

LADY BICYCLE RIDERS IN BATTERSEA PARK, LONDON.

"BICYCLING is not nearly so much of a craze in England as here; and the reason therefor, as I figured it out after much interested investigation, is illustrative of a notable difference between the United States and England in athletic and sporting matters," said a wheelman who had just returned from a transatlantic trip. "Because of the superb roads to be found in every part of England, I expected to find the country simply overrun with bicycles. I soon learned that the sport had by no means the general hold on people disposed to exercise or athletics as it has here. It has taken a comparatively greater hold upon the women than the men, which is entirely consistent with my theory. The latter statement is amply confirmed by a visit to Battersea Park, London, where many members of the aristocracy may be seen riding daily."

"Battersea Park is across the Thames, and is not a great way from Westminster and Kensington, so that it is little wonder that it was selected by the leaders of society for the purpose of enjoying their favorite sport. Before the advent of lady cyclists the park was practically unknown to many of the inhabitants of the fashionable West End of London, but to-day the sight presented to view between the hours of ten and one of a fine day is really well worth seeing. The gentlemen ride in trousers instead of knickerbockers, and flannel or all-wool garments are conspicuous by their absence, while the ladies, with few exceptions, endeavor to make cycling keep pace with the fashion, for *crépon* skirts of more than ample proportions, balloon sleeves and hats of Brobdingnagian proportions are decidedly in the ascendant."

"One of the neatest bicycle costumes to be seen in the park is of golden brown kersey cloth; the skirt reaches to the shoe tops and is stiffened with haircloth to a distance of eight or ten inches, and it is four yards around. Leggings of the same material as the gown meet knickerbockers of light texture at the knee. The jacket is lined with cream white satin; under this is worn a white shirt waist or a perfect fitting white sweater. A golden brown hat with black quills, tan shoes, and white or brown gloves, and a bunch of violets finish the costume."

"Nearly all of the ladies sit far too low and carry their hands too high, but on the whole their appearance contrasts very well with that of American lady cyclists, who are found in London in considerable numbers during the season."

"During the past three months there has been an unprecedented exodus of America's fashionable people toward the summer resorts of Europe, and it is interesting to note the great number of wheels they have taken abroad to be used in touring in Great Britain and the Continent. No pleasanter way of seeing the sights can be imagined than to wheel from town to town over the magnificent roads of England and France. These American tourists are really missionaries for the American bicycle industry, for though our fashionable people will buy their wardrobes in London or Paris, they invariably take their American wheels with them."

In America wheeling is very popular among ladies, and a journal is now devoted to their interests. The *Wheelwoman* is published in Boston, and it states that it is devoted to the interest of those who ride the wheel and to the conversion of those who do not."

The bicycle craze has even struck the women of the South and promises to take as complete possession of them as it has of their Eastern, Western and Northern sisters. Richmond women were the first in the South to take to wheeling, and several prominent society women have organized a club modeled after the exclusive Michaux Club, of New York. The Michaux Club is composed of many prominent members of society and they ride under cover during the winter. In Brooklyn the Riding and Driving Club is about to make a large addition to their palatial club house and riding academy to accommodate the members who are cyclists."

On August 20 the Knickerbocker Club, of New York, took a run to Mason's Hotel, on the Brooklyn cycle path, and the occasion was the inaugural ball of the club, which was composed of feminine bicyclists who favor rational dress."

The eighty lighted cycles presented a pretty appearance. The bloomer costume prevailed among the ladies."

We are indebted to the Illustrated London News for our engraving."

MANUAL AND SENSE TRAINING. THE GREAT PROBLEM IN EDUCATION.*

By PETER T. AUSTEN, Ph.D., F.C.S., Professor of Chemistry in the Polytechnic Institute, Civil Service Examiner in Chemistry for the City of Brooklyn.

In a recent lecture on the subject of "Science Teaching in Schools," I endeavored to explain how important it was to train the young in observation. I claimed that in no way could this necessary training be given them other than by the study of physical science, and endeavored to show that no matter how much drill a child might have in arithmetic, history, grammar and languages, its full powers would not be developed unless it were taught physical science, and that, too, not by books alone, but by actually studying the objects themselves, and by producing and observing the phenomena. I said that all children, without exception, should receive the elements at least of a scientific education, and I also maintained that if they were not taught the elements of science, they would pass through life unable to draw upon a considerable part of their intellectual resource. No one who is a teacher, and who is accustomed to study men in their progress through life, can fail to be deeply impressed by the excellent results which follow where science has been properly taught in the schools; and on the other hand, by the flaws that are observed in those in whose education science has not taken its proper position."

To a visitor from some other world how absurd it would seem should we say to him, "We teach our children how to spell words of which they know not

the meaning; how to write, but not how to produce ideas about which to write. We teach them dead languages, and do not give them a working knowledge of their own tongue. We teach them about the past and its history. But concerning the material world in which they live, move and have their being, and on the exact knowledge of which their chances of success and happiness in that world will in large part depend, we teach them little. Even when they grow up, they know hardly anything about hygiene, ventilation and sanitation. The working of their own bodies is a puzzle to them. They don't know what to eat, or drink, or how to clothe themselves. They are sent naked and unarmed out to fight their way in a world of matter and force; ignorant of the pitfalls on every side of them, of the temptations that may allure them, and of the punishment to others as well as to themselves that will follow their misdeeds."

