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THE SCIENTIFIC AMERICAN SUPPLEMENT.

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WORKMEN AND THEIR INSTRUCTORS.

That there is a gulf between the purely practical man and his teacher the theorist is one of the misfortunes of our day; and that there exists between them a lack of appreciation, one of the other, is painfully apparent to anybody who comes into contact with them both. Neither will allow that a goodly store of the knowledge and experience possessed by the other would not be a decisive benefit to him. But the theorist well knows that the efforts he may make in purely practical pursuits, however successful from a mechanical point of view, are sure to be, comparatively, financial failures: or, in other words, the expert workman must as a rule look for financial success in the same degree as he abandons his practice and enters the domain of theory. It is a very easy matter to quote examples of great men, who, like Galileo, threw their whole life and soul into their studies, and, rising to the pinnacle of fame, made the world their debtors; but how would it have been if Galileo had known that, so soon as he had advanced to a certain hight in knowledge of his beloved science, he must, to advance any further, abandon it and enter an arena new to him? And this is the precise position of the expert workman. The day has gone by when fame alone is a sufficient reward for labor or skill. Diogenes would in our day find his tub kicked into the street, and himself under lock and key as a vagrant. Galileo would be sneered at as a visionary; while ordinary good breeding prohibits enthusiasm, which is now-a-days considered an attribute of youth or inexperience. The ordinary mechanic of to day is a child of to-day, with its ruling passions well developed in him. Among those passions a desire, a greed almost, for money is not the least; and he naturally takes the readiest course to obtain it. Now what is that course? Is it to become a skillful, practical mechanic? By no means: it is to learn the most commonly known method of doing work, the principles, so far as generally known, governing the manipulation or construction of the work or machine, as the case may be. In fact, since to take charge of others is his aim, he only exerts himself to gain sufficient knowledge to enable him to do so. The shop manipulation, knowledge of business, force of character, mathematics, mechanical drawing, etc., necessary to the attainment of his object, he strives to master. The better his education, the more sure he is to rise; so that a really intelligent and well educated man, with ordinary exertion, is rarely found in the working mechanic, even if he has had ten or twelve years of experience. As he drifts away from his position as a workman, he drifts away from its elements; as a working foreman, his studies are less practically manipulative; he has spent perhaps five years at his business, and during that time his attention has been divided between two things, one to become as expert a workman as he can, the other to gain the extra knowledge necessary to bring him into notice and make him capable of managing and directing other men; and so soon as he makes the first step of advancement, his progress in acquiring manipulative skill is cut short. This is of course unavoidable; but it leads to consequences, as we shall presently see, that are not unavoidable, but are on the other hand very deplorable. As a superintendent he enters a new field, in which his purely practical knowledge is of comparatively little value to him; yet he is the representative head and front of the purely practical man, and will often aspire to a superior knowledge of even the practical workmanship. The expert workman, who has spent from 12 to 20 years in the workshop, and who, in addition to being naturally and mechanically skillful, has made the work his study, looks around him in the workshop and sees here a machine running too slow, there a workman who would do double his quantity of work if a little of that inside information, which old and skillful mechanics always possess, were imparted to him. Then he thinks how much more work could be got out of the same amount of men and machinery if they only knew what he knows. He smiles to himself, and dismisses the subject from his mind, feeling that in his sphere of knowledge he stands alone: conscious, perhaps, that he could not fill the position of even a foreman, but conscious at the same time that money is being thrown away, and that, so far as the practical workmanship is concerned, those above him do not know their business, at least not as he knows it. He has not only no enthusiasm, therefore, for those above him, but he has innately a poor opinion of them, and inwardly rebels at his own position. There is his field of usefulness a comparative waste; and his mechanical advancement is impossible, because: Here we may pause and repeat a woman's reason: Because. The truth is that he is not supposed to know anything, and for the simple reason that his judges were never in his element. They might have attained to his knowledge, but they left his field of study and do not know that it takes twenty years to become, on light work only, an expert workman at the lathe, machine, and vise.

