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THE ADVANCED SYSTEM OF EDUCATION.

The educational question is one which engages more attention every year. Formerly the teacher's art was supposed to consist in instilling into the pupil's mind the contents of books. Directly or indirectly, school education was book education. But now a change has come over the spirit of education, and manual training and cultivation of the spirit of observation have been erected into important elements of school work. We have frequently illustrated typical institutes where these advanced doctrines held sway, the Teachers' College, of this city, being the most recent presentation of the kind alluded to.

In considering the change in educational methods, a very curious point is met—what effect will the extensive introduction of manual and observational training have on the next generation in the realms of invention and science? Hitherto, by the outside world, the inventor has been regarded as the embodiment of distinct genius—even the highest courts have so spoken of him, however pronounced their minimizing tendency may be at present. The distinguished scientist is regarded as a specialized organization—as one adapted by nature for difficult research. Is there any probability that a school which teaches drawing and which keeps up the instruction for the years of its course—which teaches boy and girl alike the use of their hands and brain in all the departments of manual training, whose pupils execute individual work in constructing physical apparatus—is it probable that such a school will produce a series of scientists and inventors, or will the pupils, after all is done, leave its doors no better equipped than their predecessors of fifty or a hundred years ago?

In the old order of things there was a quality of ruggedness evoked in the successful man, perhaps at heavy expense of the weaker ones, which elicits our admiration. The United States has been prolific of men who, without any advantages, worked their way to the front, and, encountering obstacle after obstacle, only grew stronger with opposition. The annals of invention are full of veritable romances of the type indicated. Leaving aside the winners in the race for political preferment and taking into account only the inventor and scientist, we cannot but feel that, in the frequent asperity of the conditions of the lives and environments of the great workers of the age, there is to be found a school of differentiation adapted to bring the qualities of the strong into greater relief. Under milder conditions the strong might lack the very incentives supplied by the passive resistance of circumstance. But the weak would advance proportionately.

The new system of education, based on the concrete instead of the abstract, will be unquestionably a great advance and benefit to the country. There is for one with any bent for mechanics or science an absolute irritation in the insusceptibility to mechanical or scientific things so often to be found in the everyday world. Thousands of people are content to travel on steam or electric roads without knowing the least thing of the prime motor which propels the cars in which they ride.

Most astonishing examples of ignorance of things about us have been cited by students of education who have examined pupils of the old time system of schools. Tests have been applied by asking the dimensions of objects, with the strangest discrepancies in statement. But a child who has followed such a course as is given, for instance, in the public schools of Cleveland, will have a very strong idea of the relation of things. The annual report of the Board of Education of that city shows a remarkable development of work along the line of observation and manual practice. Examples of drawing executed in the different classes show that the lessons in the real things of life begin with the younger pupils. The illustrations show a whole class of children drawing from the life, some of their co-pupils serving as models. Numerous reproductions of the drawings by the pupils show a reasonable amount of success in what the educated artist finds a difficult task to do adequately. In the higher grades some really excellent work is shown.

The above report is merely cited as an embodiment of the modern theory of teaching the young. The change is not in the way of restraining genius—it is in the way of developing mediocrity. The worker in science who is great will still tower above the rest. The inventor will lose none of his fame. But the background will be a more pleasing one.

The new system will not produce an army of great investigators, but will raise the general level. The qualities required by the specialist must be implanted by nature. The object of the drawing lesson in the school is not to make artists, but to teach observation—the lesson given by the lathe is not so much in the mechanic's art as in the use of the hands and eyes. The object of manual training is at once easily understood and often misapprehended. The school employing it is not to have its success gaged by the number of successful carpenters or machinists among its graduates. It will prove its worth by the general results and the effects on the character of the pupils.

The independent scientist and inventor will be unaffected. They will still hold their pre-eminence and genius, as hitherto; will be uneclipsed by educated mediocrity. The training of the average mind will simply give a better equipped and more appreciative audience for their achievements. The occasional accession to the ranks of inventors and discoverers which such schools may develop will be a service worth all the thought, time and trouble expended on the development of the advanced system of education.