In such a world one needs more than a knowledge of history, arithmetic, and language. One needs sharp eyes which see aright, quick ears which hear true, trained and nimble fingers to execute the commands of the mind with accuracy and dispatch. A practical acquaintance with material things is necessary and adequate knowledge of the causes of their phenomena, so far as it is possible for one to know them. I do not undervalue book training. On the contrary, I say the youth must study books and understand them. But as the child grows, it gets its information and education through its senses. If these senses are not well trained, the progress of the possessor will not be satisfactory. Education by books is good, but it is not everything. From books one gets facts and information; but not the power to observe for ourselves, to test the accuracy of the information, to compare, to judge, to reason. The reader of the book may be of less value to the world than the book, for the book is permanent, easy of access, and useful to many, and that is more than can be said of the ill-trained reader. The fully educated man should be not only a reader of books; he should observe enough during his life to be able to make a book if necessary."

It is not, then, to make scientific investigators out of the young that I advocate a thorough course of instruction in science in schools, but to train and educate their powers of observation, judgment and reasoning. I say more than this, the training and education cannot be given in any other way. Quite apart from the consideration of mental training by science teaching, it is necessary that one should know something about physical science if one is to get any real satisfaction out of this life. No one will deny that some knowledge of the material things and forces is necessary to success and happiness, let alone the necessity of avoiding accident, disease and distress. How little do most people know of these things! How seldom do we find well ventilated rooms, good sanitary regulations, proper hygienic house construction. The visitor from the other world might reasonably ask, "Where do your people learn about themselves, about the world of which they are factors, about their habits of life, principles of morality, and right relations to each other?" To which we might answer, "By hard knocks, by finding that life is intensely earnest, by failure; too little, alas! by success." We might point, also, to the dark shadows that these words throw, and which cover so many broken aspirations, dead feelings and lost hopes. There is the battle field on which we rushed with colors flying, waving our swords and blowing our penny trumpets, until the "dark tower" echoed back the feeble din. Then came at us creatures that we knew not. Huge beasts, crawling reptiles, stinging gnats, and rough men with jagged clubs; they struck us and bit us, broke our swords, split our penny trumpets, trampled our colors in the mire; until disheartened and disabled, we crawled away on sore hands and bruised knees as best we could. Aye, and some stayed on the field. Then turned we back and asked of those who sent us out to do battle, "Was it fair, was it just, not to tell us of these foes and dangers?" But those who sent us answered not."

It may be urged that more bluster is made about the matter than is needed; that after all people get along on the whole quite well, and that education will adapt itself to the wants of the people. This, however, is not so. In the first place, people do not know what they want, and not knowing, do not as a matter of fact get along well. It is only those who study the subject that see where the trouble really lies."

The reports of Dun's Mercantile Agency show that men do not succeed as well as they might. In 1877, investigation showed that \$1,800,000,000, or 88 per cent., of the capital reported as invested in 200 of our railway companies, was wholly unproductive to the investors, and the greater part was wholly lost to them. "The actual shrinkage and loss to somebody, on the full value of railway investments in the United States, had been fully 50 per cent." Such an exhibit proves that "in the projection, construction and management of the railway investments in the United States, there has been gross incompetency." In 1870, 50 per cent. "of the wholesale merchants doing business in Chicago had failed, suspended or compromised with their creditors." It has been said that not more than three merchants in a hundred, "who embark in trade end life with success." One writer says that nearly all merchants fail about once in twenty years. Why does the average man fail in business? I answer, he fails for the same reason that I can't speak Hebrew; I don't know the language; and he is ignorant of the facts, principles and causes involved in business. Why does a certain man succeed? As a rule, because he understands the business. It may be said that some men are lucky. Men may make what are called lucky strikes, and pick up nuggets of gold; influence, social position, and accident will do wonders, I admit; but this does not continue. Unless the lucky man has ability, knowledge and energy, his luck will not last."

I have referred to the failures of men. How about the women? Study the statistics of great cities; visit the tenements, and ask if it were not better that some of these struggling, despairing, wretched feminine failures had never seen the light of day? Could a man who had been brought up in a country town undertake, off hand and without experience, to sail a ship in rough weather? He might get ahead on a clear day, with a kind wind to fan him along, but how about the cyclone which he could not foresee? The illustration represents the average boy or girl leaving school

and college, and taking hold of real life. They don't know how to paddle their canoes, let alone the handling of a big ship lashed by waves, bumped on hidden sand banks, punctured by submerged crags, beaten by wind and sleet, and lost in darkness. They can't read the barometer, they don't know the signs of the weather or the leeway that the ship is making. They will dawdle on the after deck and read dime novels when the typhoon is grunting in the distance and will soon turn the ocean into a devil's caldron of swirl and screech, and toss their ship over and under the spume and swash like a chip."

It is the mind, carefully educated in realities, that must then come to the rescue; a clear head, and firm hands to hold the wheel. Such a mind commands the forces of nature and makes them obey like well-trained children."