What are the chances of combining in one man, first, a mechanic sufficiently expert as a workman to stand legitimately as an authority and teacher to a large shop of workmen, secondly, one with sufficient judgment and command to govern them, and thirdly, one who shall also be an expert theoretical engineer? Let us see. Out of every 100 turners, there will be found not more than 2 of the highest order of efficiency. Out of 100 workmen, not more than 5 at most are capable of taking charge of men. Out of 100 men, not more than 5 are expert at the planer as well as the lathe; then again, not more than 5 in 100 are capable of explaining even what they do know. Out of every 100, there may be also 5 who have a knowledge af mathematics sufficient to make the calculations absolutely necessary to their work, if required to do so; then, perhaps, 5 per cent of workmen can make a decent mechanical drawing. But, on the other hand, 5 per cent are unsteady, 5 per cent are comparatively untutored, and so on; so that the chance of finding the above-mentioned combination in one man is somewhat small. It becomes apparent, then, that as a rule it is not the most useful workmen who are promoted into better positions, for the reason that the requisites to fill those positions include requirements other than manipulative skill: which requirements in the aggregate give practical expertness a comparatively small place in the general qualification of the foreman. Thus it happens that we may find a hundred cases wherein the workmen of a shop have a profound respect for some particularly expert workman, while only one case in which such respect is entertained by the workmen for the foreman of a shop; and it generally happens that, where such respect does exist, it is a bar to the advancement of the expert for the reason of the impossibility of his assuming control over men with whom his relations have been so intimate. That this should be so is not at all unreasonable, because his superiority is brought before them almost every day of their lives. He is to them, to a certain extent, a mystery in and upon a matter in which they themselves are, to themselves, masters; for of what does the ordinary mechanic assume to know more than of the trade at which he spends his days from morning till night, year in and year out? When a mechanic exerts himself to his utmost, when he puts forth the whole strength of his muscles as well as of his mind, when he calls to his aid all his experience, all his knowledge, all his determination, and all his strength, and then fails, and meets another who, with the same tools and under the same conditions, can perform vastly more and superior work, he knows that this capability is not due to either advantages of brute force or school education, but to some indefinable qualification known as skill. This seems to him to set education, perseverance, and strength at defiance; then respect creeps in, and the skill becomes a shrine, and its possessor an idol. An example of this kind occurs to our mind. A tall strong man, with brawny arms and with muscles hard and well developed, was engaged in filing up some parallel bars; he had the work by contract, and had filed up scores of them. He was an experienced mechanic, and had gotten himself into trouble for working so quickly as to get those men who chanced to have the same work to do by day's work into disrepute, because of their inability to compete with them, even in cost, let alone in time. On one occasion, however, a somewhat delicate looking workman, who worked near, challenged him to file up a bar in competition with himself (the challenger). The gauntlet thus thrown down was accepted, and for three hours the contest raged. Each was allowed new rough, second cut, and smooth files; and the excitement among the other workmen, of whom there were eight, ranged along the side of the same bench, was at a high pitch. The challenger finished his work first, and it was examined by his opponent and pronounced well executed; but a repetition of the trial of skill was requested, and made, with the same result. It was in winter; the workshop had no heating apparatus of any kind, and, though it was freezing, the contestants were in their shirt sleeves, and yet were perspiring. Then the challenger was thus addressed by his opponent, who had ceased working and had been engaged a few moments in apparent deep thought: "I cannot understand it; I can only accept and respect it. I have nearly twice your strength, and have had ten years more experience. I can look clear over your head, and can ho'd you with one hand; and yet I am beaten, beaten at my own job too; and worse than all, I cannot for the life of me tell how it was done." He surveyed himself, held out his strong arms and looked at them, then shrugged his shoulders and went on with his work. He might look within himself, and find, so far as his understanding was capable of judging, every element of superiority, except in that mysterious, intangible, indescribable qualification known to him under the cognomen of skill, which the closest scrutiny of the most experienced eye cannot detect save in its results.