Alabaster Mines.

Thirty-two miles to the southeast of Pisa, in the province of that name, a very remarkable and very ancient industry is carried on. We refer to the alabaster industry, of which a full description from actual observation is given by Vice-Consul Carmichael, of Leghorn, in a foreign post office report just issued. Volterra, where the alabaster is found, enjoys special distinction among places in the world which produce that commodity. The material, which is of five main varieties, is found in nodules embedded in huge masses of limestone. At the end of each cavern whence it is extracted, two or three men are to be seen working away with small T-shaped picks by the dim light of unprotected oil lamps of Etruscan pattern, which, by a singular tenacity of tradition, are still in use in the district. In one case the block of alabaster will be already well projected from its bed of limestone, and the operator is carefully picking away all around it in order to extricate the complete block. The larger the specimen, the more valuable it is in proportion to its weight. In another, search is still being made for the alabaster, and the workman is vigorously beating down the wall of limestone until he lights upon the white nose of what looks like a block. He then picks away carefully, so as not to injure the prize. When there seems a likelihood of a large quantity of limestone having to be removed, blasting with gunpowder is resorted to.

The alabaster industry dates back to classic times. Great changes have taken place in it, however, within living memory. In former days there were three distinct classes of workmen engaged in the work of fashioning the raw material—the master artist, who owned a workshop and employed numerous workers, selling his products direct to the alabaster shops or "galleries;" the journeymen and the travelers, men who took huge cases of the goods and sold them as they went along in all the countries of the world, civilized and uncivilized. Of these, two, the master worker and the traveler, are now extinct species. Nowadays, three men, usually relatives, work together in informal partnership, one being a turner, another a modeler, and the third a decorator, who carves such decorative adjuncts on the finished articles as fruit and flowers. Their gains are very small, and, indeed, travelers who put in at the port of Leghorn and have alabaster vases, statuary and the like offered at almost absurdly low prices refuse, as a rule, to believe that they can be made by hand. One kind of alabaster is made by a process of dyeing, which is still a trade secret, into an excellent imitation of coral. For a time this has had a very large sale, but the trade is now threatened with extinction.

Mushrooms and Manure Heaps.

As grown in old grass pastures, mushrooms are agreeable and excellent eating, especially if cooked properly and cooked fresh. Even as produced artificially for the market, they are often quite wholesome, if washed clean and cooked early. But, as is well known, says the Lancet (London), mushrooms belong to an order of vegetables of a somewhat low organization, and they grow and reproduce themselves with remarkable rapidity when sown in decomposing vegetable matter. Many growers take advantage of this fact to cultivate mushrooms on manure heaps—heaps, that is to say, not of ordinary farmyard manure, but of the vile and rotting filth of every description which is gathered together in large towns and delivered to suburban and country mushroom growers by horse wagon or train. Now, plants take up into themselves the very stuff, modified, on which they grow. Mushrooms grown on matter of this sort select from it those parts which they are able to assimilate. But the arrangement of the "cap" of the mushroom enables it also to absorb the vapor of the manure, which is a dangerous poison to man and other animals. Thus the scores or hundreds of radiating plates of which they principally consist are in practice little better than traps for the catching and retaining of more deadly poisons still.

Improved Paving.

The material consists of concrete made of small lumps of emery stone set in Portland cement. The emery may be in pieces varying from half an inch in diameter down to a powder, and is mixed with Portland cement in the proportion of three parts of emery to two of cement. The composition prepared in this way is used to face ordinary concrete slabs, constituting a wearing surface for paving flags, steps, etc.

The Durability of Pigments Derived from Coal Tar Products.

