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Rose Technic Staff
Rose-Hulman Institute of Technology

THE ROSE TECHNIC.

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THE announcement of the change in the division of the Institute year to the extent of holding a full set of examinations at the end of the winter term, was not entirely unexpected. It has been surmised that the increasing number of exemption examinations and long quizzes which have year by year been set just before the spring vacation would lead, eventually, to such an arrangement. And, indeed, this plan would seem to be far more logical than that hitherto in use. Under this plan the school year was divided practically into two terms, the second of which was just twice as long as the first. And, contrary to the scrupulous mathematical care with which grades and marks are usually determined, by calculating the moment of each subject according to the time devoted to it, thus ensuring accuracy to the tenth of one per cent, the single term was put upon a par with the double one. This was manifestly incorrect from the mathematical side and in some degree unfair to the student but to just what extent would be hard to determine.

NOW that the Athletic Association has arranged with Mr. F. C. Barnes to conduct a special Polytechnic class at the city Y. M. C. A. gymnasium until our own fine new building shall be ready for use, we can not urge too strongly upon all who expect to do any athletic work next spring, the great advantage of beginning training at once and pursuing it steadily until the weather will permit outdoor work to begin. It hardly needs any argument to show the value of such preliminary indoor work, but it is too often apt to be neglected. We do not wish to be understood as intimating that the class is intended only for those who aspire to supremacy in certain events on the athletic field, or that it is they who will reap the greatest benefit from it. Far from this. The supreme aim of the best modern systems of physical culture is to provide a means for building up and developing the physical nature of the average man in the every day walks of life. Such a man is not an acrobat nor an athlete and never expects to be. But the nature of his daily work has been such as to deprive him of the exercise necessary for complete physical health and strength, or perhaps has had a tendency to one sided or irregular development. It is the result of such deficiencies or irregularities which the gymnasium seeks to correct, with the constant ideal in view not of the professional athlete, but of the well rounded, symmetrically developed, healthy man.

In order to fulfill this end, then, the scheme of work adopted must of necessity be simple in nature. Yet it can be and is made interesting enough to be attractive without introducing features whose difficulty would tend to discourage the inexperienced beginners. And the conclusion has been more and more forced upon those who have made systematic gymnasium work a study that it is such simple comparatively easy movements or drills that are of great use in body building rather than the feats of skill which in

the minds of many are always associated with the term, "gymnasium work."

We believe that the work which will be given to the Polytechnic class to which reference was made in the beginning, is to be of the nature mentioned. We would, therefore, heartily encourage all students to enter the class, irrespective of any aims in the way of athletics, feeling quite sure that the slight expense in the way of time and money will be amply repaid in the pure gold coin of good health.

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ONE of the most important elements in the designing of a machine or structure that is to be placed upon the market or enter into competition in the business world in this day of intense competition is its cost. The successful engineer or designer is brought to a vivid realization of this fact from the eternal persistence with which it is forced upon him on every hand. And though indeed his sense of the artistic or of the beauty of mechanical perfection sometimes revolts at such seemingly hard restrictions yet the fact must remain as long as the wheels of business bear the stamp of the mint.

What wonder is it then that the college graduate entering for the first time into the struggle with the busy world, his head still ringing with integrations, radii of gyration, coefficients of all sorts and descriptions, and so on, should be startled, when almost at the first turn he runs up point blank against the question, "What will it cost?" He looks in vain for some formula or process which will give him the required result. For the problem scorns formulæ and refuses to be subject to any mathematical process however intricate or searching. The only school which teaches successfully the method of solution is that of experience.

Much fault has often been found with technical or engineering schools in that they seem to neglect almost entirely this very important element in the training of an engineer. This neglect is not so complete as it might appear at first glance, but true it is that the problem of dollars and cents does not occur on every hand in the work of the school, with the continual recurrence that characterizes it in the active work-a-day world. But is there not some reason in thus giving such a necessary element of engineering education a minor place. The school of experience not only, as has been said, teaches it much more thoroughly than any other can hope to do, but she teaches it also much better than she does some other branches. It is therefore wiser, perhaps, to give most of the students time to these other branches of his training, leaving the greater part of the instruction in what may be called the science of estimating to his post graduate course in actual business.

However, the argument is by no means made that the subject should be entirely neglected in technical schools. In fact these remarks have been suggested by a statement made by President Mees that a definite effort would be made in the immediate future to give greater prominence to instruction in the estimating of the actual cost of machines and structures designed by students, especially in the work of the Senior year.

In order to form a check upon such calculations and give them the value of being up to date, prominent manufacturers have been asked to furnish connected price lists from time to time. These will be kept on file for reference.

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SINCE the present Junior class has made no effort whatever in the direction of publishing a class souvenir volume, it is evident that for the present the term "college annual" as applied to "The Modulus" is a misnomer. This is to be regretted for a good many reasons. How often does an alumnus, of almost any college, refer with pride to a carefully preserved copy of the annual issued by his class as the most valuable souvenir which he has of his college days. It is a never failing source of reminiscences, a reminder of the faces of his classmates and instructors as well as of their characteristic faults and failings, forming the nucleus of many an amusing incident which he takes far greater pleasure in remembering than he does his Calculus and French. As he turns its pages he can imagine himself walking once again the familiar halls of the old

building dear with so many pleasant associations and memories. Thus the little volume forms one of the strongest ties which hold him to his Alma Mater.

As an opportunity for the exercise of ability along literary and other lines, and therefore as a means of education, the production of such a book has much significance. It calls for the highest degree of originality and ingenuity of which its projectors are capable. It is not hard to find instances where the life work of a student has been influenced, if not determined, by the efforts which he put forth as a labor, purely of love for his class and the school, in the preparation of the class annual.

A feature of the question of no small importance is the advertisement which a successful annual cannot fail to give to the institution from which it is issued. Doubtless many a student catches his first glimpse of college life in the pages of an annual belonging to some friend, and the ambition created or strengthened by this view leads finally to his entrance as a student.

Of course there are many difficulties which oppose the publication of an annual here at Rose. Among these the small size of the school is by no means the least. The class of '96 is somewhat inclined to boast of their success last year, but it is not to be overlooked that much of this success was no doubt due to the interval of three years since the publication of the first volume. The hope could scarcely be entertained that a volume of equal size could be put forth every year. If that class rivalry which says, "something better or none at all" could be overcome for a time, an annual of a size which could be maintained from year to year without too great an effort might be started. The question then remains, would not a smaller volume issued annually be better than a larger and more pretentious one issued only at intervals of several years? The balance seems to us to swing in the direction of the affirmative.

It is with the greatest pleasure that The Technic gives in another column an account of the organization of "The Rose Tech Club of Chicago." The action shows a most desirable fraternal feeling as well as a progressive spirit among the alumni resident in the Windy City. The club can not be otherwise than helpful to its eighteen charter members and also will be of great assistance to members of coming graduating classes whose lot may be cast in the great city.

The suggestion in regard to a popular abbreviation for the somewhat long and unhandy name of the Institute is a good one. "The Rose Tech" has the merit of being of sufficient brevity and leaves no possibility of mistake as to the institution intended. It would be well to consider the matter at the next general assembly, and, should the suggestion find favor with the student body, to adopt it at once.

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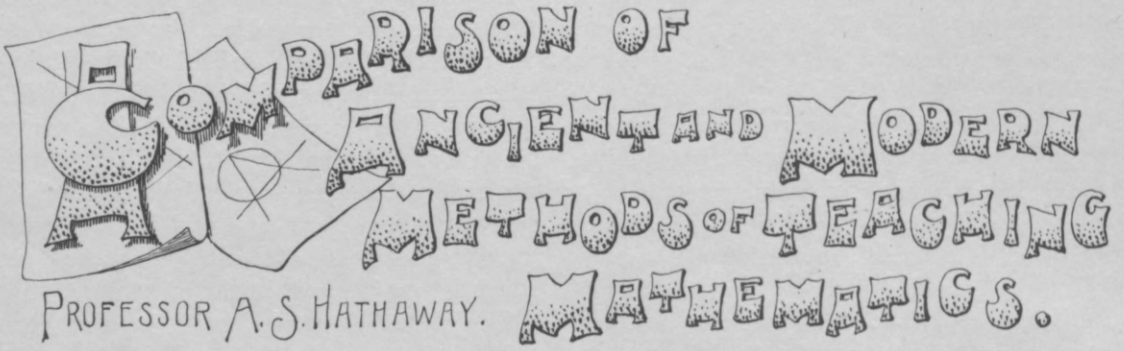
A slight change has been made in the editorial staff of The Technic since the last issue. To fill the vacancy caused by the resignation of Mr. H. D. Gerwig, '98, the Board of Editors have elected Mr. A. C. Eastwood, also of '98. Mr. Eastwood has entered upon his work with all his well known energy and thoroughness, and The Technic, as well as the Institute in general, may be congratulated upon his acceptance of the position. We ask for him all the courtesies and favors that have in the past been shown to the representatives of the paper.

* * *

We are pleased to note the renewed energy in the Orchestral Club. After slumbering for a term it has awakened and promises to resume its old time activity. As a student organization it is of too great value to be neglected. The remembrance of its highly enjoyable concerts in past years is still with us, and it is to be hoped that the club has a similar treat in store for the students and friends of the Institute this year.



Professor A. S. Hathaway.