ANCIENT GRECIAN GLASS.

Among the rare objects discovered in ancient Grecian burial places are some curious ones of glass, mostly found in the graves of women. Frequently these consist of vessels with long necks, drinking vessels (without handles and round at the bottom), and of flat and open dishes. All these glass objects appear to have been articles of luxury, and not domestic utensils. According to the recent investigations of Professor Landerers in Athens, this gloss is usually a silicate of soda, sometimes of potassa; but it is always very rich in lead oxide. These wonderful ancient productions often show the most magnificent rainbow colors, with a metallic luster like polished gold and silver, and the material of which they are formed may be split up into very thin layers. That this peculiar appearance is the result of old age, which has produced a change in the material, may be seen in the glass vessels preserved in the Metropolitan Museum of Art, in New York city, which are of still older date, having been procured from the island of Cyprus, by General Di Cesnola. These objects belong to a period of time intermediate between the ancient Egyptian and the Grecian periods; and the coloring operation is the same as that which takes place on the surface of glass panes in windows exposed to continuous changes in moisture and dryness. But it is found in its most complete result when, in the course of centuries, the action of time penetrates the whole mass, forming layer upon layer, shining with the colors of soap bubbles or mother-of-pearl, but with much greater intensity.

Among the rarely occurring objects are some of a deep green or black brown color, which are called vulcanic glass, and are made of obsidian; but to these the ancients added oxide of lead in the form of massicot, so as to make the mass more easily fusible.

Colored glasses have also been found in the ancient Grecian burial places; the yellow colored (which, however, had become almost opaque) contained a silicate of alumina colored with oxide of iron; probably ocher was used in these, mixed with the pulverized glass before the melting, so that the color was obtained after the fusion. A blue glass, which contained streaks of blue of various shades, contained oxide of copper; and in producing this effect the ancients used probably the malachite and azurite (both mineral carbonates of copper) or other green or blue colored copper ores, or the so-called *cæruleum*, which in Egypt was made of copper, sand, and salt, and was used to color the cases in which the mummies were preserved. A specimen of white glass, resembling opal, but showing thousands of cracks, was undoubtedly made of milky half opal, which is found in Greece in the island of Mylos, and which was fused to make objects of the peculiarly colored appearance.

These and other modern investigations continue to prove that the so-called lost arts of the ancients, which some persons grossly exaggerate, trying to make it appear that the ancients surpassed the moderns in knowledge and civilization, did not amount to more than laborious attempts to produce a few of the richer objects which modern industry produces with the greatest ease and in the utmost abundance, placing them, for reason of their low price, at the disposal of every industrious man, even of the comparatively poor laborer, who, thanks to the inventive genius of the present day, enjoys comforts which the working man of ancient Greece would never think himself worthy to enjoy.

MECHANICAL VIBRATION AS A SUBSTITUTE FOR ANÆSTHETICS.

The application of anæsthetics in cases of surgical operations is of comparatively recent date. Dr. Morton discovered that the ethers, inhaled to a sufficient extent, produced a general anæsthetic state, during the continuance of which operations, which otherwise would be most painful, might be performed without the knowledge of the patient. The surgeon availing himself of anæsthetics is enabled to perform operations with greater deliberation and with greater precision, not having to contend with the writhing and shrinking of the patient; but certain dangers which accompany general anæsthetics, whatever the agent employed, have induced experiments for producing the effect locally.

For minor operations, surgeons have had recourse to refrigeration produced by a spray of very volatile liquid, or by the application of freezing mixtures. Intense heat induced by a galvanic current has also been employed, and various other agents have been tried with more or less success; but barring this danger, chloroform and ether stand thus far unrivaled. The desirability of an agent that will produce local anæsthesia cannot, however, be questioned.