I will go farther, I will leave business and take ordinary life. I say that the average man and woman is a failure. I don't mean every one, I mean the average. Many a one knows it in his heart of hearts that this is the case. Your hopes have not been fulfilled, you are not what you hoped you would be. Your work is mostly done by will power, not by love. You haven't what you want, you don't want what you have. You are a clerk, you want to be a musician; you are a musician, you would rather be a writer; a lawyer, and wish you were a machinist; a teacher, and you would be a preacher. The wife you want you cannot have, the one you have does not want you. You would be this, that, or something else, but you don't know how to be it. So you put Duty on the altar and worship it, and in fact that is about all there is for you to do. I am not a pessimist. Far from it. I simply note what I see about me, as a conscientious observer should do. It is a great thing to be able to see things as they really are, but it is about the hardest thing to do that there is. The average man is not properly educated for the work that he really has to do in this world, and on the successful carrying on of which his efficiency, success and real happiness will depend. To put it more concisely, the average education of a man does not adjust him to his environment. As regards the education of women, the education usually given does not fit them for anything of particular value. In many respects women are potentially equal if not superior to men as factors in our civilization. Pedagogically speaking, they are magnificent possibilities, but rarely practical realizations."

Aside from the knowledge that can be obtained from books and words, that is by printed and oral instruction, and this should include not only printed words but diagrams, pictures, etc., instruction must be given by things themselves. An education must be given in material things, and that can only be given by actually handling them and working with them. Here let me guard against a very common misunderstanding of this subject. Even men of high position in educational circles sometimes curiously misapprehend the idea and object of manual training."

Manual training does not necessarily mean a special industrial education. But this education is of great importance in the growth of a nation such as we are. The industrial schools, wherever they have been established, have done wonderful work. Hundreds, yes, thousands, of young men to-day are actively engaged in remunerative industry who owe their entire education to these schools. No city should be without them. Every city should have these schools, where boys may learn machine work, plumbing, carpentry and the trades in an efficient and practical way, so as to be able to go out and make their living by their hands. How else can a young man learn a trade to-day? If a wealthy man wishes to aid a town, let him found a trade school. He will find that it will not cost so much; he will find others who will assist; and it will not be many years before the institution will be one of the most powerful factors in the civilization of the town."

Indeed, such small ferments can be started without much difficulty and at small expense. A lady friend of mine tried the following experiment: In a low quarter of our town there was a very low set of bad boys called the dock gang. They were a perpetual nuisance, and, as they were growing older, promised to pass from boyish hoodlums into dangerous criminals. They stole, set fire to sheds, drank what they could get, smashed windows and in every way showed steady and ardent progress in criminal education. This lady thought she would try an experiment. She hired a room in that quarter of the town, had it cleaned, painted and papered, and placed a placard on the door announcing that it was the "Whittling School." She bought a dozen good, strong jack knives, several blades and of the best quality of steel, several oil stone slips, an oil can or two, and a plentiful supply of wood. She got the names of the boys comprising the gang, and invited them all to meet her at the "Whittling School." Then she hired an ingenious joiner, and told him to show the boys how to use a jackknife in every way that a jack knife could be used. Well, the boys came; not one of them had even washed his face. They came to have fun and raise a racket. They stayed and forgot the racket under the influence of the jack knife in the hands of the ingenious joiner. The dock gang now disappeared, and in its place instead there was evolved a class—not a gang, but a class—of young men—not hoodlums any longer, but young men."

Out of a board, these boys seem to be able to make almost anything with jack knives. And the teacher, by the way, the joiner, carries his head quite high when he talks about his "class." The teacher—he will be a professor next, I suppose—soon found that the limit of the jack knife was reached. A kit of tools was supplied and the boys, or perhaps I should say the students, studied the plane, the chisel, the gouge and other implements. Further, some of these boys developed unusual skill and ability, and were able to go to work for a good living. Indeed, I hear that one of them has begun to invent."

So a jack knife turned the prospective criminal into a valuable man. Carlyle was right when he said, "Man without tools is nothing; with tools, he is all." There is a mistaken idea that, to accomplish anything great in this world, one must needs have a large sum of money, powerful adjuncts, influence and what not. But the fact is that individual effort is, after all, the surest force there is. Probe every great movement,

* A lecture given before the Bridgeport (Conn.) Scientific Society.

enterprise or undertaking in this world, and sooner or later you will find an active man whose brain and energy constitute its mainspring. So long as the individual is idle, reforms must be undertaken by corporations, but if the individual is active, reforms go of themselves. How many persons there are that could start and maintain a whittling school, a cooking school or some such useful institution, and run the whole thing, be president, faculty, instructors, all in one? A few months would give surprising results.

Let me return now to that most important distinction between manual training, which is educational, and industrial education, which is learning a mechanical art. Almost all the opponents of manual training in the public school start out from the false premise that it "has for its aim the education of children to be mechanics." Against this phantom there have been directed much wordy thunder and sarcasm, and there have bloomed many of what Huxley calls the "pernicious flowers of rhetoric."

Then it has been urged that manual training would break up home industry. This statement is false. The recent distribution of electric power is making home industry more possible than formerly. All such arguments are really directed against premature professional or technical training, which has nothing whatever to do with manual training. Note this distinction, for it disposes of most of the opposition at once. Those who wish to acquaint themselves with the many objections raised to manual training, and how they are easily disposed of, should read the translation of Seidel's excellent essay on industrial instruction.