By ancient methods of mathematical teaching, I mean those of Euclid, the best text book of ancient times. They consist in teaching an arbitrarily formed series of set propositions, arranged in logical order, which the student is compelled to follow blindly, without suggestions of principle or plan. The most important proposition of all, the key to a whole series of results, may present itself as a mere corollary to some proposition that is unimportant in itself. There is no distinction, no emphasis. Here are your axioms, here your definitions; now take this proposition, next that one, and so on. No examples, no explanations of the connection between this proposition and that, no determination of general principles that underlie them all. The student is presented with a skeleton that is valuable and necessary, but the ligaments and tissues, the nerves and arteries that give life to it are ignored.

This method still predominates in our elementary instruction. The propositions, the arrangement, and the point of view of mathematical instruction two thousand years ago are impressed upon the minds of our youth to the exclusion of the ideas and principles that have made all mathematical progress possible.

It may be properly urged that a logical development of mathematical truths is necessary for a complete understanding of those truths. It is also true that we have in the Euclidean order an extremely perfect arrangement for the logical development of geometrical facts. But the deep foundations of this logic, the necessity for the particular arrangement of propositions and the principles that are involved, are not understood by ten per cent of the teachers and text book writers of our day, much less by the students. We teach to our youths what was in ancient times almost the crown of knowledge, and rarely attempted, except by men of mature thought and intellect. It is to be expected that the logic that was suited to such intellects would often be too difficult for younger students to appreciate. While following, therefore, in modern times the objectionable model of Euclidean methods we have, in reality, neglected and perverted the only valuable feature of it, its logical arrangement. Instead of the rigid and symmetrical skeleton that Euclid has provided, modern authors have, for the most part, substituted a limp figure with its parts tied together with pink and blue ribbons, according to their own fancy, in all varieties and styles of plausible and weak logic, so that besides the failure to develop proper ideas and fundamental principles there is also a failure in sound logic.

The skeleton is necessary to the rigidity of the living figure, and it must be created. This framework is as much neglected in algebra as it is overemphasized in geometry, at the same time that the principles of algebra are inadequately developed and ancient. A skeleton is, however, lifeless without the tissues, the arteries, the nerves, that envelop it. It has been through the study of these environments of facts, in the discovery of fundamental principles and processes, and in the adoption of suitable notations and appropriate

A paper read before the annual meeting of the Indiana College Association at Indianapolis, Dec. 27, 1895.

modes of expression that all mathematical progress has been accomplished.

We can do no more than the ancients could do with their famous problems of squaring the circle, duplicating the cube, trisecting an angle. But we can tell them why their labor was useless. We know that a quadratic equation has two solutions, that a straight line and a circle determine two points, and that problems in one are interchangeable with problems in the other. Hence, we can tell the ancients that their problems were not solvable under their self-imposed restrictions to a straight edge and a compass, but that some of them were solvable by aid of other instruments, as they found out for themselves. The fact stated above, with regard to the relation between quadratic equations and the straight line and circle, was known to the ancients, but its relation to the problems in hand never occurred to them. They were not in the habit of thinking about the relations of things. It was just as useless in their minds as it is in some good people's minds, now, who think time is wasted that is spent in finding out just why 3x2 equals 2x3. We can say to the ancients, if you had only wasted your time in thinking about a principle that was well known to you, you might have developed the calculus with far less labor than you put upon these problems under self-imposed restrictions that precluded their solution. Newton is Archimedes born again. He has only changed his point of view. The method of exhaustions in the hands of Archimedes was identical in principle with the method of limits. Archimedes used the method to discover many remarkable facts. Newton studied the method, systematized it, named it, and then applied it to elucidate the principles and laws of nature and in one bound mathematical and phyical science leaped to an eminence that was before deemed impossible of attainment. Without the knowledge of principles that the calculus gives, and the ideas that it formulates, our present industrial progress would be absolutely impossible. This is as axiomatic as to say that some one had to find out that steam had expansive power before we could have the steam engine. Of necessity, knowledge must precede the application of knowledge.

Steiner is also the new birth of Apollonius, who wears the crown of ancient geometry. The principles of projection, the fundamental facts and theorems of homographic ranges, the existence of the principle of duality are all shown in the works of Apollonius. He confined his attention to the elucidation of facts which were arranged in logical order of development, and these facts cover about all that we know to-day in the geometry of the conic sections. But the expenditure of energy that would be required to master the works of Apollonius would make that subject still the highest of all mathematical subjects and a test of great ability. This was done away with by the introduction of analytical geometry; but if objection be offered that this is algebra applied to geometry and, therefore, a new process, we point to Steiner who in the realm of pure geometry of form and position, takes possession of the very facts elucidated by Apollonius, discovers a great principle and out of it develops the subject of modern geometry, whose power rivals that of analytical geometry, and whose usefulness in art and science is just beginning to be realized.

By studying the processes that Apollonius employed, by systematizing and connecting his facts, by emphasizing the principles that extended throughout the whole work, Steiner has enveloped the ancient skeleton with tissues, supplied it with nerves and arteries, and made it leap forth a new creation, endowed with life and energy.

The objections to ancient methods of teaching do not hold against the construction of a rigid and symmetric frame work. Modern methods, as exemplified in the advanced instruction of our better colleges and universities, are most critical and most thorough in respect to logic. Even the geometry of Euclid, marvelous as it is, does not escape modern criticism. The objections lie in the exclusion of ideas and principles that are of first Importance. There should be fewer set propositions, those being selected that are, so to speak, the keys to the whole subject. The Society for the improvement of Geometrical Teaching has

made a step in the right direction, but it is not long enough. Instead of having one complete book, the subject should be divided. Make, for example, an elementary book, that develops the important properties of the straight line and circle which do not depend upon the theory of parallels. Into this could be introduced the principles of symmetry, of duality, and of homologous constructions with respect to center and axis, with many simple problems and theorems as exercises. Such a book would teach the use of the straight edge and compass. This book could be given to students at an early age, and the use of instruments in drawing and demonstration would make the principles familiar and thoroughly understood. The next book would take up the theory of parallels and complete the subject of plane geometry, introducing the principles of proportion, similarity, and of homographic projection in general, and the general principles of construction with the straight line and circle. A long continued series of propositions should never be given. The object should be to inculcate a large number of elementary ideas, not too difficult for the student to comprehend, with the aid of many examples and problems and as few set propositions as possible. Logical consistency should be rigorously adhered to but not emphasized, trusting to the students' natural logical instincts to make the matter plain. In this connection, I may say that I have great faith in the natural logical instincts of students, and I have hardly ever found it to fail that where a class found great difficulty in comprehending a subject that it was due, in some measure or other, to obscurity and false logic on the part of the text book or on my part. It is only after repeated failures to understand while forced to learn, that a student arrives at the pernicious habit of accepting everything that is plausible and of memorizing those demonstrations and rules that should be seen and derived with little effort on the part of the memory.

We hear great complaint from college instructors of the lack of preparation in their entering classes. To my mind, after a careful consideration of the subject, it seems that it is not so much a lack of preparation as a lack of ideas and of power to think due to the kind of preparation that a student receives. It is notorious that if you give an entrance paper with explicit examples in algebra to work and definite propositions of geometry worded as in the usual text books that the majority of applicants will readily pass. On the other hand, submit a paper that requires the student to know something of the relations and principles of elementary mathematics, a paper that is easier in respect to the work that is required and the memory that is taxed than the regular text book examination, and the large majority will fail to pass, the exceptions being the few who have previously been accustomed to independent thinking.

The fault lies in our ancient methods of elementary instruction which are thorough in their way, but which exclude all the ideas and principles upon which modern mathematics is founded. Why should valuable ideas that a student can comprehend be ignored while he is taught to memorize what he cannot comprehend. The student is taught not to think for himself, but to memorize set ways of thinking that are for the most part antiquated. In algebra he is accustomed to have a concrete example submitted as a proof or a rule given as a reason, so that if you remove him from the region of numerical examples where perhaps his common sense has taught him something he will be just as likely to take $\sqrt{a^2+b^2}$ to be $a+b$ as anything else.

The essential difference between ancient and modern methods of instruction is that the first is empirical, the second rational. The empirical method is the natural method of the formative period of mathematical knowledge. As many facts are required as possible, and the principles that underlie the facts often escape attention or are ignored. But the propositions that were to the ancients a series of isolated facts are to us parts of a connected whole. We possess also a flexible and powerful notation that was unknown to them. It is said that the Greeks took a dislike to number because it was found that the ratio of the diagonal to the side of a square was not a commensureable number. It was more probably be-

cause they had no suitable notation. Arithmetical operations were extremely difficult, and as the letters of their alphabet were employed to represent numerals, anything like algebraic analysis as we understand it was impossible. It is obvious therefore that new and rational methods of teaching should be adopted that shall emphasize principles while not neglecting facts, that shall present the facts in logical order but in such a way as to emphasize the principles that underlie them. In geometry, for example, the principles of symmetry, homology, duality, projection, are as well within the comprehension of the average student as the principles of proportion and similarity. So is the algebraic principle of positive and negative which often brings into one proposition several different propositions and extends others. There is not a student of algebra whose handling of algebraic expressions would not be improved and the ease and rapidity with which he could do his work enhanced by a study of the fundamental laws by which the forms of ordinary expressions are changed without changing their values. The habit should also be acquired of attaching to letters the idea of value, so that the general demonstration of propositions and principles shall have the same concrete significance to the student that numerals might give. We have the evidence of De Morgan, one of the ablest of mathematical teachers, famous both for his powers as a successful teacher and an able investigator—a rare combination indeed—that there is no more valuable drill in algebra than the general demonstration of algebraic propositions and the practice of deducing special results from the general—limiting cases as they are called in algebra. To understand and do this the student must really think out the demonstration. He cannot memorize it and succeed. I have had students to say that they understood the general demonstration but could not apply it. I know at once, and so tell them, that they are mistaken, that they have memorized it, but that understanding it is a different matter. No general proposition is ever understood until it can be applied in many different ways to problems apparently different but involving the general principles of the proposition. The student is not so much to blame for associating the ability to repeat with the ability to understand. It is the way he has been taught. It is on this account that few set propositions should be given compared to the number of original propositions and problems that illustrate and exemplify the principles.