Dr. Livingston records a remarkable instance of general nervous insensibility, which, although produced by an undesirable agent, proves that the nerves may be thrown into an insensible state by a means quite unlike the ordinary administration of anæsthetics. He says: "I saw the lion just in the act of springing upon me. I was upon a little hight; he caught my shoulder as he sprang, and we both came to the ground below together. Growlinghorribly, close to my ear, he shook me as a terrier dog does a rat. The shock produced a stupor similar to that which seems to be felt by a mouse after the first shake of a cat. It caused a sort of dreaminess, in which there was no sense of pain, nor feeling of terror, though quite conscious of all that was happening. It was like what patients, partly under the influence of chloroform, describe, who see all the operation, but feel not the knife. This singular condition was not the result of any mental process. The shake annihilated fear, and allowed no sense of horror in looking round at the beast." In describing his injuries, he says: "Besides crunching the bone into splinters, he left eleven teeth wounds on the upper part of my arm."

The often related circumstance of the man who went into a sawmill and tried to see how near he could put his finger to the revolving saw without touching it, and on looking, found to his surprise that his finger was gone—and who, a few moments afterwards, illustrated to the proprietor of the mill how he lost his finger by putting one from the other hand so near the saw that he lost that also—although ludicrous, suggests a principle and a line of experiment which might, if investigated and followed out, result in a blessing to humanity.

The principle seems to be this: That rapid vibration, or a series of sudden concussions, even though slight, and not painful of themselves, will produce, in the part subjected to the treatment, a numbness or insensibility in the nerves, which may be immediately followed by a surgical operation without pain or inconvenience to the patient. The means for carrying out this principle are subjects for experiment. A square stick, having rounded corners, rapidly revolved, will produce insensibility in a finger placed so that it may be vibrated by contact with the corners of the stick. It may be a question whether this effect is produced directly by the rapid vibratory motion of the parts, or whether it is due to a compression of the nerves, the effect of which is prolonged by repeated concussions; in any case, it would appear that experiment might bring out a means for producing local anæsthesia or insensibility of the nerves by causing the parts to be vibrated rapidly by some mechanical device.

CANNED MEATS POISONED WITH MERCURY.

In our paper of May 27 we published the statement of Professor Falke, of Manhattan College in this city, to the effect that, on opening a can of cooked corned beef, bearing the stamp of a Chicago company, which he had recently purchased at a respectable grocery here, he noticed some globules of metallic mercury; and on examination of the meat, found additional quantities of the poison in the form of albuminate of mercury. Professor Falke mentioned the matter before the Academy of Sciences, and the can was examined by the members. After some discussion the conclusion reached was that the presence of the mercury was accidental, caused doubtless by the accidental breaking of a thermometer bulb in testing the heat of the can, etc.

This statement having met the eye of one of our esteemed correspondents at the West, he wrote to us, stating that it was common at some establishments in his vicinity to seal the cans with mercurial solder, and that possibly that had something to do with the case in question. We deemed it hardly possibly that intelligent parties engaged in supplying the public with canned food would venture to make use of so dangerous a material in such a connection; and we therefore wrote to our correspondent, asking him to send us a specimen of the solder in question. He did so, and we caused the solder to be analyzed at the laboratory of Professor A. R. Leeds, Stevens Institute. We were surprised at the result, showing, as it did, that the solder contains a large quantity of mercury, which is at once liberated under the heat of the soldering iron, and is readily condensed in metallic form. This appears to be a sufficient explanation of the presence of free mercury and of albuminate of mercury in Professor Falke's case; and warrants the conclusion that the many cases of sickness from partaking of canned meats, reported in the papers, may be due to the same cause.

Mercury is mixed with the solder in order, doubtless, to make it run and seal more easily; but it is a dangerous and subtle poison, and its employment in connection with canned foods should be prohibited under severe penalties. We hope our legislators will promptly move in the matter.