Bacon said that "Education is the cultivation of a just and legitimate familiarity betwixt the mind and things." To which might be added by way of method, the injunction of Comenius, "Let those things that have to be done be learned by doing them." While education is now considered a far more complicated undertaking than in the days of these thinkers, their words are true and forcible. Manual training has not for its object the education of the young to be mechanics, but is intended to train the senses and the hands and the members, and through these the mind. It is the development of object teaching, the conclusion of the kindergarten. It is the education in the properties, working and applications of material things, and the training of both body and mind by the study of these material things. Our boys and girls have a right to the knowledge that belongs to our time, not alone to a portion of it, but to as much of it as they can master. We have no right to restrict the young to certain fields of knowledge, and to exclude others of equal importance. I claim that the first step in education and the last should be the education of the senses and the members. Not that the steady development of the mind should be neglected, far from it. I wish that half the so-called education of to-day did educate the mind, and practice and sharpen the ability to reason correctly, instead of simply wearing the memory, and making the mind a dumping ground of indigestible facts, from which the student can assimilate but little real intellectual nutriment. If history cannot be taught so as to let the philosophy of history appear, what is the use of history? Why coop up the children in the cemeteries of the past, when they can play in the flower-speckled gardens of the present? We are making plenty of real history in this country. Why spend years on a dead language, if good reasons cannot be presented for doing so? We can get the ideas of the old writers, if not their charm of form, from translations. Emerson was not astray when he advised their use.

The theory of manual training has been well expressed by Ham in his book on the subject. "In the process of education," he says, "the idea should never be isolated from the objects it represents: first, because the idea, being the reflex perception or shadow of the object, is less clearly defined than the object itself, and second, because joining the object and the idea intensifies the impression. Separated from its object the idea is unreal, a phantom. The object is the flesh, blood, bones and nerves of the idea. Without its body the idea is as impotent as the steam that rises from the surface of boiling water and loses itself in the air. But unite it to its object and it becomes the vital spark, the animating force, the Promethean fire. Thus steam converts the Corliss engine—a huge mass of lifeless metal—into a thing of grace, of beauty and of resistless power. Suppose the teacher, for example, desires to convey to the mind of a child having no knowledge of form, an impression of the shape of the earth; he says, 'It is globular.' The child's face expresses nothing, because there is in its mind no conception of the object represented by the word globular. The teacher says, 'It is a sphere,' with no better success. He adds, 'A sphere is a body bounded by a surface, every point of which is equally distant from a point within called the center.' The child's face is still expressionless. The teacher takes a handful of moist clay and moulds it into the form of a sphere, and, exhibiting it, says, 'The earth is like this.' The child claps its hands, utters a cry of delight, and exclaims, 'It is round like a ball!'

"This illustrates the triumph of object teaching, the method alike of the kindergarten and the manual training school. As the child is father to the man, so the kindergarten is the parent of the manual training school. The kindergarten comes first in the order of development, and leads logically to the manual training school. The same principle underlies both. In both it is sought to generate power by dealing with things in connection with ideas. Both have common methods of instruction, and they should be adapted to the whole period of school life, and applied to all schools."

In an address at the laying of the corner stone of the school for primary, superior and professional instruction at Paris, Jules Ferry, the late French Minister of Public Instruction, said: "We desire to enoble hand labor. We have written this motto in large letters upon our programme, and we have chosen the surest, indeed the only, means of securing the recognition of the nobility of hand labor, not only from those who exercise it, but also from society as a whole. We have introduced hand labor into the school itself. Believe me, when the plane and file are accorded their place of honor by the side of the compass, the map, and the text book in history, and when they become the objects of rational and systematic instruction,

only then will a great amount of prejudice die out, and much of the spirit of opposition vanish away. Social peace will find a place upon the seats of the elementary school, and Harmony, with her beaming light, will illuminate the future of the nation."

Seidel concludes: "Truly, if this has been declared by the leader of public instruction for a great nation, and if, as we see to-day in France, the word has become flesh, then this matter cannot be arrested by a few apt phrases of schoolmen, but with or without the mediation of official pedagogy, must make its way through the educated world." Ham says that "The true definition of education is the development of all the powers of man to the culminating point of action; and this power in the concrete—the power to do some useful thing for man—this must be the last analysis of educational truth." The idea is not new, for it will be found in the writings of Bacon, Rousseau and Spencer, and in the systems of Comenius, Pestalozzi and Froebel. Such a system of education may be called the natural system.

Kopp remarks, and the point is an interesting one, that in the ancient times, manual labor and work of all kinds were matters largely relegated to slaves, and were consequently looked down upon. Science and art were divorced. A high ideal or even a proper respect for scientific work or manual or sense training will rarely be given by classical study. Indeed, of those who study the classics only, but few ever find out what really caused the downfall of the ancient civilization. A classical scholar has too often a most thoroughly antique idea of what physical science really is. Neither does he understand or appreciate manual training and technical education, and what they are. He does not seem to understand the causes of action and change, nor grasp the real significance of what takes place about him.

Emerson said, "We are students of words; we are shut up in schools and colleges and recitation rooms for ten or fifteen years, and come out at last with a bag of wind, a memory of words, and do not know a thing. We cannot use our hands or our legs or our eyes or our arms." George S. Murrain put the matter more strongly. Said he: "Up to the day when I took my diploma, there had been, I may say, nothing in my education that required me to use my eyes, or any of my senses or perceptions, for any purpose save to read the printed page. I had been taught no knowledge, and no means of acquiring knowledge, except from books. Of knowledge at first hand, I had learned absolutely nothing. The whole habit of personal observation of the phenomena and processes of the material world was left out of our education entirely. That omission for myself, I unspeakably lament. History and literature I can to some extent pick up as I go along; but I shall never get that intelligent, sympathetic working knowledge of my physical environment for which the aptitude and instinct might have been easily gained when I was fourteen or sixteen. I was given, indeed, some of the keys to the riches of literature, but of things, I never learned the alphabet. I acquired no use of my perceptions save with my eyes to read the printed page, and with my ears to hear my instructor's voice." These are quiet and very significant words, not impatient ones. I believe that there are many men and women who can say the same. Understand that I do not decry the merits and worth of classical studies or of any study. I simply hold that they should not be given a greater prominence than they deserve.