It is wonderful what a simplification of the subject is made by a few simple principles that are thoroughly grasped. We have all had experience in that; history teaches it. All progress in mathematics has come from the development of a few given principles and ideas. Archimedes and Appollonius rank as high as Newton and Steiner in point of intellectual vigor and mental ability. If the latter can, by an examination and development of the principles under which the former unconsciously worked, attain such vastly superior results, does that not indicate that there is an enormous difference in results due to the mere method that is employed independently of mental vigor. If we are to keep pace with the march of progress it will be necessary to devote less time to the mere memorizing of facts, and more time to the thorough acquisition of the principles upon which these facts are founded.

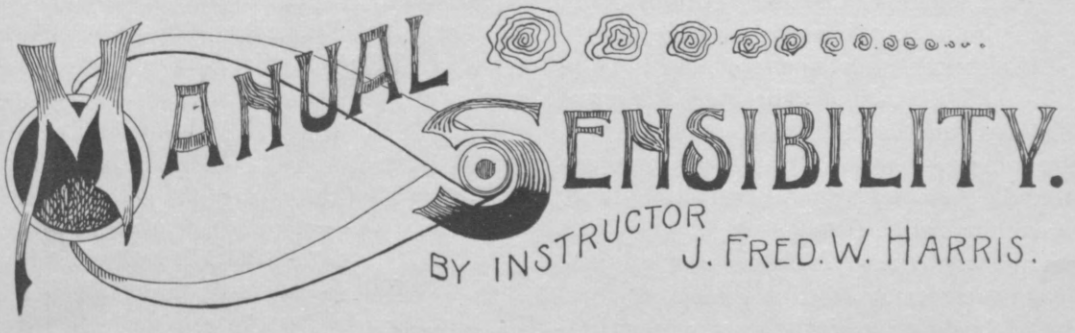
Euclid joined together the material at his disposal with marvelous skill and logic, and left to all time a structure whose architecture and solidity can be little improved upon. But its rooms are close and dark, its windows are small and let in little light, and give little opportunity for outlook. A thousand and one carpenters have built after the empirical plan of this ancient architect. It remains to find a modern architect or school of architects that shall create a structure suited to modern needs, fitted with all modern improvements. Uniformity in elementary text books in essential outline is desirable, absolutely necessary in fact, throughout such a country as the United States where students frequently go from one state to another, and there is constant intercourse and interchange of students among educational institutions. But we must not follow the ancient plan of instruction to secure this. Instead of erecting here a course of geometry that goes up

one step after another in a closed spiral staircase cut in solid rock, and then coming down again to take another course of the same character, let us have a broad and generous plateau, embracing all that is simple and elementary, in which the eager student can find material to excite his interest, and abundant food for thought, thus stimulating early his reflecting faculties. Then above this another plateau, equally generous that shall lift him to a higher level and a broader view.

What a waste of time there is in algebra, in drilling the student in the solution of equations, and impressing upon his mind that the great object of analysis is to find x. One of the greatest stumbling blocks to the student in his advanced study is the necessity of getting rid of this idea that is fostered by a thousand senseless and impractical examples. Instead of all these, why not bring into elementary algebra, some of the notions of graphical representation, some of the elementary ideas of calculus even, and bring into geometry some of the relations of algebra and modern geometry. Enlarge his vision early before it becomes set and crossed. Take off the blinds. Let the elementary student be taught early the practical power and scope of analysis and construction as applied to the progress around him. I believe that in this way we shall, with students of the same mental endowment as now, train up thinkers instead of memorizers and accomplish the work that is now accomplished in mathematical training with less effort and time. The natural result of this will be that every youth will be encouraged and fitted to do more thorough and thoughtful work in whatever department of industry his lot in life is cast.

WHAT IS MAN?

What is Man? A dust-made mill,
Shaped by Evolution's skill;
In her smoky shop, the earth,
Half in madness, half in mirth,
For a million ages she
Has been moulding, framing thee,
Mysterious machinery!
Strange invention, planned and wrought
To grind the grist of *life* and *thought!*
Relentless Fate sits, night and day,
Beside the mill, and grinds away:
Grinds out joy and grinds out sorrow,
Smiles to-day and tears to-morrow,
Love of honor, lust for fame;
Grinds out vanity and shame;
Grinds out pity, grinds out scorn,
A hopeful youth, an age forlorn;
Grinds out Reason's endless strife
With Faith, that dreams immortal life;
Grinds out doubt and prayer and trust
Until the mill, consumed with rust,
Returns its dust unto the dust. *Ex.*



One of the interesting things in manual training is the manner of handling tools and instruments as shown by the different students. Manual sensibility does not seem to depend upon mental ability; in fact, those having the highest degree of mental capacity are inclined to be indifferent to manual operations, or, if not indifferent, lack the ability to come in direct touch with the material world. This lack of manual sensibility is not confined, however, to those of high mental faculties; it is also noticeable in those of the lowest mental capacity.

The greatest sensitiveness to outward things is through the eye and fingers, and in varying degrees. In the writer's observations, those having the most sensitive touch and a fair eye for distances are the best workmen. That is, they are the most capable of handling tools and making the most accurate and delicate mechanism.

To persons of insensitive touch we apply the term "clumsy," and such are incapable of measuring distances or force, and are only fitted for the rougher class of mechanical manipulation; while those having sensitive touch always have the ability to measure strength used or force imparted with a fair degree of accuracy. The sensitive capacity varies in the sexes, there being probably among females the highest degree of sensitive touch and sight as confined to color and form. While the sense of touch in the male may be less, the sense of distance, size and amount of force applied is much greater.

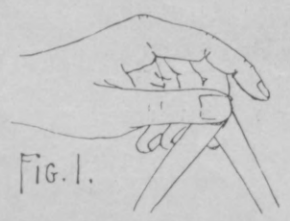
The sense of touch seems to be the most important one in manual dexterity, there being at least three distinct types. The first or highest type, is where contact is by the ends or balls of the fingers or thumbs with a very light touch. The second, is where contact is by the side or near the side of the fingers or thumbs with a heavier touch. The third, is where contact is by means of the muscular part of the fingers, the knuckles, and the muscles of the thumb (the Abductor Pollicis) or the muscle of the fleshy part of the hand (the Palmaris Brevis), with a heavy pressure.

Sensitiveness of touch does not seem to be dependent upon the nervous organization, as we find it in both extremes. Temperament seems to be a greater factor, the larger number of the "clumsy" type being found in those of a phlegmatic temperament, while the expert workmen are more apt to be of sanguine disposition.

The shape of the hand or fingers is not confined to any type, since we find the short, thick, or stubbed hand with large fingers and the thin, delicate-shaped hand with long, taper fingers, in all types. The various shapes of finger-ends, from pointed to flat, are also found in all types. The end of the fore finger generally ranks highest in sensitiveness, although in some exceptional cases the second finger is fully its equal where touch alone without grasping is considered. In the sensitive hand the thumb never covers the other fingers in grasping, while in the insensitive grasp the thumb is generally placed over the first two fingers if the object grasped is small enough to admit of it. One of the most familiar examples is the grasping of a hammer. The sensitive hand takes a grasp to suit the work to be done. For a light hammer, the handle is grasped lightly with the last three fingers and palm of the hand and

guided by the forefinger laid along the top of the handle, with the thumb along the side, or the balls of the thumb and finger are placed on opposite sides. In the insensitive hand, the same grasp is used for all straight-handled tools of whatever weight. This hand is always more calloused and is stiffer than the sensitive hand, which is undoubtedly due to the tight grasp and the greater abuse it receives by the heavy touch.

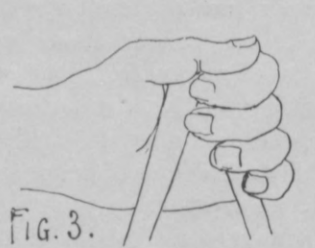
In close measurements with the usual workshop tools, the difference is perhaps more noticeable. The sensitive hand will determine the size within the one one-thousandth of an inch by means of the ordinary calipers, holding them by a light grasp of the ball of the thumb and first or second finger, Fig. 1. The insensitive will use



either two or three fingers and the thumb, and will take hold of the side, Fig. 2. In the worst cases, it will be grasped by the whole hand similar to a hammer handle, Fig. 3. and the measurement will seldom come within less than one sixty-fourth of one inch of the actual size. This hand is the one that screws up a nut until it strips the thread, or twists off a tap or set screw. The owner of such a hand will tell you, in the most surprised manner, that he only screwed it up tight and is confident that the material of which it is made is of an inferior quality. At one time I thought this was the result of pure carelessness; but, from the number of cases which have come under my observation and the similarity of their methods, I am of the opinion that there are some so constituted as to be entirely unable to obtain a clear conception of the strength required, or of the touch necessary for accurate work. The "clumsy" type are seldom able to form a clear mental picture of even the simpler forms of machinery as given in working drawings. They require some assistance in the way of perspective drawings, and in some cases

must *see* the mechanism itself before they can associate the parts in their minds. Generally, if not in all cases, the sensitive type will obtain a clear mental picture from the drawings, not only of the object itself and its relation to other parts, but can see the operations necessary to produce it from the raw material, and can illustrate the movements or processes by a sketch of some kind; while with the "clumsy" type, drawing of any kind is apt to be hard labor.