In the meantime, we caution our readers to avoid the use of foods that are put up in *mercury-soldered cans*.

Any chemist or intelligent person, by a few simple tests, can quickly determine the presence of mercury in the solder. In the specimen sent to us, the mercury is revealed by simply heating a bit of the solder in a small test tube over a lamp flame. The metal condenses on the interior of the tube, and a bright globule may be soon collected.

THE CENTENNIAL EXPOSITION.

We noted, not long ago, the excursion of the 4,000 employees of the Singer Sewing Machine Company to the Centennial. The admirable example thus set has been followed by other large employing concerns, and it is to be hoped that parties of working men will be despatched from all our great manufacturing establishments. Employers will find it directly to their interest to encourage these excursions, and to grant the men the necessary holidays. To examine the Centennial, even rapidly and cursorily, is to receive almost insensibly a vast amount of useful information. Besides, as we have already suggested, the advantages thus to be gained will be enhanced if the workmen are required to make some report of what they have seen relating to their own trade, on their return. A suitable reward might be offered for the best report, and thus many might be induced to observe more closely than they otherwise would. Those who stay at home might be constituted the jury for decreeing the reward, and thus, being obliged to hear all the reports, they as well as the excursionists will share in the advantages of the journey.

Of course, the hot weather has kept away large numbers of people from Philadelphia. Still the attendance is reported to be large and to yield remunerative returns. This certainly is encouraging, as no one would have been surprised had the receipts fallen off seriously during the heated term. The rush will probably begin about the first of September; and from that date until the Exposition closes, the buildings will be thronged. Those, however, who saw the grounds just before the present hot weather set in, probably saw them at their best, as the vegetation has been sadly injured by the drought, and the asphalt pavements, becoming melted, have lost their smooth surface.

As a market, the Centennial as proved a great success. Our people have bought out whole foreign departments, and in many sections it is hardly possible to find an object not ticketed "sold." The foreign buyers of American goods have likewise purchased liberally. The New England exhibitors of cotton and wool machinery have found some good customers in the Brazilian staple and fleece displays. The *Boston Commercial Bulletin* reports that probably two large mills, from Yankee plans and Yankee fittings, will be built in Brazil. Over a hundred and fifty thousand dollars worth of pumps, engines, blowers, and drills have thus far been sold to South American buyers. Boot and shoe machinery is also, we learn, meeting a splendid foreign sale; and even in objects of art—notably furniture—the sale of a fifteen thousand dollar suite to a Parisian house shows that American art industry is by no means unappreciated. Those who have made a study of the business aspects of the Exposition predict an enormous trade in the fall; but it is stated that exhibitors manifest too great carelessness in selecting the persons who explain their exhibits. There seems to be almost a dearth of smart salesmen, while all such on hand are said to be succeeding beyond all expectations. There is one manufacturer who exhibits his own machine in a way that may serve as an example for general emulation. The device is a very ingenious safety lock for elevators, and under ordinary circumstances would probably be shown in the model. The manufacturer, however, decided to exhibit the invention on a full sized working elevator; and when the judges came to examine the device, he had everything in readiness. Entering the car, which he had previously loaded heavily with pig iron, he was lifted to a hight of about thirty feet; then he coolly reached upward and began to hack at the supporting rope with his knife. Consternation speedily became manifest among the judges. Some implored him to come down, that they were satisfied, and did not want to see him killed. The imperturbable inventor went on hacking at the rope, which suddenly parted. The spectators turned away so as not to see the rash man dashed to pieces; but instead of gratifying their anticipations, the elevator car was instantly caught, and actually jumped up a couple of inches above the marked point for its stoppage. From the expressions of the judges, that exhibitor may expect a favorable report; and as he adopts the same startling plan for attracting visitors' attention, it is needless to say that a crowd always surrounds his exhibit.

