases by means of high chimneys would take two hundred and fifty furnaces for the city of London alone, at the cost of two millions of dollars, and a yearly outlay of half a million for fuel, exclusive of the wages of labor. To disinfect the sewers of a large city chemically would be a worse undertaking than pumping out the ocean by Paine's magneto-electric machine. It is evident that both of these schemes are impracticable, and the contamination of the air and water is likely to go on for ever if no better remedy can be found. But this is not all; the present system of sewage acts as a destructive agent in other ways. It not only pollutes the water and gives rise to pestilent fevers, but dilutes a most valuable manure, and destroys it for all useful purposes. We spend fabulous sums of money to destroy the very article which, if properly treated, would be worth millions of dollars.

Now suppose some inhabitant of Mars were to visit our earth. He would naturally be received half way by a self-appointed committee of our first citizens, and, in the course of the inevitable *fêtes*, balls, dinners, and receptions through which he would be obliged to pass, might be shewn through a house "replete with all the modern improvements." The water arrangements, upon which we particularly pride ourselves, would be pointed out, and then would come a sail around the city at low tide, when the mouths of the sewers would be belching forth their greatest stench; and the practical side of the question would be exposed to view, and the chairman would deplore the fact that, in spite of our scientific knowledge, we were unable to abate this nuisance, and he was sorry to inconvenience his noble visitor, and he would about helm and get out of it as fast as possible.

What opinion would this son of Mars form of our boasted civilization? In one place he is shown where we pour the noxious matter in; and where it comes out we deplore our inability to neutralize its deleterious effects. He would probably ask: *Why pour it in at all?* And that would show us at once where the Columbus egg of this difficulty lies, and afford the solution. Why pour it in at all? Why pump water up hill to let it run down? Why spend millions to undo what never ought to be done at all?

It is evident that the building of such works as the Thames embankment, the construction of great chimneys to carry off foul gases, and the immense loss to agriculture, could be avoided if we applied the remedy at the outset, and that would be by using the ounce of prevention and disinfecting all animal matter by dry earth, and never allowing it to pollute our waters.

While our water arrangements appear to us, individually, a great convenience, they are, collectively, the fruitful source of most of our diseases, and ought to be differently regulated.

In spite of all precautions, much impurity would be likely to find its way into the sewers: but the worst evil could be stayed, and disinfecting rendered substantially unnecessary. Pure air is irreconcilably hostile to contagious disease. If we cannot aspire to have it out of doors, it is in vain to look for it in factories, shops, and overcrowded houses.

Nearly all writers on this subject expend all their force and arguments in favor of a complete system of drainage and sewage. We would not gainsay the value of these precautions, but would again repeat that the true remedy is to stop filling the sewers with matter that no power can afterwards cleanse.

"The river Rhine, it is well known,
Doth wash the city of Cologne;
But tell me, nymphs, what power divine
Shall henceforth wash the river Rhine?"

PORTABLE FIRE EXTINGUISHER.

The value of a ready means of extinguishing fires at their very commencement has often been dwelt upon in these columns. We have shown, by facts, figures, and argument, that a large proportion of all the fires which occur could, by such means, be extinguished before extensive damage occurs.

Without making invidious distinctions between the portable fire extinguishing apparatuses now in use, we may well refer to the history of a single one as ample proof of the correctness of our position. We refer to that known as the Babcock Fire Extinguisher, which has made for itself a most honorable record, and is becoming quite extensively introduced. We have not space to enumerate the large number of fires which have been almost immediately extinguished by this machine, but the number is very great. A few words, however, as to the origin of the present form and use of the device, may not be uninteresting.

The original machine was of French origin, and is known as the Carlier and Vignon Machine. To this machine as a starting point, have been added a great number of American improvements. Observing the bulletins of the Northwestern Fire Extinguisher Co., 407 Broadway, New York, announcing the dangerous fires that have been recently controlled at the outset by the use of these portable extinguishers, we have taken pains to investigate its claims upon public favor, and are satisfied that it deserves to rank among the best of modern appliances for saving property.

The machine as now used employs what is known as the Bate and Pinkham mode of charging, by which the liquid acid and the solution of bicarbonate of soda are kept separate until the apparatus is required. By this means there is no gas generated except at the time of using, and consequently no loss of gas or strain upon the cylinder during the intervals. The moment the two materials are allowed to commingle, which is done by simply pulling out the knob of a stem which controls a stopper, a large quantity of carbonic acid gas, in which no fire can live, is generated under great pressure which forces out thoroughly mingled water and gas in a fine, small stream through the nozzle of a small hose, provided with a stopcock to control the flow. Suitable arm straps enable the person using the device to place it upon his back, leaving his hands free to direct the flow from the hose.

A very small portion of the mingled gas and water, a mere film, is sufficient to extinguish a fire that has not been so long in progress as to heat the burning material through and through to the point of ignition. The gas extinguishes the flame, and the water cools the material, a most scientific combination.

It is becoming quite common for merchants and manufacturing establishments to have one of the extinguishers on each floor of their building, ready for immediate use.

It occupies not much more space than a water pail, and no more skill is required to operate it than pouring a bucket of water on an ignited floor.

SCIENTIFIC AND PRACTICAL INFORMATION.

FORTIFYING RAILWAY STATIONS.

Some years since the subject of permanently fortifying important railway stations was discussed by the Prussian Government and abandoned as impracticable. Russia has, however, taken up the project and is putting it into actual practice. The two frontier termini of the Brest and Kiew railways in the direction of Austrian Poland are thus being protected by a citadel and a few outlying forts, probably destined to be the nucleus of a consolidated military fortress in the future.

TEST FOR SILK FABRICS.

The *British Trade Journal* states that Mr. John Spiller, in the course of some investigations made last year, found that hydrochloric acid was an energetic solvent of silk, although it left wool and cotton unacted on, at least for a lengthened period. The practical bearing of this discovery was exemplified by the immersion of several so-called pure silk ribbons and other fabrics in the acid, when the silk was dissolved away, leaving the threads of the adulterating material intact; thus by obtaining a small sample, and immersing it for a few seconds in the hydrochloric acid, or preferably by dropping a little of the acid on the center of the sample, if it be pure silk a hole will be produced; but, if impure, the