There are some wonderful cases of manual sensibility in every day life, as for instance, in the detection of counterfeit money and the separation and classification of injured notes by the female operatives in the Treasury Department at Washington. In the manufacture of standard gauges



where the accuracy is guaranteed to be within the one ten-thousandth of one inch. In wire drawing where in some cases the operative can detect an increase in diameter of less than one-thousandth of an inch solely by the sense of touch in the thumb and finger. In the manufacture of steel

balls for bearings, where I have known an operative by rolling them between the thumb and finger to pick out several balls of a group which, by actual measurement with a micrometer caliper, proved to be out of round not more than eight ten-thousandths of an inch.

My observations indicate that the highest type of manual sensibility is with those of sanguine temperament who use finger points in all operations of contact, that side contact shows deficiency, and that the worst type is among those of phlegmatic temperament where the muscular parts of the fingers and thumb or lower part of the hand are used for contact. The first type shows the greatest amount of directing and measuring force, while the last seems to have a mist between the work and the mind through which it is groping its way.

THE CARE OF WESTON AND OTHER PORTABLE INSTRUMENTS.

In every laboratory and every station of any pretensions there is usually a collection of portable "secondary standard" electrical measurin instruments. The dependence which can be put in their indications depends very largely upon the way in which they are kept and the records of them that may be referred to.

There are in the possession of the Louisville Electric Light Co. the following instruments:

1 Weston A. C. and D. C. Voltmeter . . . . . range, 60-300 volts
2 Weston A. C. and D. C Voltmeters . . . . . range, 10-120 volts
1 Weston D. C. Voltmeter, three coils . . . . . range, 0-280 volts
0-140 volts
Calibrating coil
1 Weston D. C. Voltmeter, two coils . . . . . range, 0-300 volts
Calibrating coil
1 Weston D. C. Voltmeter, two co ils . . . . . range, 0-600 volts
Calibrating coil
1 Weston D. C. Voltmeter, one coil . . . . . range, 0-600 volts
3 A. C. & D. C. multiplying coils for the above . . . . . to 6000 volts,
4 Cardew Voltmeter . . . . . range, 30-120 volts
2 Weston D. C. Ammeters . . . . . range, 0-10 amps.
3 Siemens portable D. C. Ammeters . . . . . range, 40-360 amps.
1 Siemens Dynamometer A. C. and D. C . . . . . range, 30-200 amps.
4 Whitney A. C. Ammeters. . ½ to 5, 5 to 50, 20 to 100, 40 to 200 amps.
1 Weston A. C. and D. C. Wattmeter . . . . . range, 0-600 watts
4 Standard Shallenberger meters, ... 10, 20, 40 and 120 ampers

A systematic record of the above instruments is kept, according to the form copied below:

Weston D. C. Voltmeter No. 174.
Range: 0–240, 0–140, Cal. coil.
Date of injury: May 10th, 1895.
Date shipped: June 12th, 1895.
Date calibrated: June 24th, 1895.
Date received: June 30th, 1895.
Character of injury: Let fall and broken by Matthews.

Resistance: 280 coil, 25926.
140 coil, 12963.
Cal. coil, 162.28.

Aside from the evident advantages from a systematic business point of view, of keeping such a detailed account of the instrument it is even more useful as a complete index of the capacities of the meters which finds frequent use in the selection of the meter best adapted to the work in hand.

In order to be assured of the permanence of the instruments it, of course, is necessary to use the greatest care in handling them and in all cases when they are carried from place to place they should be carried in the hands of thoroughly reliable and conscientious men, who are instructed not to set them down until they are delivered at their destination. Great circumspection is also necessary in the use of the meters during the measurement. These precautions will suggest themselves to every thoughtful person. One or two points, however, it may be well to notice. In using multiplying coils and measuring voltages higher than 1000 volts the voltmeter circuit must be provided with a small switch, by means of which the opening of the high potential circuit with the push button may be avoided.

Generally, in using ammeters connect them behind a short-circuiting plug, so that the current may be brought on the meter with less of a jerk than if the circuit is closed directly through the meter. This precaution will save a very great many cases of bent pointers, burned coils, etc. Don't wipe the glass over the scale before taking a reading. Don't let any Weston meter stay in circuit longer than is absolutely necessary for the taking of the reading. This applies as well to Weston ammeters as voltmeters. Don't try to bring the pointer back to zero, in case it is slightly off, by taking the reading with the meter out of level. It is hardly necessary to remind the intelligent student that the alternating current must be religiously kept away from Weston direct current meters or, in fact, any meter in which a permanent magnet will be demagnetized by it. As far as is practicable the meters should be put where they will not be subjected to frequent extreme variations of temperature. In handling the meters make it a practice to set them down on the table in such a way that a corner or side of the meter touches the table first, that is, don't set them down flat all at once, as it is hard not to bump them when set down flat. When measuring resistances of coils having high self-induction, as converter coils or field nagnets, be careful to break the voltmeter circuit before the main circuit carrying the current through converters, etc., is broken.

Whenever a meter is received from the factory, either new or recalibrated, immediately check it with all of the other meters of approximately the same range. To accomplish this checking with the conditions of varying voltage and other disad vantages always present in stations, of course requires some practice and great care, but if simultaneous readings are taken repeatedly the comparisons may be made very satisfactory and reliable.

It is the belief of the writer that Weston voltmeters, if properly treated will not change more than one per cent in a year. The ammeters are not so reliable, depending as they do on the measurement of a small fall of potential around a shunt contained in the base of the instrument.

The above paragraph must not be understood to mean that Weston instruments are to be blindly relied upon. If improperly cared for they are subject to very grave errors, and as a consequence, should always be checked up with the other instruments on hand after having been put to any trying or prolonged service. If, on checking a meter, it is found to be incorrect even to a small amount, it is much better to box it up in excelsior, with a good handle to the box, and ship it to the factory for recalibration than to try to make a calibration curve or table and far better than to try to recalibrate at home, Mr. Mundy of the Louisville St. Ry. Co. to the contrary.

With good Weston instruments, a Wheatstone bridge is a useless piece of apparatus in the station as equally reliable results can be obtained in a fraction of the time required for its manipulation.

J. Buckner Speed, '94.

Louisville, Ky.

"THE ROSE TECH' CLUB OF CHICAGO."

MINUTES OF THE 1ST MEETING, JANUARY 13TH 1896.

Pursuant to invitations sent out by Messrs. H. S. Putnam and T. L. Condron to the resident Alumni of Rose and others who had attended for at least two years and are now engaged in business in Chicago to meet in Mr. Putnam's office 1428 Monadnock Block with a purpose of forming an organization among such graduates and ex-students, the following men met:

1. H. S. Putnam . . . . . Class '86
2. T. L. Condron . . . . . Class '90
3. S. S. Frank . . . . . Class '92
4. B. R. Putnam . . . . . Class '92
5. S. L. Henrikson . . . . . Class '94
6. David McCulloch . . . . . Class '94
7. A. V. H. Mory . . . . . Class '94
8. J. R. McTaggart . . . . . Class '95
9. W. W. Crowe . . . . . Class '95
10. J. R. Leighty . . . . . Class '91
11. Walter Mills . . . . . Class '91
12. R. H. Buntin . . . . . Class '92
13. O. E. Becker . . . . . Class '95
14. A. L. Hebb . . . . . Class '95

Letters were received from the following who were prevented from being present but wished to be included in any organization formed:

Wm. Menden . . . . . Class '91
J. H Driver . . . . . Class '91
A. W. Wicks . . . . . Class '92
C. B. McCulloch . . . . . Class 94

When the meeting had been called to order Mr. H. S. Putnam was chosen as president and Mr, Condron as secretary.

The next special business was to adopt a suitable name for the organization and after discussion it was formally moved by Mr. Condron that the organization be known as "The Rose Tech' Club of Chicago," which name was unanimously adopted.

Mr. Mory presented the following resolutions which were adopted:

Resolved: That it is the sense of this Club that the abreviation "Rose Tech'" is to be preferred to "Rose Poly'" which latter has a most undignified sound and conveys a very indefinite meaning. Also, that we suggest to the student body the adoption of a new school yell introducing in the place of "Rose Polytechnic" the abreviation "Rose Tech.'" and

Resolved, That we believe it would be to the advantage of the school to become known among other schools and colleges and among technical men in general as the "Rose Tech'" as an abreviation for the full name "Rose Polytechnic Institute," and

Resolved, That the use of "R. P. I." has become so intimately identified with the Rensselaer Polytechnic Institute, better known as "Troy" that Rose men should avoid using the same lest they be open to the charge of wishing to mislead people as to their Alma Mater.

On motion of Mr. Mills that a committee be appointed to extend in the name of the "Rose Tech' Club" an invitation to the class of '96 and members of the faculty of "Rose" to visit Chicago on their Spring tour and to arrange for their entertainment by the "Rose Tech' Club." The president named the following:

Mills, Condron and Crowe.

On Motion of Mr. Condron that a committee having the president as chairman be appointed to arrange for the next meeting of the Club in February, at a club dinner the president named the following.

H. S. Putnam, Leighty and Buntin.

At 11 P. M. the club adjourned subject to the call of the president. T. L. CONDRON,

1750 Monadnock Block, Secretary.

ALUMNI NOTES.

Bixby, '92, has severed his connection with the Ewart Mfg. Co., of Haughville near Indianapolis, and is now with the Metallic Manufacturing Co. of Indianapolis. The latter company is equipping its works at the corner of Georgia and Pennsylvania streets for the manufacture of bicycle chains and other specialties. They have recently completed several machines from designs by Mr. Bixby for the rapid automatic production of chains.