A paper on this subject was recently read before the Society of Chemical Industry, London, by A. P. Laurie, M.A., who said, the method has been to grind a little of the pigment into a stiff paste with water, and then to dilute with more water and a few drops of a strong solution of pure gum arabic. This dilution was practically the same in each case, and was so adjusted that, on stirring up the diluted pigment, which was kept in a corked bottle, and then laying on a wash with a soft camel hair brush, I should get a tint of the depth required. These washes of color were laid upon Whatman paper in five coats, each coat covering less of the surface than the one laid on before, so that at the end, on the top of my strip of paper, I had a layer of color five coats thick, and a series of coats lying in steps down the paper, till at the bottom I had only one coat of color. These washes were so regulated in strength that they were not so weak as to make one and two indistinct, and not so strong as to make five and four indistinct. In practice, I get in this way coats closely corresponding for different pigments in the strength of coloring effect that they represent, and while this is, of course, far from a perfect method, it yields results which are sufficiently good for practical purposes.

In practice I cut a little portion from the top of my washes of the pigments, and attached it with a piece of gum paper to a sheet of glass which was fixed to a window with a north exposure.

To summarize, I can say that alizarin and its derivatives and galloflavine form remarkably durable lakes; that some eosine lakes, naphthalene, scarlet, and erythrene come next; that after these comes crimson lake; that next to crimson lake comes acid green, while among the very fugitive colors we must place methylene blues, methyl violets, brilliant green, and some eosine lakes.

In some cases colors quickly change in tint, but do not necessarily fade rapidly. This is probably the worst fault a color can possibly have.

Mr. R. J. Friswell said it was impossible to draw an inference from the behavior of a particular dye when used in one way as to how it would behave when used in another. For instance, eosine, when dyed upon wool or cotton, was one of the most fugitive of the aniline colors, yet if it were precipitated on baryta or lead bases in the proper manner, it was one of the most permanent. As a manufacturer of dyes, he was interested in their permanence when applied to fabrics or yarns. He had come to the conclusion that no law could be laid down that a particular color was fugitive or non-fugitive sui generis. All experiments showed this to be absolutely impossible. The permanence of a color was a function of the color itself plus the substance with which it was combined. That was shown by the behavior of colors of the methyl violet, brilliant green, and malachite green series when dyed upon starch. The speaker instanced some tubes of starch dyed with one per cent of methyl violet and brilliant green. These tubes were prepared about ten years ago, and after being shown for months in an exhibition in East London, had been exposed to sun and light for years, but were still absolutely unchanged. Had wool or cotton been used, the color would have disappeared in a few months. To obtain reliable results, Mr. Laurie should obtain colors the genuineness of which could be certified, and should himself prepare the lakes to be experimented with. He would caution the author against being misled upon one point. If he dyed two parts of color upon 50 grammes of barium sulphate and then mixed it with another 50 grammes of barium sulphate undyed, and compared this with another 100 grammes dyed with two per cent, the two might, owing to the imperfection of human vision, appear to have the same tint. But as a matter of fact he would have double the amount of color undergoing the action of light in the one case, just as a double depth of solution gave double absorption in the spectrum of the colors. The slowness of some colors to fade might be accounted for by their producing dark-colored decomposition products on the surface, which had a protective action on the color beneath.

Powdered Zinc for Recovering Photo. Wastes.

Dr. Stiebel, of Frankfort, uses zinc in powder to get back the gold from toning baths. This agent renders excellent service for precipitating neutral or alkaline solutions, even when they have a slightly acid reaction. The excess of acid is better neutralized by the addition of alkali, otherwise it would be necessary to greatly increase the quantity of zinc powder necessary to weaken this acid, which is not the case when the solution is neutral or alkaline. Dr. Stiebel took for his experiments a solution of hyposulphite of soda of 1:5, which contained exactly per liter 1·0988 gr. of silver and 0·4618 gr. of gold; 250 cubic centimeters of this solution were treated with 2·5 gr. of zinc powder, which had previously been strongly agitated in pure water. The mixture was stirred with care. At the end of ten minutes, when the liquid had regained all its limpidity, the filtered solution, treated with sulphide of potash, showed no longer any black coloration, because it no longer contained silver.