Dr. Youmans said very aptly: "The human mind is no longer to be cultivated merely by the forms or arts of expression. The husks and shells of expression have had sufficient attention; we have now to deal with the living kernel of truth. Under the old idea of culture, a man may still be grossly ignorant of the things most interesting, and now the most important to know. Modern knowledge is the most perfected form of knowledge, and it is no longer possible to maintain that it is not also the best knowledge, for that cultivation of mind and character which is the proper (i. e. the highest) object of education." In another place he says: "The old method (of education) occupied itself mainly with the study of language; the new method passes beyond language to the study of the actual phenomena of nature. The old method has for its end lingual accomplishments; the new method, a real knowledge of the characters and relations of natural things. The old method trains the verbal memory, and the reason, so far as it is exercised, in transposing thought from one form of expression to another; the new method cultivates the powers of observation and the faculty of reasoning upon the objects of experience, so as to educate the judgment in dealing with the problem of life. The old method left uncultivated whole tracts of the mind, that are of supreme importance in gaining knowledge of the actual properties and principles of things which are fundamental in our progressive civilization; the new method begins with the systematic cultivation of those neglected mental powers."

I might quote many other authorities in a similar strain to show how deeply this problem of educating the young, so as to make them really competent to enter into the struggle of life, and be of real value in our civilization, is occupying the attention of thoughtful men, but these are sufficient to indicate the trend of thought on the matter.

Give us, then, fuller knowledge of the world we live in, both material and mental. Give the young a thorough training and education in physical science; and now let me repeat it, give them a good manual training as well.

Should girls have manual training? Why not? The inference is the affirmative. Let me say at the start that when I say the young I do not discriminate between the sexes. A girl deserves as thorough an education as a boy. I have read a great deal, studied a great deal, observed a great deal and experimented a great deal on this matter, and all the conclusion that I can reach is that if you exclude anything from a girl's education, it usually turns out that it was the one thing she ought to have had. In the laboratory I have taught both women and men; I cannot see much difference between them. I find very stupid girls at times; and the only objects which can compare with them at all are the stupid boys. Again I meet girls that are so bright that I can only compare them to bright boys.

I recollect the governor of one of our most prosperous States once wandered into my laboratory and was much interested in the explanation I gave him of how we taught the young men chemistry, how they had to make the experiments, observe and record the phenomena, and then pass by degrees into accurate work, using the balance and weighing down to the thousandth of a grain. It was all new to him; the boys working in their acid-eaten old aprons, the blackened ceiling, the remains of many a "bust" on the walls, the unearthly smells, the roar of the furnaces, the swinging needles of the balance, the quick handling of the apparatus; every action full of interest and energy. "It's just like old Squeers," he said. "Tell a man to spell winder, and then make him go and clean it." And when he left me he shook hands and said with great energy, "Why, you are a regular old Squeers!"

Now, how can this education in material things be given? What are the links between us and material things? What bridges the great gulf between the aboriginal savage and the civilized man? They are the hand tools, the ax, the saw, the plane, the hammer, the square, the chisel, the file, the knife and the awl. When automatic, they are machines, but the machine is only a materialized idea. These are the links between the man and the natural world, and if anyone of them is not there, the bond between the man and his environment will be just so much the weaker.

There may be some who consider these tools as not worthy of serious attention, and yet I think when the matter is carefully considered this opinion will not be held. The pen and pencil are not of more importance than these tools; in fact, they too might be called tools in one sense. The pencil expresses ideas in words or by sketches, while the chisel and the plane express ideas in wood. Here I repeat that I am not advocating manual training with a view to making mechanics who shall push the plane by the day for a living. Manual education is to give the power of expressing ideas, not by words or drawings, but by material things. The distinction is the soul of the whole thing. As Dr. Belfield well says, "Here is the mistake of those who would degrade a manual training school into a manufacturing establishment. The fact should never be lost sight of for an instant that the product of the school should be, not the polished article of furniture, not the perfect piece of machinery, but the polished, perfect boy. The acquisition of industrial skill should be the means of promoting the general education of the pupil; the education of the hand should be the means of more completely and more efficaciously educating the brain." Dr. Belfield also says that in his opinion, "one hour in the shop of a well conducted manual training school develops as much mental strength as an hour devoted to Virgil or Legendre." In this connection I will quote another authority, Mr. John S. Clark, of Boston, who draws attention to the fact that the schools educate automatically, training the absorbing powers of the brain, and failing to cultivate the faculties of assimilation and recreation, and neglecting almost entirely to develop the power of expression. He says, "Studying the functions of the brain, we find that in our educational purposes it may be likened to an organism with a threefold form of working, an organism with a power of absorption, a power of assimilation and recreation, and a power of expression, a giving out. The form or character of a brain is measured entirely by its expressing power, by what comes out of it. Examining a little closer, we find that the brain absorbs through all the five senses, while for expressing purposes it makes use of but two of these senses, or rather of but two of the organs of these senses—the tongue and the hand. The simple fact is that our education is not broad enough on the expressing side of the brain, that too much attention has been given to the absorbing side of this organ, that no adequate provisions have been made whereby it can discharge its power in work connected with the industries. A more perfect education will then be to give as studies, reading, mathematics, geography, grammar, history, language, physiology, literature, natural history, theoretical sciences, practical sciences. Then, as means of expression by the tongue, speech, and by the hand, writing, drawing, and the manual arts."