Troxler, '95, also met with an accident, although not a serious one. While at work in one of the stations of the Louisville Power Co., he

absent mindedly walked into a pit in which the foundation of an engine was being built, spraining his wrist quite severely, and probably retiring him from active work for quite a while.

The TECHNIC learns indirectly of the birth of a son to O. P. Hood, '85, and wife. Here's our hand with the heartiest of congratulations. The order of the Sons of Rose Veterans is as yet so limited in numbers that the addition of a single member counts away up.

S. M. Rock, '82, who is still in the Homestead plant of Carnegie Steel Co., has passed a successful examination for the position of assistant engineer in the U. S. revenue service and expects a Pacific coast commission in the near future. These commissions are for life tenure.

A. V. Tuller, '95, writes from Carrier Mills, Ill., (away down in Egypt) that "there is nothing down there but swamps, woods and negroes; with the addition of buffalo gnats and mosquitos in summer."

By a letter from E. C. Thurston, '90, we are informed of the death of his wife recently at Providence, R. I. We join with his classmates and schoolmates in extending our sympathy and regrets, which even though they are a little late, are none the less sincere.

R. D. Valentine, '93, is still in Pittsburgh with the Westinghouse Electrical & Mfg. Co. He has been working on commercial testing of quarter phase motors and reports multiphase work on the boom.

A letter from T. W. Ross, '93, states that he is now stationed off the coast of Florida on one of the U. S. revenue cutters which is keeping an eye on the Cuban war.

Galloway, '90, was injured, though not seriously, by the overturning of a tower wagon on which he was working at Marion, Ind., a short time ago.

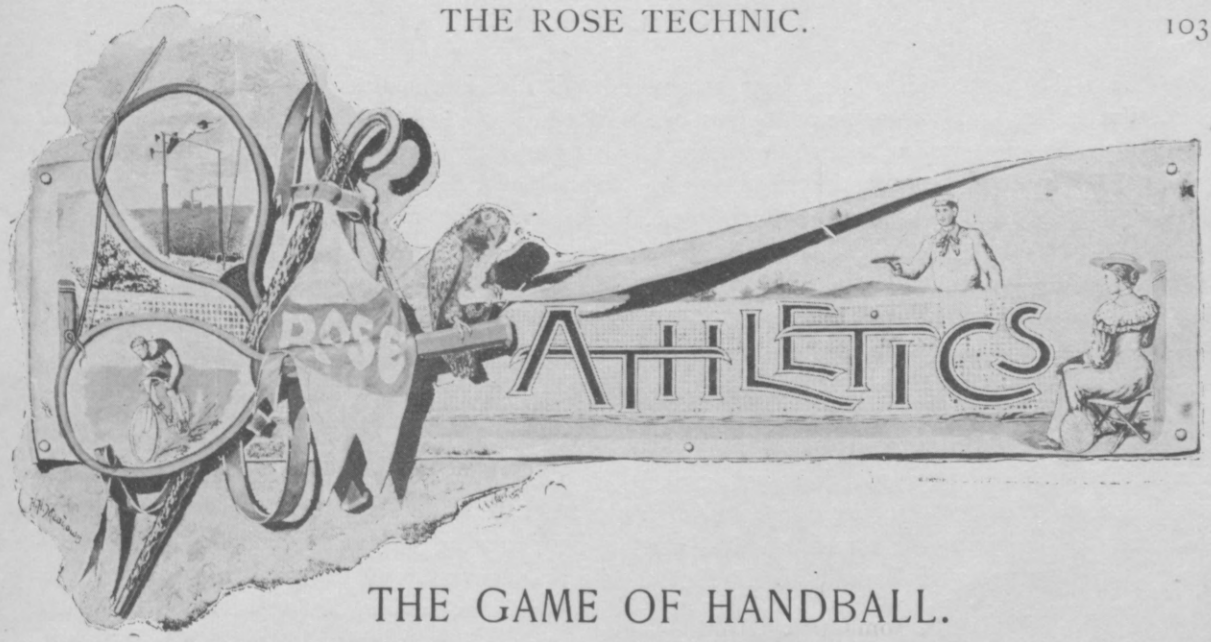
E. D. Frohman, '94, is with the Pittsburgh Testing Laboratory, Pittsburgh, Pa.

THEN AND NOW.

She was a simple village lass,
  With rosy cheeks aglow;
Her white arms to the elbows bare,
  For she was kneading dough.

Love in a cottage is not what
  It seemed two years ago,
For since that day I've married her,
  And now we both need dough.

—*Yale Record.*



THE GAME OF HANDBALL.

In a description of the new gymnasium, contained in a previous issue, it was stated that provision would be made for an excellent handball court, but as handball is a form of sport which is no doubt unfamiliar to the majority of people, we will endeavor to give some idea of the game, the benefits derived therefrom, and the rules governing it. The game is thought to be of Irish origin, having been played in that country for more than a century past, and has only been introduced into American sports in comparatively recent years.

The game's greatest recommendation is the fact that it is an exceedingly healthful and exhilirating exercise and is one of the best games known for general physical development. In proof of this, it is a well known fact that pugilists, in training, have adopted this as one of the best means for keeping in form or in preparing for some great event. Expert base ball players resorted to handball formerly for the same reason as did the wearers of the gloves, viz: to keep in form physically and also to keep in practice during that season of the year when base ball is, of necessity, neglected. Winter training is not given the attention among ball players now that it formerly received, consequently handball has ceased to be a popular form of sport among this class.

The regulation handball court, that is, one constructed solely for handball, is walled in on all four sides. The most satisfactory are of about the following dimensions: length, 65 feet; width, 24½ feet, 35 feet high at the front, tapering down to 33 feet high at the rear. The walls are usually of brick, and in some courts the front wall is faced with marble in order to give a good, smooth surface. The side walls are usually faced with cement for the same reason. The back wall is 12 feet high, built of wood. It might be remarked that this form of court is strictly American, as the Irish game was, until quite recently played in uncovered courts, with no back wall. Their courts are also much longer and wider than the American and the style of play is in many points quite different.

A gymnasium court is necessarily of a somewhat different nature from the regulation, there being no side walls. To overcome this difficulty, the court, instead of being rectangular, is trapezoidal in shape, the back wall being the longer of the parallel sides.

In playing the game, the use of both hands is required, and this is a serious drawback with beginners, and in fact with many otherwise fair players who have been in the habit of depending entirely

upon the right hand. This is another recommendation in favor of the game as it gives one excellent practice in learning to use the left hand. Quickness of eye and great activity of body are also requisites to the playing of a good game. Great care is necessary in serving the ball, in order to keep it as much as possible out of the reach of your opponent. A person with a cool calculating head has greatly the advantage over one who is ambitious and smashes at the ball without any very clear idea of where it is going.

The manner of striking the ball and the position of the hand is of very great consequence and in reference to this we quote from an authority: "When ready to make the attack on the little sphere, the player should brace himself firmly, with the hand that he intends to use slightly curved, fingers well set together and the thumb resting on the base of the forefinger. When the ball bounds upon the floor the hand should be drawn back, higher than the shoulder and when the black object reaches to the height of the hip, bring the hand around close to the hip, so that its contact with the ball will be in the soft portion between the fingers and the palm." If the ball is struck with a great deal of force with any other part of the hand than that mentioned, the striker is liable to disable himself temporarily. If care be taken to have a properly constructed ball, trouble in this direction can be avoided to a great extent.

In the regulation court, which, as has already been stated, is rectangular in shape, a black line is drawn across the floor, parallel to the ends and half way between them and is known as the ace line. Six feet in front of this and parallel to it, another line is drawn and the server is obliged to confine himself to the territory between these lines. If it be a two-handed match, his opponent, who is designated as recoverer, stands anywhere in the court back of the ace line, usually near the back wall. The server, as a general thing, stands close to the right wall on the ace line, serving the ball to the front wall, whence it rebounds, going around the court much as a billiard ball goes around the table, with the exception that the handball is in the air. It is the duty of the recoverer to return the ball to the front wall the moment it strikes the floor, catching it on the first bound. If the ball is returned to the front wall the server must recover it either on the fly or first bound, and the operation is repeated until one of the opponents fails to recover the ball.

In a gymnasium court the recoverer has a larger territory to cover and the method of service is also somewhat different, as the ball, in rebounding from the front wall, must fall within certain prescribed limits, there being no confining walls to govern its course. A skillful server, upon such a court, can cut the ball in a manner similar to the tennis player, causing it, upon striking the floor to bound in a manner at once erratic and puzzling to the inexperienced player. In a closed court there are various methods of scientific and effective service which we have not the space to enumerate.

Handball is not confined to two handed matches, by any means, as there can be four and even six in the game at one time.

For a more complete description of the methods employed in playing the game and the rules governing the same we must refer the reader to Spalding's Handball Guide, from which the major portion of our information was obtained.

In conclusion, we desire to recommend especially this game of all among the students who indulge in physical exercice to any extent whatever, but more particularly those who contemplate training for base ball and tennis work in the spring.

THE GYMNASIUM.

Operations in the gymnasium suffered a suspension just after the Holidays, due to the completion of the brick work and the concentration of the carpentering forces upon the laboratory, which building it was desired to push to completion as rapidly as possible. The favorable progress of the latter building has allowed a return of the carpenters to the gymnasium, which will now receive their entire attention.

Subscriptions to the fund fell due on January 1st therefore those at present unpaid are now

more than fifteen days overdue. The treasurer of the fund, W. E. Burk, has been quite busily engaged since Christmas receipting for subscriptions and up to the present something over one half have been paid in. This is the stage when funds are a very necessary thing to have on hand in order to carry on the work and the committee is desirous that all subscribers bear this in mind and act accordingly.