So much has been said and written about Japan that her neighbor,

CHINA,

through the general similarity of the exhibits, has come in for little or no attention. And yet the Chinese display embodies some articles as marvelous in their workmanship as the Japanese lacquers and bronzes. At the entrance of the section is erected a large massive door of a temple, curiously ornamented with Chinese characters and oddly contrasting colors. The same general design is followed in the show cases, which have roofs like pagodas, terminating in graceful peaks and spires. In lacquered ware products, Japan excels; but in the more minute arts of carving and inlaying work, the Chinese are the superiors. Certainly, some of their carvings in ivory and mother-of-pearl reveal a patience and delicacy of touch nothing short of marvelous. Commencing on the west side of the section, the attention is attracted by a large display of ancient vases and ornaments. Some of these are of immense age; and they are of the highest value, as showing, probably, the earliest efforts of Chinese art. The designs, which are strikingly original, consist of strange looking birds, and animals, and natives engaged in various occupations. There is one pair of enormous vases, ornamented with handles fashioned to represent elephants' heads. On the eastern side of the section are shown handsome screens, elaborately ornamented with pictures of Chinese ladies in beautiful costumes woven in silk. Near, there are cases of curious ornaments cut out of ivory; and adjoining are superb displays of porcelain. Then come specimens of wood carving. By this means, the Chinese give us an idea of their habits and customs, as there are a large number of curious groups, in processions and ceremonials, in which all the figures are carved with the utmost minuteness. There is a multiplicity of carved picture frames, brackets, doors, cabinets, and like objects. Perhaps the most prominent article in the entire display is a bedstead made of fine grained wood, every inch of which is covered with carving of the most wonderful delicacy. The canopy is semicircular, and arches from foot to head. It is made of the finest and thinnest silk—a mere film—and on this are embroidered in silk the most exquisite designs in birds and flowers. It can well be believed that the bed represents the labor of years. Another bedstead, less elaborately ornamented, has been sold for $1,600. There are, beside, numerous exhibits of work and jewel boxes, made of highly polished and costly wood, together with card and chess tables of every form, inlaid with ivory and mother-of-pearl. The specimens of silks are of the finest quality. The colors, especially orange, maroon, and green, are exceedingly lustrous, while the parts that are embroidered exhibit exquisite skill. The rear portion of the Chinese section is filled with china and lacquered ware in endless variety. The department is always full of visitors, and the people seem never to tire of looking at these evidences of the strange civilization of the Orient.

New Caledonia Nickel.

Through the explorations of M. Garnier, New Caledonia now yields a green mineral, consisting of hydrosilicate of nickel and of magnesia, which appears destined to acquire considerable industrial importance. The mineral is found in the midst of very abundant masses of serpentine at various points of the island, and in association with euphotides, diorites, amphibolites, and other magnesian rocks. Sometimes this combination of nickel shows itself on other rocks in the form of a fine green covering; at others, it penetrates the rocks and colors them intensely; and again it is found in both filaments and in nodules. As might be expected, the nickel is accompanied by iron, cobalt, and chromium, almost invariably. The metallurgical treatment proposed by MM. Christophle and Bouillet is quite simple. The material dissolved in hydrochloric acid is precipitated by lime under form of a nearly pure nickel oxide. Reduction by charcoal easily gives a metal 99 per cent fine, incomparably purer than that obtained from the sulphuretted and arsenious ores hitherto employed. It is not, however, in the free state that the metal is best used. As combined with copper in the proportion of 15 per cent nickel against 85 of copper, a white malleable and very fine alloy is produced, excellently suited for all metallurgical manipulations.

A rod of brickwork = 272 superficial feet, 1½ bricks thick, or 4,350 bricks average work. One yard of paving = 36 bricks flat or 52 on edge. There are 384 bricks to a cubic yard, and 1,000 bricks, closely stacked, occupy about 55 cubic feet.