As matters now stand, the schools fit the student to some extent for certain professions, as law, medicine, theology, science, bookkeeping, etc. But the public school system does not, except in a few instances, fit the average boy for active work in the world. The vast body of mankind cannot be professional men, but producers of material things. They must work on the industries. A general education should then be an education not merely to educate a few for confined fields of work, but it should establish a broad and solid foundation, on which the boy's mind may build any kind of home it wishes to live in. Is he to become a lawyer or a preacher or a scientist? The manual training that he will have had in such a general education will be of as great value to him as to the boy who becomes a mechanic or a farmer. What is the average graduate of a high school fitted for? He can read, cipher, write and draw a little, but is he developed and trained in any way commensurate with the possibilities that are in him? How far has he been taught to know his own powers, to know what he is good for? Of the immense number of ways in which he can be of value in our civilization, how many has he been shown? If we compare a boy to a mine that contains more or less valuable metal, I should say that the school system does not develop the mine. It does not discover the lodes of precious metal, its shaft and galleries are not cut in the right directions, the little metal that is extracted is not refined, the processes are crude and wasteful, and not seldom the mine is allowed to fill up with water and choke damp. Again there are many mines, rich in precious metal, yes, and in gems, that our present pedagogical engineer is unable to work. He does not even get below the dirt layer, he fails to discover the treasure and to make it available to the world.

The introduction of manual training into the school system would of course involve a considerable expense, and means would have to be found for meeting it. But if it is a necessity, then it is our duty to the young to see that it is provided, for as I have said, the young have a right to the knowledge of their day.

We see to-day vast upheavals in our civilization.

Great sums of money are wasted by the laboring classes in strikes and other foolish attempts to impede or resist the inevitable progress of mechanical methods. The lower classes are ignorant and improvident, and hence poor. As Prof. Woodward writes: "The public schools have no funds to spare; salaries are still too low, and the demand for extensions outruns the supply." As Col. Jacobson has said: "The alternative before you is more and better education at greater expense; or a still greater amount of money wasted on soldiers and policemen, destruction of property, and stoppage of social machinery. The money which the training would cost will be spent in any event. It would have been money in the pockets of Pittsburg if she could have caught her rioters of July, 1887, at an early period of their career, and trained them at any expense just a little beyond the point at which men are likely to burn things promiscuously. It is easier and better and cheaper to spend our money in training good citizens than in shooting bad ones."

It might be argued that the courses of study are at present overcrowded, and that there is no time left for taking up any new studies. This was the cry raised when science first began to be heard from. It was said there is no time for it. But after a while it was found expedient to make time for it by cutting out other and less important studies. If it comes down to whether a boy has only the time to learn what he should eat in order to get the most life out of his body, or to learn to read a Latin poem, no matter how exalted its sentiments may be, I say the former knowledge is the more important, and if he cannot learn both, let him throw over the Latin. If the opponents of scientific education wish to fight the battle on the ground of time, they will get very badly worsted. If in the present schedules of studies there is no time for manual training, then some of the studies must be eliminated. That is a simple solution and a practical one. The present system of education may be likened in value to a certain man who bought a fine boiler, fed it with water, stoked it with coal, and kept up a high steam pressure for years, until the boiler finally wore out and was sold for old iron. But as he had no engine or means of utilizing his steam, it was a question among his friends as to what good he had done, or of what use was his well fed and carefully stoked boiler, since its power was not rendered available by means of an engine. He would better have spent the same money on a smaller boiler with an engine attached; producing less power, but making it all available. The subjects that stand in the way of manual training have got to go, just as those subjects that stood in the way of science had to go. The intellectual value of manual training is so great, however, that even if less time be given to certain other subjects, owing to the increased acuteness of the student's mind, as great, if not greater, progress will be made in them. Let that not be overlooked.

What departments should be included in manual training? The organization of the departments and the extent to which the work in each is carried will of course depend on the size of the institutions and the amount of the available funds. There is no doubt, however, that if a department for manual training is introduced in a school, it will grow rapidly and push its way against all obstacles.

First of all there should be the drawing room. Here both geometric drawing and free hand drawing should be taught as a means of expression. This branch of manual training people know something about, and can understand to some extent its uses. Says Mann: "The value of drawing as an educational agency is simply incalculable. It is the first step in manual training. It brings the eye and the mind into relations of the closest intimacy and makes the hand the organ of both. It trains and develops the sense of form and proportion, renders the eye accurate in observation and the hand cunning in execution. Drawing is a language—the language in which art records the discoveries of science. It is not German, it is not French, it is not English—it is universal. The face of the student exhibits vivid flashes of intelligence as the picture reveals itself under his hand. Each line is a word, an angle completes the sentence; with a curve and a little delicate shading we have a paragraph."