The gymnasium equipment will naturally be quite modest at first though it is thought that we will be able to start in with a very fair amount of apparatus which will be supplemented at various times until the equipment becomes complete. It is the intention of the committee on such matters to give Freshman talent an opportunity to display itself in the manufacture of the clubs and dumb bells. In all probability they can be supplied in this manner as satisfactorily and much more cheaply than if gotten from a supply house.

A Poly class is being formed at the Y. M. C. A. which will be transferred to our own gymnasium as soon as it is ready, continuing under the direction of Mr. Barnes until the end of the year.

Of course every one is aware that a certain amount of gymnasium practice is highly beneficial, but some colleges go further than this and apparently consider it a necessity, the University of Chicago, for instance including a certain num- of gymnasium credits among the requirements for securing a diploma.

The building will not be completed and ready for use much before the spring term and therefore will not be made use of for indoor sports to any great extent until next winter. Meanwhile let us congratulate ourselves that we have such a pleasant prospect in store for us.

FOOTBALL IN THE HOLIDAYS.

A game of football was played on Saturday, Dec. 28th, at Cairo, Ills., between the Cairo High School and a picked team of college men in which Rose had four representatives. The team was composed of men from the Pennsylvania Military Academy, Champaign, Wabash and the four men from Rose, viz: Hellweg, Lufkin, Whitten and Lansden, Hellweg playing center, Whitten a guard, Lansden an end and Lufkin quarter. Though the college men had had no opportunity for practicing together still they were able to give the Cairo people a good many pointers. The grounds were quite muddy but the boys claim that the game was a very pleasant one, which opinion was probably influenced to some extent by the result of the game, the score being 18 to 0 against Cairo.

Hellweg was the only man who suffered any accident. He returned after the holidays with a stiff leg which adds greatly to the dignity of his carriage but is not of any serious consequence otherwise.

OLYMPIC GAMES.

The renewal of the ancient practice of holding Olympic games at Athens has attracted widespread attention in the athletic world. The following, in reference to this subject, is taken from the Yale Alumni Weekly:

Prof. William M. Sloane, of Princeton, the American representative on the International Committee in charge of the Olympic games, to be held at Athens next spring, reports such great interest in this country that it bids fair that a team from the different athletic clubs and colleges will be sent to compete in the different events.

Some very prominent men have been appointed to the honorary committee from the United States.

Among those who have promised to serve are President Cleveland, who will act as chairman; Joseph H. Choate, Provost C. C. Harrison of the University of Pennsylvania, Albert Shaw, editor of the Review of Reviews; S. B. G. Laste, editor of the Ephemeris, and the following college presidents: Dwight, Elliot, Gilman, Low and Patton.

It is expected that the large colleges will be represented in most of the events. The games will continue for ten days, and on the entire program there is nothing that would be new to American college men. According to Prof. Sloane the large athletic clubs are seriously considering the invitations received from the Hellenic committee. Nearly every event is limited to amateurs.

These games next spring are designed to be the first of a series of such meetings; consequently the success of this attempt would mean a great deal to international athletics of the future. The next meeting will be held at Paris on the occasion of the World's Exposition in 1900, and the third meeting, according to the present plans, in New York in 1904. An executive committee for America is being chosen by Prof. Sloane.

NOTES AND CLIPPINGS.

A proposition for the formation of a gymnasium class has been made by the city Y. M. C. A. to our athletic board on terms that should at least prove attractive to the students. The idea is to make a fee of two dollars for membership in the association, to cover all the privileges that members usually have, with the intention of transferring the class to our own gymnasium as soon as finished. Mr. Barnes will continue the instruction of the class and have charge of all gymnasium work and athletic training for the balance of the school year. He will probably give three hours per week to the instruction of the class.

The New York Sun makes the All-American football team as follows:

Gelbert (U. P.) left end; Church (P.) left tackle Chadwick (Y.) left guard; Gailey (P.) center; Wharton (U. P.) right guard; Murphy (Y.) right tackle; Cochran (P.) right end; Williams (U. P.) quarter back; Thorne (Y) and C Brewer (H) half backs; Brooke (U. P.) full back.

The University of Chicago Weekly has selected what it calls an All-Western eleven. The men are taken from Chicago, Michigan, Northwestern and Minnesota. The team named would make formidable opponents for any team in the East, in fact the statement might be risked that they would outmatch any single college team in the country.

The Hemenway gymnasium, Harvard's athletic quarters, which has recently been undergoing most extensive improvements has just been reopened to the students, very much improved and enlarged.

The question of intercollegiate cycling is again being agitated by some of the Eastern colleges. A large number of colleges in the East as well as some in the West are interested in the move. The object is to hold a purely collegiate bicycle meet each spring and at the same time to abolish bicycle events from the regular field day meets.

A plan is on foot to organize a dual league between Yale and Princeton for annual competition in track and field athletics. Princeton has already made the proposition, and it is likely that Yale will accept. The date will probably be the Saturday prior to the intercollegiate championship—*Crimson.*

Immediately upon the resumption of work after the Holidays base ball talk takes the place of foot ball. Already the University of Michigan has made arrangements with Chicago University for four games in the spring, which are expected to decide definitely the question of supremacy on the diamond between these two.

At a recent meeting of representatives of Harvard and U. of P., arrangements were made for a track athletic meeting to be held in Philadelphia on May 16th, between the teams of the two Universities.

The University of Toronto won the foot ball championship of Canada.

GYMNASIUM BREVITIES.

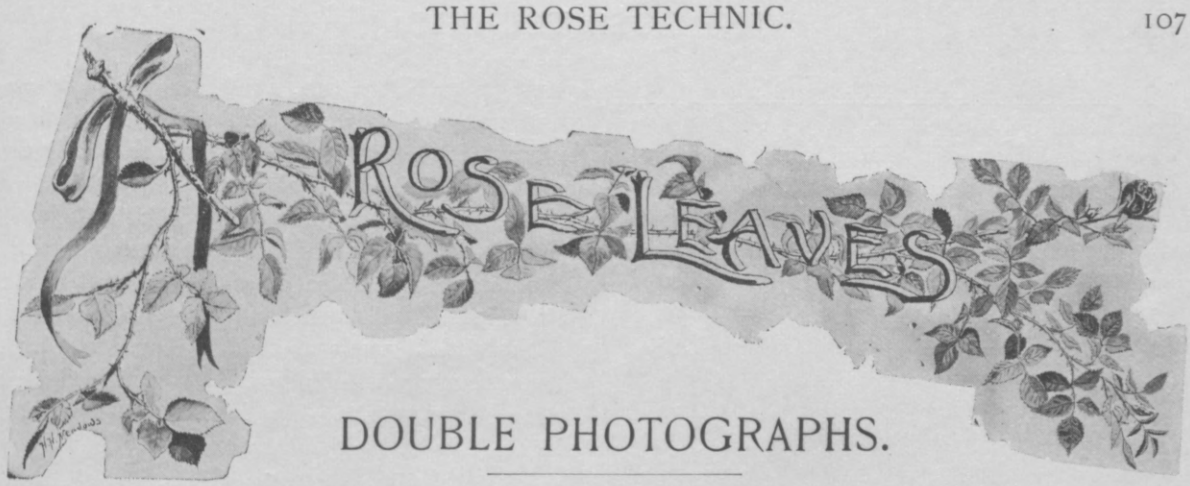
Pierson objected strongly to taking neck extension work.

Ingham says they don't make tennis shoes big enough for him in this country.

Davis gave as a reason for getting out of time that his hair fell over his eyes and he could not see the instructor.

The Poly. Class will meet every Wednesday and Saturday evening at 8:00 o'clock sharp. Visitors are welcome.

You could pick out every member of the class on the morning after the first meeting by his slow and reluctant gait. It caught everybody even the old timers pretty hard.



DOUBLE PHOTOGRAPHS.

The amateur photographer is notoriously gifted with an excessive amount of enterprise. Although he is often in newspaper and popular phraseology denominated a "fiend" or a crank, yet it must be remembered that these are only synonyms for enthusiast as seen from the other uninterested side of the question. The fact is, that about as soon as his fingers have attained the rich pyro color, and he feels himself competent to produce one or two pictures out of a "roll" with a minimum amount of apology for something being slightly off in the developer, or those spots which must have been on the film or plate before he got it, or other trifling defects—barring which, the negative is simply a "cracker-jack," our average amateur in happy possession of of his first camera begins to tire of plain straight-forward picture taking. He exercises his ingenuity in trying all sorts of experiments. The capacity of his camera for murdering perspective is utilized in the production of portraits of feet of appalling size with the owner sitting off in the distance smilingly indifferent as to the terribly dropsical state of his extremities. The fascination of the flash light is sure to attract him, and the realms of night are forced to give up their secrets until, perhaps with scorched fingers and singed eyebrows, he turns to the next diversion. Fondly trusting in the popular notion that an "instantaneous picture" will catch anything from a running horse to a rifle bullet, he plans all sorts of interesting and startling effects in that line. He attends the race meets and catches all the exciting finishes. He waits in the glaring sun for an hour for the limited mail in order to get a striking picture of it as it dashes around the curve at sixty miles an hour. He lies in wait for all his wheelmen friends as they spin past him, and exultingly informs them that he "got them that time." But his ardor is somewhat abated when he discovers to his intense disappointment that the speeding racers have nearly vanished into thin air so far as the impression on his plate is concerned; that the limited mail seems to be distributed uniformly over a considerable stretch of track, and that his friends of the wheel all have a decidedly uncertain and dizzy look. He sadly relinquishes his idea of a gallery of moving objects and is ready for another novelty. And so he goes on delving into the mysteries of the fascinating art, achieving some successes in the midst of the multitude of failures. These rare gems shining out like the great dipper from among the host of twinklers of inferior and insignificant splendor, lure him on until at last his diligence is rewarded by the granting by friends and foes alike of the full and complete right to the title—amateur photographer.