In the precipitate, Dr. Stiebel found: 0·2715 gr. of silver=98·84 per cent of the quantity calculated; 0·1150 gr. of gold=98·97 per cent of the quantity calculated, that is to say, practically the entire quantity of the precious metal that had been used. The advantages that this method has over the sulphite of potash process are twofold. First the gold and the silver are obtained by a single operation, then the solution of liver of sulphur is avoided, pernicious as well for the sense of smell as for the products kept in the laboratory. Zinc dust allows the operation to be more rapidly performed than with the metal in sheets. On the other hand, the gold and silver obtained, especially when they are in small quantities, are more regularly distributed through the pulverulent matter. It follows that in filtering there is less danger of loss. One condition of success is to use exact quantities, say five times the supposed quantity of the precious metal, then to only use a very weak acid solution, and to carefully distribute the zinc powder in the solution.

To those who might make the objection that the method proposed by Dr. Stiebel offers some danger by the possible presence of arsenic in the zinc powder, which might give rise to arsenical hydrogen, the author advises operating in the open air or in a laboratory having a good draught.—Paris Photographe; Wilson's Mag.

Car Fenders.

A writer in a New York daily, in solving the fender problem, sets forth that the car body should be sufficiently elevated to allow a person lying upon the track to escape contact with it. That as there is usually several feet from forward wheels to front end of car, the driver would have six or seven feet additional space in which to stop the car before the wheels reached the fallen person. He would place a guard close in front of wheels carried very close to track and employ Belgian block or asphalt in order to secure the true, smooth surface necessary to make the low-running fender clear the ground. The writer also says:

"An ideal condition of roadbed, car and safety device would be, first, and principally, a smooth surface road, a car body sufficiently elevated, and a wheel guard attached rigidly to and in front of and entirely around the trucks, reaching within one and a half inches of the ground, allowing that space for the oscillation of the car truck. This means a complete inclosure of the wheel system, and, with a life-saving guard at the forward end of the truck running freely over a uniform roadbed, would positively discount liability of accident."

The Street Railway Review remarks: Certainly a fender that will "fend" is one of the things that is surely coming, where it has not already been introduced, and managers must study the question carefully, as they will soon have to face it, either of their own free will or by ordinance. The elevation of the car body, however, would doubtless be generally considered a great objection, making entry and exit slower and more difficult, while the steps would still hang as low as the generality of car bodies at present.

A Simple Photo-engraving Method.

In the March issue of the Inland Printer Mr. W. H. Hyslop gives the following explicit instructions, by following which he claims that any one familiar with dry plate photography may produce half-tone printing blocks.

Take any of the slower brands of gelatine films—that is, those coated on celluloid—and expose behind a ruled screen in the usual way, giving, of course, a much shorter exposure than given for wet collodion.

Develop the plate with the usual pyro-soda formulæ sent out by the plate makers, and fix in hypo-soda. Wash thoroughly, and while this is proceeding make up a very hot and saturated solution of chrome alum, and have it in a deep tray.

When the washing is completed, plunge the negative into the hot alum solution and keep it there for five or ten minutes, when it will swell where it has not been exposed to the light and remain sunken where it has been exposed.

From this solution the plate is taken and washed; it is then placed in a strong solution of chloride of aluminum for ten minutes, then washed again and dried over the stove.

When dry it is ready for mounting on the block or for electrotyping. If a small edition of prints is required, an electrotype is unnecessary, because the film is already as hard and as difficult to injure as a copper block. It only remains, therefore, in this case to mount the film on a type-high block with celluloid cement, as used for celluloid electrotypes, and it will stand all the impressions desired. Where a large edition is desired the film may be sent to the electrotypers and manipulated in the usual way.

There is no doubt, concludes Mr. Hyslop, but that this is the process of the future, being quicker, simpler, and cheaper than present methods; indeed, it seems impossible that cuts can ever be made at a less price than by this method.