Then there should be the carpenter's workshop. Here are taught the properties, nature and applications of various kinds of woods, where and how the trees grow, how they are felled and transported; in fact, the history, science and uses of wood and the use of the tools used in working wood. All sorts of devices are worked in wood. "The lesson proceeds by the usual laboratory methods employed in teaching the sciences; the class learns the thing to be done by doing it. The students are at their best, because the lesson compels a close union between the then great powers of man—observation, reflection and action. No student seeks aid from another, because such a course would be impossible without the knowledge of the whole class. A feeling of self-reliance is thus developed, the disposition to shirk repressed, and a sense of sturdy independence encouraged and promoted."

Next in order comes the wood-turning workshop. As before, the student is taught the history of the art, the evolution of the lathe and its tools, the effects of these tools on civilization, how materials are worked on the lathe, and all the tools and mechanical operations pertaining to this art. Understand here, as heretofore, that "the true purpose of education is the harmonious development of the whole being. The purpose of this turning laboratory is to educate boys, not to make turners of them. In the midst of the whirl of shafting and wheels, with a keen-edged tool in his hands, the student no longer thinks merely of becoming an expert turner; he thinks of becoming a man."

Next comes the founding laboratory. Again the student is instructed in the history of this art, and he will find here, as in other arts, wide application of his classical studies if he wishes to go into the matter. The bronze castings from the ruins of Egypt, Greece and Assyria, the cast statue of Praxiteles, the brazen bulls of Babylon, the writings of Herodotus, the great bells of China and Russia, Vulcan, the God of Fire—why, here is material for real enthusiasm in the student for further knowledge of what has been done in the art he is now studying. The boy will forget his marks and dive impatiently into books for information. He wants to know; not merely to be able

to answer his teachers' questions, but to satisfy his own inquisitiveness. He studies the metals, their properties, how they are cast, how the moulds are made. I doubt if there is a better way to start up a real enthusiasm for classical history than to put students in actual work with the metals. He will get also an idea how "through all the early ages the brand and scorn of slavery adhered to labor, while the arts, the products of labor, were so often deified."

Next comes the forging laboratory. Here again is the course of instruction carried on in the same way as in the preceding departments; drawing, bending, welding, tempering, hardening and all the operations, tools and mechanical appliances of forging are studied.

Next and last comes the machine tools laboratory. This indeed is a wonderful place. The student is first educated in chipping, filing, and fitting, and then begins with the machine tool lathes, drills, planers, and all the innumerable appliances used in this work. He is dealing with great thought in metal. The automatic lathe works like an intelligent slave, and the planer runs back and forward with unerring precision. The student marvels at the powers that he has learned to command. He watches the tool do the task he has assigned it, and thinks what he may do one day. Such a boy will be a power in his community and in time in the world. This education has trained not only his hands, but all his senses. He sees exactly, he hears accurately, he can taste and smell with precision. His senses are keen, quick and alive. He observes rapidly and accurately. He does not misjudge. He picks out at once the valuable from the worthless. He knows his own powers, and his own weaknesses. Happy is he who has that latter knowledge; his senses have

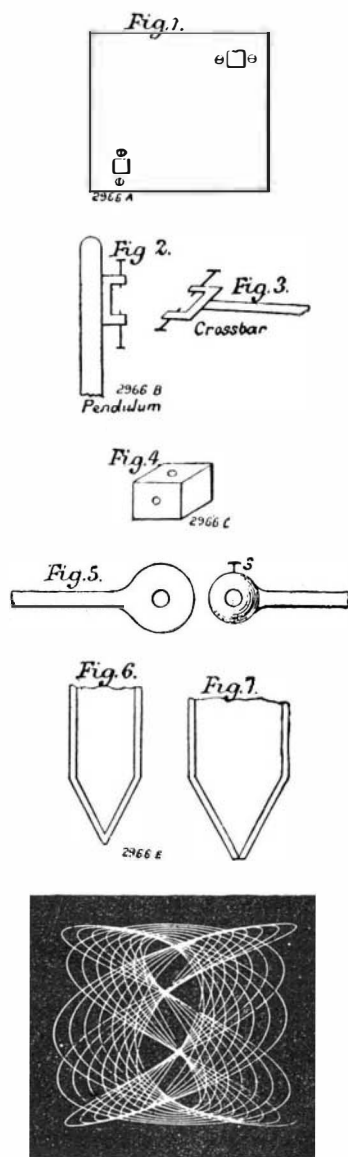


FIG. 8.

THE SYMPALMOGRAPH.

been thoroughly trained, and he goes forth a man equipped for work. The chances are enormously in his favor, that whatsoever he may undertake will be a success, whether he becomes a mechanic, an artist, or a preacher.

And as to practicality, I am not spinning cobwebs. I am advocating nothing that is not done, and that too with success. The St. Louis Manual Training School, the Chicago Manual Training School, the Toledo Manual Training School (for girls), the Russian industrial schools and many others can easily be cited.