The writer has traveled the ups and downs and the devious windings of the route described and speaks from a memory full of rich experience and a heart full of sympathy for those who come after in the same path. It is therefore not with the dire intention of kindling any will-o'-the-wisp which shall lead the traveler who may follow it astray, that the suggestions which follow are made. Rather is it to point out one direction in which

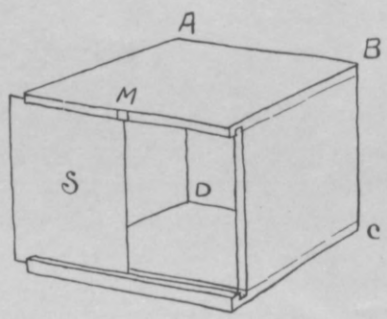
success is comparatively easy and the results sufficiently startling to satisfy even the most ardent seeker after novelty.

Nearly everyone has noticed at some time or other what are known as double photographs—that is, pictures in which the same person appears twice, each individual apparently as utterly unconcerned in the presence of his ghost or his second self as if they were a pair of twins. The impression seems to exist among many persons that such effects are produced by some complicated arrangement of the camera or some special methods of manipulating the negative or of combining two negatives. But on the contrary the apparatus needed is extremely simple and can be applied to any camera whatever.

Perhaps the very simplest scheme is one that, however, can be applied only under special conditions which deprive it of the value which its simplicity would give it.

It consists in finding a background which is as near to absolute blackness as is possible. A large open doorway leading into a dark room—that is, with no open windows on the opposite side, is perhaps the best. The person who is to be doubled simply takes his position in one side of the doorway; an exposure of the required length is made; he then moves over to the other side and a second exposure is taken, the black background preventing any mixing up of images.

But a far better plan, in that it can be applied under any and all conditions of lighting or background, is the one with which we are chiefly concerned. The additional apparatus required consists simply of a box of a size A B C D sufficient to just fit over the front of the camera and of a length about equal to the focal length of the lens, open on two opposite ends and fitted on one of these ends with a slide S made of stiff cardboard similar to the ordinary plate-holder slides, with the edges cut straight and square. The interior of the box and inside face of the slide should be painted dull



black. Having placed this box on your camera, set it up in any place desired and have the subject pose at one side of the field. Place the cardboard on the opposite side of the box with the straight edge in the center. If you have a glass plate camera, focus on the ground glass and see

that the subject is entirely in the limits of the half of the plate. If it is a film camera, guess at it. Make the exposure of the usual time, close the shutter, have the person move to the other side of the field, shift the cardboard across, and expose again. The secret of the whole process is in the adjustment of the relative position of the edge of the cardboard in making the two exposures. Being quite close to the lens, and hence very badly out of focus, this edge does not cause a sharp line on the plate but rather a very "fuzzy" one of considerable breadth. By the proper placing of the edge for the two exposures these two hazy outlines may be so made to overlap that the effect upon the resulting negative is to hide the junction entirely. The required position of the edge is evidently not the same—that is, at the center, for both halves, but at a small distance away from it. This distance may be very readily determined by a few trials and marked once for all as at M in the figure on the edge of the box over the slide.

Prepared with this simple addition to his camera the amateur is prepared for any number of novel and amusing effects. A man may be shown seated quite comfortably in a wheelbarrow and at the same time condescendingly bending to the task of wheeling himself. A friendly game, a sparring match, the telling of a good story by one friend to another, in all of which the two participants are one and the same, are all easily arranged. However, the possibilities do not stop at the repeating of a single person, as may be readily seen. A small picnic party can be very easily multiplied by two, thus lending increased animation to the scene. The participants in the boxing match may be surrounded by an interested crowd in which each spectator appears twice. And so on to the limit of the curiosity or ingenuity of the operator. It might be added that by using two slides in a similar manner the plate may be divided into thirds and triple pictures obtained, but generally the double ones are of sufficient interest.

Here is a chance to add to the Institute's mechanical equipment, if some one will take hold of it and push it systematically:

"The Lodge & Davis Machine Tool Co., of Cincinnati, offers to present to the technical school receiving the greatest number of ballots before March 1, 1896, the Nickel and Gold Plated Tool Room Lathe exhibited by them at the World's Fair in Chicago, valued at $1,500. Every one in the United states interested in technical education is entitled to a vote. Only votes conforming to the following conditions will be received:

1. Full name and address must be given.
2. Give name of technical school preferred.
3. No duplicate votes will be registered.
4. No votes will be registered that are received after 12 noon of March 1, 1896."

THE NEW BLACKSMITH.

Mr. Edward Nicholas, the new instructor in blacksmithing was born in South Wales. He came to this country when only eleven months old and lived in Philadelphia for a short time. Then moved to Dayton, Ohio and there learned his trade. When 21 years old, he came to Rockville, Ind. There he had a shop of his own for several years and in 1886 was elected Sheriff of Parke county and held that office for four years. He next took charge of the shops of the Parke County Coal Co. and remained with them till last June when he came to Terre Haute to take the position of foreman in the plant of Keyes & Co., manufacturers of automatic trap doors for regulating the draught in mines. The verdict of those who have worked under him is that he is a jolly good fellow and he will no doubt take well with the boys and make a good instructor in his department.

ASSOCIATE PROFESSOR OF PHYSICS.

Professor Arthur Kendrick, A. M., who came ot the Institute at the beginning of the present term to take up the work of Associate Professor of Physics, comes to us from Worcester Polytechnic Institute, where he has been for the past two years and a half as Assistant Professor of Physics. Professor Kendrick is a native of Nashua, N. H., but at present calls Newton, Mass., his home since his parents reside there. His degree of Bachelor of Arts was received at Amherst college in 1887.

For three years succeeding graduation he taught the natural sciences at Leicester Academy, Mass. At Harvard University he received his degree of A. M. and continued his graduate studies there for three years. He was also engaged as laboratory instructor for one year. From there he went to Worcester.

The *W. P. I.*, the journal of the Worcester Polytechnic Institute, speaks in the highest terms of Prof. Kendrick and his work there, and regards his departure as a great loss to the institute. Although since the opening of the term, he has scarcely had time enough to become acquainted with the students or the work here, yet he has shown a degree of energy which argues well for his success. We know we express the sentiment of the entire student body when we extend to Prof. Kendrick a hearty welcome to the Institute.

INSTITUTE COURSE OF LECTURES.

The following schedule for the remaining numbers of the course of lectures by members of the faculty and others has been arranged. The lectures on astronomy which are not scheduled will be given either on Mondays at 11:00 a. m. or on Fridays at 3:00 p. m. Attendance upon these latter lectures will be required of the Junior class but will be optional with the Seniors.

Jan. 28, 11:00 A. M., Dr. S. M. Rice. Emergencies.

Jan. 31, 5:00 P. M., Thos. Gray. History and Manufacture of Ocean Cables.

Feb. 7, 11:00 A. M., A. S. Hathaway. Tops.

Feb. 14, 5:00 P. M., Thos. Gray. Laying, Repairing and Operation of Ocean Cables.

Feb. 20, 11:00 A. M., A. S. Hathaway. Gyrostats.

Feb. 28, 11:00 A. M., J. A. Wickersham. Words.

April 2, 11:00 A. M., Dr. S. M. Rice.

April 9, M. A. Howe. Latitude and Longitude Determinations.

April 16, M. A. Howe. Map Making.

April 24, C. S. Brown. Some Modern Steam Engines.

May 1, W. L. Ames. Modern Methods of Illustrating.

May 7, C. S. Brown. Thermal Storage.

Meyer has been laid up with a severe cold.

Boudinot has decided to take the chemical course.

The chemists have been inspecting the Wabash Distillery lately.

Shaffer ex '99 has entered the Freshman Class at Purdue University.

Ford and Fletcher, both '98, have sprung twin wheels on us recently.

We are credibly informed that "Monk" Gordon is fostering an extra eyebrow.

VanCleave has decided not to finish his course in chemistry and will enter a medical college next fall.

Instructor Logan has been dangerously ill for some time but all will be pleased to hear of his recovery.

The Senior electricals will have some work during the present term in designing roof trusses, under Professor Howe.

Mr. Smith, of wood shop, is taking the Senior electricals back to their Freshman days, in a series of lectures on pattern making.

Two students were amusing themselves by "popping" some burned out incandescent lamps. "I wonder," said one, "if it is proper to call that an explosion?" "No." said the other, "It's an insplosion."

Prof. Wickersham has consented to teach a class in Spanish, to be composed of those whose term marks exceed the legal limit of 75 per cent.

Instructor Harris is learning to play the mandolin. At least that is what those rooming in the same house say and they ought to know.

If you hear any of the Soph's remark "What T'ell Bill" it may be explained in the fact that the class has taken up Wilhelm Tell in German.

Dr. M. "Now who is the rascal that has carried off my pliers?"

Harris. "I assure you Doctor, I am unguilty.

Wednesday was Butler's ('98) early morning. When asked if he had enjoyed a hearty breakfast, he said "Well not exactly, I had a pill and a cigarette."

R. L. Mc. hastily erasing a thoughtless mistake from the blackboard, "They say we get absent minded as we grow older but I did not think I was that far along."