Scientific Safe Making—Manufacture of Burglar Proof Safes.

The latest burglar proof safes and vaults are magnificent specimens of skillful workmanship. Although the doors often weigh tons, they swing as easily on their hinges as a window shutter. After the first great door is thrown back and displays its glittering array of bright locks, its glass incased clocks and its smooth steel bolts, there is another door almost as strong, with bolts and locks of its own. When this is open, it reveals three other doors. The upper two are of thin steel and have no locks. Only papers and books are to be kept in the little pockets or pigeon holes which they inclose.

Under them and shutting in the cash drawer there is the third door with its own lock and bolts. In this safe the size of the cash repository bears about the same relation to the size of the whole safe as a pumpkin seed does to the pumpkin. And it is not only burglar proof, but fire proof—warranted, in fact, to stand for at least seventy-five hours the greatest amount of heat that any burning building could give it.

The making of a safe of this kind is a complicated and expensive operation, in the opinion of the Chicago Record. All the steel used comes in the form of plates from the works. After having the necessary screw-holes bored in them they are heated to a high temperature and then tempered by suddenly immersing them in water. When they come out they are often a little twisted and warped and have to be rolled cold and sometimes polished clean by a swiftly moving emery wheel. The noise of this operation is ear-splitting and so rasping that a man with ordinary nerves can hardly endure it. When the plate is perfectly level it is transferred to another machine, where it is clamped tight, and an emery wheel shaves off the edges.

The plates are now put together, first one of hard steel, then one of wrought iron or soft steel, and so on until the necessary thickness is obtained. From the iron the safe receives its tenacious qualities—it cannot be cracked or broken as easily as steel—and the steel imparts a hardness that defies the burglar's drill. The screws are also made of combined steel and iron. Each of them is only long enough to reach through two plates, and the screws which join the third, fourth and fifth plates to the first are never directly under any other screws, so that there is no chance for a burglar to bore down through a row of screws. The plates are also drawn very close together, for if any space was left between them, a safeblower might succeed in getting his dynamite into it.

Between the interior and exterior walls of the safe a large amount of hydraulic cement, combined with other ingredients, usually according to a secret receipt, is packed solidly. In case of fire the theory is that the water in the cement—about 43 per cent—will, owing to the heat of the outside covering, become steam, partially, at least, and be driven close to the inner wall. Here it will remain and furnish a blanket impervious to heat. All the bolts are cylindrical and from an inch up to two inches in diameter. Combination locks are now used exclusively. The mechanism of most of them is extremely simple. In one lock there are a number of round brass disks or "tumblers," each pivoted at the center on a small shaft which runs through the safe door and connects with the lock knob. Each tumbler has a slit in it just the size of the steel arm which controls the bolts and reaching nearly back to the center. When all these slits are together and pointing in exactly the same direction, the arm slips into them and the bolts can be thrown. But if the slit in a single one of the tumblers is even a thousandth of an inch out of line, the arm will not slip back. The disks are set a short distance apart, and small screws with big heads are fastened at random over them. As these strike together in turning, the tumblers whirl, and a man might turn the lock knob a thousand years without once getting the slits in all the tumblers together. But the man who knows just how far to turn one way and then how far back again according to the combination numbers has no trouble at all.

The combination and numbers are easily changed by changing the screws in the disk. Many of the best safes and vaults are now being provided with time locks. Two and sometimes three clocks are inclosed in glass cases just inside the safe door. When the door is locked, no one can open it again until the clock hands have traveled the set distance around the dial, and touched a little trigger which releases the bolts. More than one clock is used, so that if one runs down the others will go on and perform their duty. In the big banks the vaults are closed about five o'clock in the evening and set to open a little before nine o'clock in the morning. It is a general impression that an expert burglar can open a combination lock by listening to the clicking sounds, but dealers say it is not possible for any one to do it. If a safe owner forgets his combination, the safe has to be bored into —there is no other way of opening it.