The more one studies this subject, the more important does it appear. What is demanded, and what must eventually come, is an education that shall develop every power, and train every sense and member. The individual must be adjusted to his environment, and unless his senses are trained to act intuitively to their utmost efficiency, and his ability to express and to produce his idea is developed to its fullest extent, I maintain that the young man will never attain his maximum efficiency in the world. The demand and the opportunity for a man who can express ideas only by his pen, and who is acquainted with things only by reading about them, is daily becoming less. His chance of success will never be as great as he has a right to expect; he will never be of the value to the world that his organization of body and mind would enable him to become if he is properly and thoroughly educated. In the long run the average man takes out of life not more, if as much, as he puts into it. The less a man puts into the world, the more will he be dependent on the work of others. The inefficient must be supported by the efficient. We must train and educate the young so that they may not be able only

to absorb knowledge, but be able also to express, apply, produce and make knowledge. In other words, they must be educated so that their powers of absorption and expression shall be developed to the utmost, and so that their entire value may be realized by the world. So far as our knowledge makes it possible to do it, manual training is intended to fit them for actual life.

THE SYMPALMOGRAPH.

By CHARLES E. BENHAM.

THERE is nothing in the least new about the compound pendulum, of which so many forms have long been well known. There is no need, therefore, to recapitulate the history of the invention and its many developments, nor even to describe what is so generally familiar. At the same time a few practical hints upon the construction of a simple ordinary form may be of interest to some of your readers who are, perhaps, not in possession of information which will enable them, for a small sum, to construct the instrument for themselves. Without any further preface, therefore, I will give such particulars as are necessary, and trust they will enable those desirous of experimenting with the sympalmograph to do so.

The table must be not less than 3 ft. 6 in. high, the top being 2 ft. square. The legs must be fairly stout, and joined by crossbars to insure steadiness. It is better if the legs can be screwed to the floor to secure further stability, and care must be taken that the crossbars are not placed so as to come in the way of the pendulums. Near to two corners of the top, diagonally opposite each other, the holes are cut for the pendulums, for which may be utilized good straight broomsticks. Six or seven inches from the top of the stick a steel knife edge is thrust through at right angles to the rod, and the projecting ends of this rest in the bevels of screw heads filed V-shape in the center and screwed into the table on two sides of each of the holes in the table top. The screws should be placed so that the two pendulums swing at right angles to each other, Fig. 1.

Along each broomstick glue a tape measure to mark the height of the weights in inches, the scale starting from the level of the knife edge. The weights are easily cast in lead, and may be cylindrical, with a hole in the center a trifle larger than the broomstick, so that they may slide up and down on it. A hinged iron collar, with horizontal top and thumbscrew to make it clamp the rod, acts as a rest to support the weights at any required height.

The above instructions having been carried out, we shall have a table with two heavy pendulums swinging at right angles to each other, and capable of adjustment to various lengths so as to give different periods. The heavier the weight, the longer, of course, will the pendulum keep swinging. Eight or nine pounds will suffice for our purpose. We have now to record the combinational results of these motions.

For this purpose we must unite the projecting top parts of the pendulums by two jointed crossbars. These must be fitted with universal joints, of which there are several forms. In my own case the attachment to the pendulum is made with an arrangement of which the following is a description:

Two pointed screws set in brass are attached vertically to the side of the pendulum (Fig. 2), and a similar arrangement is fixed horizontally to the end of the crossbar (Fig. 3). The four points are made to nip four sides of a little brass cube slightly punctured to receive the points (Fig. 4). In this way we have a simple universal joint adjustable by the screws, and subject to very little friction. The other ends of the crossbars are jointed together, one terminating in a pierced brass ball and the other in a concave cap, also pierced, and fitting on top of the ball (Fig. 5). Through the pierced ball the pencil or pen is placed vertically, and held tight by the screw, s, and the apparatus is then nearly completed.

The making of the pen requires a little practice, but the knack soon comes.

Draw out a glass tube of small bore but thick glass to a fine point, seal this point in a flame, and the appearance magnified will be as in Fig. 6. Grind now the point on a hone with water until the hole is just reached, examining the tube with a magnifier from time to time as the work proceeds and grinding carefully to prevent going too far. At last a tiny aperture will be reached, and the appearance magnified will be as in Fig. 7.

Small as this hole is, the line which the pen will describe when full of ink will not be a fine one. It will be as thick as the glass point, not as the hole. We must, therefore, carefully grind away the sides of the point on the hone till our pen is sharp. Of course, this is done without enlarging the hole.

Now put the pen point into a bottle of Indian ink, or any limpid colored fluid, and draw the liquid into the pen by suction, and fix it vertically in the hole in the brass ball. But it should be first mentioned that each crossbar must be counterbalanced by a projecting bar stretching out behind the pendulum, with a little pan at the end for weights, so that the pen may fall as lightly as possible on the paper. To the bar with the ball must also be attached a thread leading up to a catch fixed above the table, and suspending it until the catch is unloosed, and the pen allowed to fall on the paper. This arrangement is easily made with a little kind of gallows rising from the side of the table. One of the pendulums is, of course, kept at a fixed length—39 in. is convenient, as being approximately the length of a seconds pendulum. If the other is at 39 in., the two together describe the spiral figure of unison, and by raising the weight we find by experiment the distances which give us period ratios of the small numbers—2 to 3, 4 to 5, etc. We shall not be able to shorten our pendulum sufficiently to get the ratio 2 to 1, but by placing a heavy weight on the top of one pendulum, on the principle of the metronome, we can make it oscillate very slowly, and can then get ratios up to 1 to 7.

A fine needle in a cork fixed in a glass tube will give us more perfect figures than a pen if we trace on smoked glass, previously smeared with rectified petroleum. Brush the petroleum over the glass, and then hold carefully in the flame of a candle, moving the glass about to prevent the heat breaking it. In a short time we shall have a surface of dry carbon per-