Prof. H. was absent on Friday morning. There were rumors afloat that he had been detained at the barber's but he appeared in the afternoon with those whiskers still flourishing.

"How do you remember which is stalactite and which is stalagmite?" "Why the one that has *tite* in it sticks tight to the ceiling and the one that has *mite* in it might stick to the ceiling but it don't."

Chemist, showing remnant of a volume with blackened edges. "That book was very valuable once and I treasure it now as a relic of the Chemical Lab. fire." Civil, casually. "Yes, it was evidently at one time a very warm book."

Prof. W. had a freshman at the blackboard using him as a shining example for the rest of the class. Wishing him to emphasize a certain initial letter for purposes of memory he said energetically. "Now make that a great big black letter.

Glascock, '99, remained in Terre Haute during the Christmas vacation and devoted his spare time to the rearing of a neat little moustache. His landlady appreciated his efforts in so far as to place a moustache cup at his place at the table, although the new attachment is as yet in no danger of getting wet.

The arrangement of thesis time for the Senior class is as follows:

January 27—Feb. 1 inclusive. March 16—25 inclusive. April 1—11 inclusive.

Thesis subjects are to be handed in on or before Friday Jan. 24.

Dr. M. explaining liquid pressure.—"Now let the liquid be in a column and become suddenly hard, slice it up into bricks and slip your hand under the bottom brick; now melt the bricks and what is the effect on your hand?" Student promptly, "Burn it."

Doesn't Prof. W. look fatherly in those new specs? Certain irreverent students should remember that it is highly improper to do more than smile when the aforesaid glasses display a provoking tendency to assume an angle of thirty degrees with the horizontal.

Something will certainly have to be done to help the complexion of the reconstructed laboratory. Its walls bear many traces of the fiery ordeal through which it passed. Standing in such close proximity to the clean new gymnasium building, the contrast is decidedly against it.

Some of the friends of Werk, '96, were recently treated to their first taste of *Terrine de fois gras* which "Mike" imported from Paris.

Failey, Meriwether, Mead, Camp, Ingle, Ford, Butler, Wiley, Scott, Roberts, Pirtle and Eastwood viewed the Kermiss from the bald headed row Saturday night.

When the Baldwins were holding their spiritualistic meetings at Naylors, an uncertain Freshman wrote the following question, to be answered by the mediums: "Will I flunk?" It is doubtful if the spirit knew just what sort of inquisitiveness was intended, at any rate the question was not answered.

A little group of experimenters in the Mechanical Laboratory were discussing the merits of their respective watches when Mr. P. came up

and producing his massive silver timepiece remarked. "This watch keeps a peculiar sort of time of its own. A kind of cross between solar and luney. Mostly luney."

Dr. H. H. Ballard returned from his home in Baltimore on last Monday the 13th. He took advantage of the slack condition of work in the chemical department, to lengthen his vacation somewhat. That he enjoyed the time thoroughly may be inferred from the fact that he spent a considerable portion of it in a dentist's chair.

Three new students have entered the lists since Christmas.

Noble C. Butler '98, of Indianapolis, comes from Purdue University.

F. T. Platter, Denison, Texas enters the Freshman class.

Geo. Champe, Dublin, Ind., is an I. U. graduate and will take Post Graduate work in civil engineering.

It has been stated that there is a growing sentiment among the members of the faculty in favor of establishing the monthly quizzes as fixtures, the date of which would be announced or posted besorehand. This would prove a great blessing to many of the students in removing a prolific source of worry and speculation, for no longer would the question be propounded with an earnestness born of intense interest, "When do you think the Prof. will spring the next quiz on us?"

A TWO TO ONE SHOT.

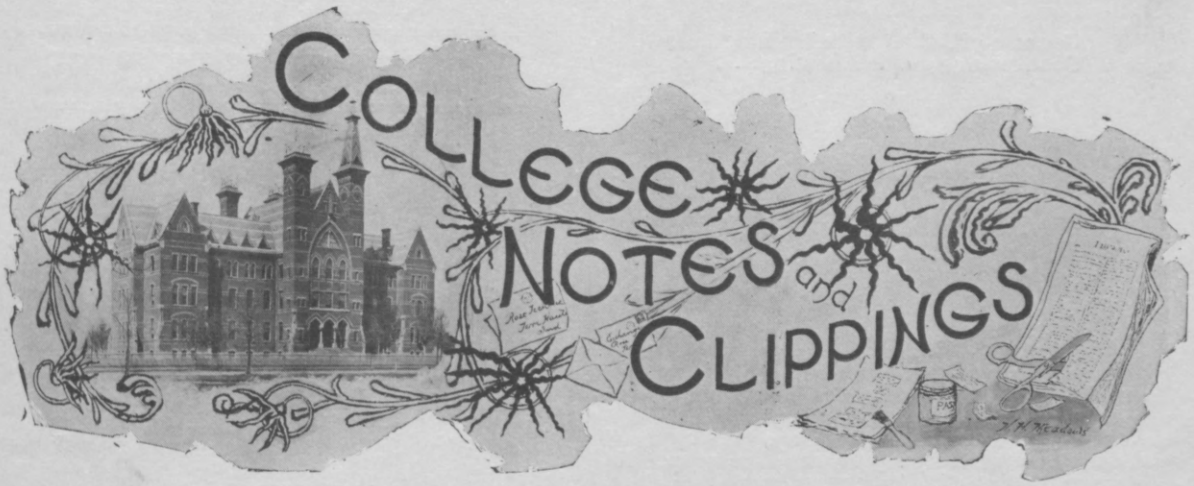
Two pairs of skates
Two maidens gay
One kodak fiend advancing.
Two lusty squeals
Two pairs of heels
One picture quite entrancing.

Two maidens grieved
Two stories told
One papa quite erratic
Two powerful thumps
Two painful bumps
One drubbing most emphatic.

The ice at Kennedy's pond has attracted, during the past week, almost every good, bad or indifferent skater that the Institute can boast of. Among them was Vorhees who was unfortunate in meeting with quite a painful accident. Both his feet were frozen, and for some time it was thought that an amputation would be necessary. Happily such was not the case although he will be confined to his room for some time.

The motto which the local editors carry pasted in their hats, think over by day and dream over by night is, "Never allow a differential to come within striking distance without nailing it." Knowing this fact, perhaps, and fearing lest our supply should become exhausted, the Freshman class has kindly made THE TECHNIC a present of a large quantity of nails, of carefully assorted sizes, sufficient to last for a long time to come. We must express our hearty appreciation of such considerate kindness and the least that we could wish in return is that the history of '99 may be so crowded with interesting incidents and events that we shall be kept continually busy nailing them.

Upon a certain morning not more than two weeks ago, when a dense fog enshrouded everything like a wet blanket, the Institute cart of a certain memorable Halloween fame, with horse and driver, slowly wended its way toward the Big Four crossing at 3rd ave. with a load of bricks. No sign of impending danger was visible within the circle of about a hundred yards beyond which the fog descended like a wall. But as the outfit was just in the act of crossing the track, with a rush and a roar the morning passenger train emerged from the fog and struck the cart just amidships. For a few seconds there was an indistinguishable cloud of brick bats, cart, horse, and Irishman. Then the latter element gathered himself together and finding upon a hasty inspection that he was all there ejaculated, "Sure and here's one man that's glad he's livin'."



Yale has thirty-three men on her glee club.

Yale has graduated 92 college presidents.—*Ex.*

There are from 1,500 to 2,000 American students in France.—*Ex.*

There are nearly 2,500 students enrolled at the University of Minnesota.

The greater the mind, the easier it is for it to dwell on a small point.—*Voice.*

Prof. in Physics—"What is a fluid?"

Student—"Anything that runs."—*W. P. I.*

Fire destroyed the new $1,600 rowing barge of the University of California Boat Club last week.

At Dartmouth those who do not pay their athletic subscriptions have their names printed in the college paper.

One girl to another—"Was he very much cast down after he had spoken to papa?"

"Yes, three flights of stairs."—*Ex.*

He wrote a verse on "Trilby"
To keep up with the fad;
The editor declined it
Because its feet were bad.—*Ex.*

Prof. (to first arithmetic class)—How many in a family consisting of husband, wife, and child?

Smart Prep.—Two and one to carry.—*Ex.*

EXPLAINED.

Children don't die young because they are good, but stay good because they die young.—*Plexus.*

The management of the Pennsylvania team is liable to a fine of about $2,000 damages for failure to meet the B. A. A. eleven on Manhattan field.

Scientists claim that cigarette smoking leads to idiocy. We do not know how true this is, but we are satisfied that idiocy leads to cigarette smoking.—*Siftings.*

The entire property of the universities and colleges of the United States is valued at $200,000,000; one-fourth of this belongs to four universities.—*Penn.*

The Letter "L."—The addition of the letter "l" to the motto on our coinage would prove highly satisfactory to the anti-silverites, "In Go(l)d We Trust."—*Ex.*

Class spirit is a good thing. So is a locomotive; but, if you turn the thing loose and let it go without control, there is no telling where it will stop or what harm it will do.—*Ottawa Campus.*

The man who makes us weariest
Of all the human race—
Is he who writes a verse like this
To fill a little space.—*Ex.*

Freshman Year—"Comedy of errors."

Sophomore Year—"Much ado about nothing."

Junior Year—"As you like it."

Senior Year—"All's well that ends well."—*The Wabash.*

President Angell, of the University of Michigan, has announced that hereafter in choosing members of the faculty at Ann Arbor, no discrimination will be made between men and women. If a woman is better qualified, the preference will be given her.